

# **INFORMATION ABOUT THE HOST INSTITUTION**

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# **ABOUT THE CENTRE**

Name of Centre Active learning for Core Technology education – ACT!
Is the Centre already established at the time of the application (yes/no)?
Please name any consortium partners for the Centre



# ABSTRACT

**Describe briefly the aims as well as the current and planned activities of the Centre (150 words)** The main aims for Active learning for Core Technology education – ACT! are to establish a smooth transition from upper secondary school to higher technology education; modernise core courses in foundation subjects (mathematics, physics and computer science) to obtain cross-disciplinary integration; design intelligent tools and methods for digitalisation in core courses, and develop learning environments and forms enhancing student participation. ACT! will build on documented excellence from a large number of innovative education projects based in the involved subjects, and originating from different parts of NTNU. Actions are based on a comprehensive view of students' learning processes, taking into account their experiences before entering higher education, as well as their needs during education and in their future professional life. The activity in ACT! is closely monitored by panels representing students, the school sector, professional life, as well as international experts in the field of technology education.



# **APPLICATION DOCUMENT**

The application must be written in English and follow the requirements set in this template. It must not contain more than 10 pages in Times New Roman, 12-point types, with lines spaced 1.5 and margins of 2 cm. Within this format, the applicant must provide:

#### a) Documentation of educational quality in existing provision

The applicant must comment and critically reflect on themes and questions set out in the criteria, and compare their existing provision with similar provision within the same subject/discipline area, both nationally and internationally. Through this, the applicant must document that the academic community qualifies as a Centre for Excellence in Education.

#### b) A centre plan

The applicant must comment and critically reflect on themes and questions set out in the criteria. The Centre Plan must outline the vision of the Centre, its strategy and plans. It must present the plans for the dissemination of knowledge and practices to its own institution(s) and to other educational communities as well as an evaluation and impact framework.

### **Appendices**

The following appendices must be included (and no other):

- 1. A list of references
- 2. A budget for the Centre for the first five-year period, including motivation for costs (see guidelines at <u>www.nokut.no/SFU/utlysninger</u>)
- 3. An action plan for the Centre, including milestones (no more than three pages)
- 4. CVs of the proposed Centre Leader and two to five key members of the Centre team (each CV must not exceed two pages)

All appendices must be in English.

### **Practical information**

The rector of the host institution must sign the application.

The deadline for submitting applications is set in the announcement of the call.

All applications will be published on the NOKUT website, alongside the expert panel's feedback.

# **APPLICATION DOCUMENT**

# Active learning for Core Technology education – ACT!

# Vision and profile

The vision of ACT! is to modernise the base for technology education in Norway, by reforming the form and content of core courses in the foundation subjects mathematics, statistics, physics, and computer science for technology students at NTNU. Actions are based on a comprehensive view of students' learning processes, taking into account their experiences before entering higher education, as well as their needs during education and in their future professional life. ACT! (later referred to as the Centre) will have major national impact, due to NTNU's position<sup>1</sup> within technology education in Norway. The Centre is based on the view that science and mathematics along with analytical skills and problem solving skills are important knowledge areas for engineers preparing for leadership roles in the 21<sup>st</sup> century (Redish & Smith, 2008). In Norway, the importance of technology education is recognized e.g. in the National Strategy Plan for Science and Mathematics (Kunnskapsdepartementet, 2015). The Centre Plan consists of four Work Packages (WP), each split in a number of Action Points (AP). Taking a comprehensive view of students' learning processes, from start to end of their studies, and entering professional life, the main aims for the Centre are to:

- establish a smooth transition from upper secondary school to university studies (WP1);
- modernise core courses to obtain cross-disciplinary integration (WP2);
- design intelligent tools and methods for digitalisation in core courses (WP3);
- develop learning environments and forms enhancing student participation (WP4).

The expected result will be a technology education that:

- emphasises solid fundamental skills and knowledge in foundation subjects, with an interdisciplinary approach, involving active and motivated students;
- recognises where the students are coming from, by improving connections with upper secondary school;
- recognises where the students are heading, by being well adapted to the needs of the technology programmes for which the courses are required, and more generally to societal needs for a strong basis in foundation subjects;
- takes place in learning environments characterized by innovation and openness to new demands and opportunities; accessibility of resources; diversity both in methods and in resources; and

<sup>&</sup>lt;sup>1</sup> With c.2500 technology students annually, NTNU accounts for about 40 % of all technology students in Norway, more than 75 % on master level (Samordna opptak, 2015)

quality at all levels.

The Centre is based on close cooperation between the departments IMF, IDI, IFY, IA<sup>2</sup> at NTNU, and with other institutions, nationally and internationally (e.g. MatRIC<sup>3</sup>, MEC<sup>4</sup>, SIGMA<sup>5</sup>, KHDM<sup>6</sup>, SEFI<sup>7</sup>). It is built upon our current successful involvement with innovative education projects. including KTDiM<sup>8</sup>, which "has implemented differentiation in education and combined large class education with individual adaption."9 We have extensive experience with digital resources and innovative ways of working with students to enhance learning outcomes and we have systematically collected data on the impact of various action points. Results have been presented in conference presentations and papers<sup>10</sup> (e.g. Rønning, 2014, 2015). Our dissemination plan will ensure communication of results, methods and knowledge acquired in the Centre, nationally and internationally. Digital resources produced at the Centre will be made freely available. In KTDiM, students have played a central role in designing, monitoring, evaluating, and improving the project (Ehrnström et al., 2014) through surveys, interview groups and evaluation groups. Inspired by this, a Student Panel for the Centre has already been established and this panel has been actively involved in the planning of the Centre. The Student Panel will be maintained as a permanent body within the organisational structure and will play an essential role in running the Centre. This will ensure a student-centred focus.

The key personnel in the Centre have broad experience, with teaching, educational research and development, innovative education projects, and educational leadership. A Management Board, involving education leaders at NTNU, and an International Advisory Board will be established. These boards will play an important role in developing future strategies for the Centre.

### Documentation of educational quality in existing provision

**Input factors.** The involved departments are and have recently been involved in numerous educational development and research projects, including:

- KTDiM (2014-16): Quality, accessibility, differentiation in the foundation courses in

<sup>&</sup>lt;sup>2</sup> Institutt for matematiske fag, Institutt for datateknikk og informasjonsvitenskap, Institutt for fysikk, Institutt for allmennfag

<sup>&</sup>lt;sup>3</sup> Centre for Research, Innovation and Coordination of Mathematics Teaching (www.matric.no)

<sup>&</sup>lt;sup>4</sup> Mathematics Education Centre, Loughborough University (http://www.lboro.ac.uk/departments/mec/)

<sup>&</sup>lt;sup>5</sup> SIGMA Maths and Stats Support, Coventry University

<sup>&</sup>lt;sup>6</sup> Kompetenzzentrum Hochschuldidaktik Mathematik (www.khdm.de)

<sup>&</sup>lt;sup>7</sup> European Society for Engineering Education, www.sefi.be

<sup>&</sup>lt;sup>8</sup> Kvalitet, tilgjengelighet og differensiering i grunnundervisningen i matematikk, https://www.ntnu.no/ktdim/

<sup>&</sup>lt;sup>9</sup> Translated from NOKUT's evaluation of KTDiM's application for Utdanningskvalitetsprisen 2015

<sup>&</sup>lt;sup>10</sup> See https://www.ntnu.no/ktdim/resultater

mathematics, budget 8.1 MNOK. (Relates to WP1, WP3 and WP4);

- IKTiSU<sup>11</sup>: Computer science in technology education. In particular IFY and IMF have been involved with several subprojects. (Relates to WP2);
- Edumecca<sup>12</sup> (2009-2010): Development of tools and methodologies for increasing student interaction and engagement during lectures, 500 kEUR. (Relates to WP3);
- Done-IT<sup>13</sup> (2011-2013): Development of new forms for digital assessment, budget 500 kEUR. (Relates to WP3);
- Exploiting Ubiquitous Computing, Mobile Computing and the Internet of Things to promote STEM Education (2016-2019). EU funded. (Relates to WP3);
- Future Learning (2016-2019): Orchestrating 21st Century Learning Ecosystems using Analytics. (RCN funded. Relates to WP3);
- Project funded by Norgesuniversitetet<sup>14</sup> (2015-16): Creating a computational-physics online platform with IPython Notebook. (Relates to WP2);
- ICT in laboratory and calculation exercises in physics. (Relates to WP2)

The combination of projects and initiatives both at department level and at the top level at NTNU<sup>15</sup> <sup>16</sup>, have increased the awareness of educational quality. Several top level initiated projects are directly relevant for the Centre, e.g.: *The University School Project*<sup>17</sup> (WP1) and the *IT in Education* and *Alternative Forms of Assessment* projects (WP3). Positive effects are also expected from the project for *Recognition of Pedagogical Competence*<sup>18</sup> (jointly with UiT), where the Centre leader has been involved. From our master and PhD programmes we have access to excellent graduate students who are involved as learning assistants and trained in cooperation with UNIPED<sup>19</sup> through the LAOS-programme<sup>20</sup>. IMF, IFY and IDI are important contributors to the master programme for secondary school teachers in science and mathematics, which, in combination with the University School Project, guarantee close contact with the secondary school sector (WP1). Research quality is important for successful research-based education. The involved departments can document this through RCN-evaluations (The Research Council of Norway, 2010, 2012a, 2012b). IMF has an active research group in mathematics education.

Process factors. Technology education has been criticised for being over-adapted to a narrow range

<sup>&</sup>lt;sup>11</sup> https://www.ntnu.no/wiki/pages/viewpage.action?pageId=69242289

<sup>&</sup>lt;sup>12</sup> http://histproject.no/node/167

<sup>&</sup>lt;sup>13</sup> http://histproject.no/node/18

<sup>&</sup>lt;sup>14</sup> https://norgesuniversitetet.no/prosjekt/creating-a-computational-physics-online

<sup>&</sup>lt;sup>15</sup> Teaching Excellence Programme, http://www.ntnu.edu/teaching-excellence,

<sup>&</sup>lt;sup>16</sup> Innovative Education Project, http://www.ntnu.no/innovativ-utdanning

<sup>&</sup>lt;sup>17</sup> http://www.ntnu.edu/school-university-partnership

<sup>&</sup>lt;sup>18</sup> http://www.ntnu.edu/teaching-excellence/recognition-of-pedagogical-competence

<sup>&</sup>lt;sup>19</sup> Section for Educational Development at NTNU

<sup>&</sup>lt;sup>20</sup> http://www.ntnu.edu/ipl/laos

of learning styles, despite that it is well known that people learn in different ways, see e.g. (Felder & Silverman, 1988) for the case of engineering students. Based on theories emphasising the need for stimulating students' affective, behavioural and cognitive engagement, we have been developing learning environments encouraging participation, communication and interaction (Mokhtar et al., 2010; Fielding-Wells & Makar, 2008), thus shifting the emphasis from teaching to learning (Engelbrecht & Harding, 2005). This has been the guiding principle for projects like KTDiM. A broad variety of digital resources have been produced and in combination with interactive lectures and a support centre, a significant increase in student activity has been observed. The reference group methodology<sup>21</sup> is an important and successful part of NTNU's QA-system. Evaluation and student involvement are taken several steps further in KTDiM and also in the planning of the Centre, and include:

- extensive annual evaluation in core courses, achieving a high response rate;
- interview groups used for evaluation and research;
- student panel for evaluation of digital resources in KTDiM;
- student panel for the planning of the Centre.

Many of our students have interests and talents that are best nurtured by early involvement in research. In 2015, we introduced StudForsk<sup>22</sup>, an undergraduate research programme in mathematics, sponsored by the Thon Foundation<sup>23</sup>. The volume of this new initiative is currently modest, but the outcome of WP2 will improve the potential for relevant student research projects in cooperation between the departments involved.

**Result factors.** NTNU dominates technology education in Norway, awarding around 40 % of all university degrees in technology, and on master level more than 75 %. NTNU has national responsibility for pre-courses and is the largest provider of such courses nationwide. A recent report by NHO (Solberg et al., 2016), reports a large and increasing national lack of qualified technology candidates. A survey by NIFU (Arnesen et al., 2015) of alumni three years after completion indicates the high relevance and scientific quality of master level technology education at NTNU:

- overall assessment of institution: total score 4.7 (max 5);
- overall assessment of scientific quality of education: 4.4 (max 5);
- reported unemployment rate of 1 % and assessment of relevance: 4.2 (max 5).

We acknowledge the difficulty of assessing the impact of the core courses as part of the total programmes. In particular, it is well known that the first two calculus courses in the master

<sup>&</sup>lt;sup>21</sup> https://innsida.ntnu.no/wiki/-/wiki/English/Completing+student+evaluations+of+courses

<sup>&</sup>lt;sup>22</sup> https://wiki.math.ntnu.no/studforsk/start

<sup>&</sup>lt;sup>23</sup> http://olavthon.mynewsdesk.com/pressreleases/olav-thon-stiftelsens-faglige-priser-og-stoette-tilundervisningsrelatert-forskning-1141796

programmes are challenging for many students. Data from student surveys and feedback from reference groups since the start of KTDiM indicate that students experience increased study activity and better learning outcomes. Furthermore, the proportion of grades A and B in these two courses has increased from 17 % (years 2012 and 2013 average) to 33 % (years 2014 and 2015 average).

## WP1: Transition from school to higher education

The main aim of this work package is to make the transition phase from school to higher education smoother and to provide opportunities for undergraduates to engage in research. The need for action on transition is well documented both in Norway and internationally as there seems to be a widening gap between higher education and preparation for higher education in schools. This has led to a number of measures being taken (see e.g Bausch et al., 2014; Perkins et al., 2012). Surveys from KTDiM show that succeeding in mathematics in the early phase of studies is seen as a key factor for students' confidence in pursuing the chosen study programme. Challenges encountered in the transition are large lectures, remote teachers, fast pace and limited feedback (UHR, 2014).

**AP1.1: Interaction with the secondary school sector.** We believe that more knowledge among both university teachers and school teachers about each other's situations would help to make the transition from school to higher education easier for students. Therefore, we want to strengthen the connection between schools and university. In cooperation with the University School Project and NSMO<sup>24</sup>, we will form a Teacher Panel, with members from upper secondary schools (including university schools), NTNU teachers in core courses, and students. The Centre will:

- host annual seminars for teachers from upper secondary school and university teachers focusing on syllabi/aims/methods in the most advanced mathematics and physics courses in upper secondary school as well as on transition challenges;
- manage a web-portal with relevant digital resources for the groups mentioned above;
- design, and actively be involved in, R & D projects relevant for transitional challenges, in cooperation with the university school project.

**AP1.2:** Closing the gap. NTNU has a long tradition with arranging events meant to facilitate the transition and induction phases. We want to extend and broaden the scope of these measures, by:

- arranging summer camps/courses aimed at students with different interests and needs;
- further developing digital resources adapted to each course (connects to WP3);
- developing the induction programme Teknostart to obtain a better integration between the core subjects and the various technology programmes;

- providing infrastructure for, and include, teamwork based activities in the first semester. The Student Panel and other students are important contributors to the points listed above.

<sup>&</sup>lt;sup>24</sup> Nasjonalt senter for matematikk i opplæringen, www.matematikksenteret.no

**AP1.3: An undergraduate research programme.** Of the c.2500 students per year enrol in technology programmes at NTNU, many will turn out to be tomorrow's researchers and innovators. To provide an opportunity for students to be actively involved in research projects we plan to:

- further develop the StudForsk-project, in particular to develop projects which involve elements from both mathematics, physics and computer science (e.g. modelling and scientific computations);
- arrange an annual conference, in order to disseminate results from these projects.

# WP2: Integration

WP2 aims to enhance cross-disciplinary integration between core courses, as well as integration between core and advanced courses, and programmes where content from core courses is applied. The use of computational methods is now a central and well-integrated tool in industry, as well as in research and development. This is reflected within many advanced courses at NTNU, but is not seen as much in the *content* and *learning outcome* of core courses. In AP2.1, we survey and identify the needs for reforming the content of these courses, and decipher these needs into a core curriculum. In parallel, we will run two more focused projects, which will give natural feedback into the core curriculum to be devised in AP2.1.

**AP2.1: Reforming the core curriculum.** A User Panel will play the role of a hub and discussion forum for input into the design and description of reformed learning outcomes. Members of this Panel will be representatives of engineering study programmes at NTNU, as well as NTNU's Executive Committee for Engineering Education (FUS<sup>25</sup>). Representatives from other technological universities, research institutes and large technological employers will also be included. Input from international recommendations (e.g. Alpers, 2013) and interaction with SEFI will also be important. The reform work will be carried out in several steps, inspired by (Graham, 2012). Step 1, *surveying:* Collect relevant data to identify both requisite skills and mathematical base knowledge for study programmes in technology at NTNU, and in relevant sectors of industry. Step 2, *identifying:* Identify key elements that should be included in the core courses of technical education and classify them as skills or knowledge. Both common and programme specific elements will be identified. Step 3, *deciphering:* Translate the identified skills and knowledge into study, course and teaching plans. The Student Panel will be involved in all steps, and the Teacher Panel (WP1) will ensure that the reformed content is adapted to the students' prior knowledge from secondary school. **AP2.2: The Dynamic Physics Project.** The core physics course is well suited for exposing the

students to cross-subject integration. A "Dynamic project", centred around the laboratory part of

 $<sup>^{25}\</sup> https://innsida.ntnu.no/wiki/-/wiki/English/Executive+Committee+for+Engineering+Education$ 

this course, will challenge the students on all levels, from project idea to final report, including practical work, uncertainty analysis, analytical calculations, numerical analysis and programming. Compulsory activities within groups of students will create a stimulating, safe environment for active learning. The proposed change represents another step away from the cookbook-recipe type of exercises, which have traditionally dominated the laboratory part of the physics course.

**AP2.3: Programming in calculations and simulations.** AP2.3 will study the use of generalpurpose programming languages such as C++, Java or Python in different engineering disciplines. , We plan to develop the basic training in programming for better integration with core courses, such as mathematics, physics and statistics to create a symbiotic learning environment. Learning resources will be developed, such as exercises and projects adapted to the calculations, simulations and visualizations typically found across the engineering disciplines at NTNU.

# WP3: Digitalization

WP3 aims to design intelligent tools and methods for digitalisation, by providing guidelines on designing and developing learning resources (AP3.1), adaptively presenting learning resources to students (AP3.2), developing automated targeted feedback for assessment (AP3.3), and by promoting student participation through use of systems for digital interaction (AP3.4).

**AP3.1: Guidelines for development of digital learning material.** Development of digital learning material for core courses is an on-going process. In AP3.1 this will be extended to all foundation subjects. Furthermore, the aim is to establish best-practice guidelines for development of digital learning material of high quality, and for how the material is best made available to students. Digital material developed in AP3.1 will be made available to students through web pages hosted at NTNU, and through electronic learning systems and adaptive learning systems (see AP3.2). Videos produced by lecturers from various technology study programmes will provide motivating examples of how the foundation subjects are used in their specialisations (coordinated with WP2).

**AP3.2: Adaptive learning systems.** The increased access to a broad range of high quality learning resources (AP3.1) enables new ways for students to achieve the knowledge and skills that each course aims for. Also, it enables students to approach the curriculum in individual ways, thereby addressing students' individual learning styles and level of competence. The core courses constitute a large-scale environment where it is possible to make use of learning analytics (Long & Siemens, 2011) to implement and utilize aspects of adapted learning in innovative ways. We will make new learning resources available as well as utilize existing resources. By gathering statistics on the use of learning resources and by monitoring students' progress, we aim to identify each student's need for support and individual adaptation and develop a learning environment that will recommend

learning resources to fit the student's profile (cf. recommender features in systems such as Netflix and Amazon). In our approach we aim to suggest to individual students e.g. tutorials and exercises best fit to create a sense of achievement and motivate the student to continue performing.

**AP3.3: Digital formative and summative assessment.** Formative assessment can be seen as a process where students are given feedback on performance during a course, with the aim of improving learning outcomes (Bjørkli, 2014), whereas the main focus of summative assessment is to measure how well learning objectives have been met. Digital assessment tools may help to increase the learning potential of assessment by providing instant feedback to the student. Students report in surveys that instant feedback on the correctness of an answer is highly appreciated but they miss information on why an incorrect answer is incorrect. The aim of AP3.3 is to design algorithms to detect in which step of the problem solving process an error is made, and provide customized feedback to the students. With respect to interim assessment, we will compare the effect on students' learning by using formative vs. summative assessment.

**AP3.4:** Active learning with digital interactivity. Students starting studies at NTNU have a high degree of digital competence (Hatlevik et al., 2013), and the majority of them have personal devices to bring to class. Students expect the use of digital tools and learning technologies established in upper secondary school to be even greater at the university level (Norgesuniversitetet, 2015, p. 99), which is not necessarily the case. The two student response systems, Kahoot! and PeLe (developed at NTNU), have shown to be highly suitable for student engagement and motivation (Wang, 2015), and for increasing student learning outcomes (Bjørkli, 2014). We aim to develop a set of best practises for the use of student response systems. This will primarily be in the context of on-site lectures and assignments, but also with an option to include blended learning scenarios, in which on-site lectures are combined with e-learning material through learning management systems. Subgoals include the provision of training, technical and methodological support for mentors in using student response systems, and to establish a framework to enable the exchange of scenarios, methodological approaches and questionnaires across different course topics.

# WP4: Learning environments

In WP4 we bring together results and experiences from WP1-3 to establish an optimal learning environment for the students. In close collaboration with projects for developing both the physical campus<sup>26</sup> and electronic learning systems<sup>27</sup> at NTNU we aim to construct a physical and virtual

<sup>&</sup>lt;sup>26</sup> http://www.ntnu.no/web/campusframtid/hovedside

<sup>&</sup>lt;sup>27</sup> https://innsida.ntnu.no/wiki/-/wiki/Norsk/E-læring

infrastructure, and develop ways of communicating and collaborating within these structures to stimulate active learning. In WP3 we will develop a wide range of digital resources. As emphasised by the Student Panel, help is required in order to navigate such resources. The adaptive learning system (WP3) will partially solve this, but human interaction is also needed. Students report that they appreciate collaborating with peers as a way of learning. However, expertise on all academic levels is important for high quality of the learning experience. From school, students are used to close contact with teachers, an issue that is only partially addressed in WP1. The support centre (see AP4.1) will be organised in a way that will stimulate interdisciplinary activities (WP2).

### AP4.1: Support centre on campus

We will develop a comprehensive support centre where students can find qualified tutors as well as a well-equipped resource library (physical and digital). To improve interaction between students and teaching staff, we will develop a system with personal learning assistants. The support centre should also provide space for groups of students working together. We plan to:

- develop a full support centre based on the British model (Mac an Bhaird & Lawson, 2012), serving core courses within the foundation subjects;
- improve the training of learning assistants for the support centre;
- develop a system with personal learning assistants for the students.

This support centre will be unique in the Norwegian context, both regarding its scope in terms of subjects and the number of students that it will cater for.

### AP4.2: Virtual support centre

Digital learning environments are of great importance for the total study process. Students communicate on digital platforms in various ways, within and outside of the organised environment around university courses. In AP4.2 we will facilitate digital learning and communication for students, and establish an environment for relevant online support of high scientific quality. By relevant, we refer to relevance to the course curriculum and the scientific background and level of the students, and by 'high scientific quality' we mean the quality of pedagogical presentation and the rigour of its content. Furthermore, AP4.2 includes establishing moderated online discussion forums, building on experience from core courses in computer science<sup>28</sup>.

We will establish a virtual support centre, which will enable:

- peer to peer interaction;
- establishing virtual colloquium groups with an on-line tutor;
- on-line tutor available for one-to-one communication.

<sup>&</sup>lt;sup>28</sup> www.ntnu.no/wiki/display/itgk/piazza

Work with digital learning environment will take place in collaboration with MatRIC.

### AP4.3: Interactivity in large scale teaching sessions

University education is traditionally characterised by an extensive use of lecturing, often to large groups with little interaction. Internationally the idea of the flipped classroom (Mazur, 2012) has gained considerable interest but successful implementations of this principle have largely been carried out with smaller groups and in subjects in fields other than those under discussion here. However, there are reports of successful implementations in environments more akin to ours (Deslauriers et al., 2011). Technological solutions for enabling interactivity in large groups are continuously being developed, by student groups within NTNU amongst others, and we will keep in close contact with such groups, providing a demanding test arena for their products. We will:

- in collaboration with the Campus Project at NTNU, engage in testing and developing innovative architectural solutions for learning spaces;
- adopt the latest innovations in technological solutions for interactivity in teaching sessions, and provide feedback to developers;
- establish best practices for engaging students to prepare in their preferred manner (using digital resources, support centre, textbooks etc.) to teaching sessions.

### Evaluation, research and dissemination

It is the ambition of the Centre to have a long-term impact on engineering education in Norway and to be a source of inspiration for similar education programmes in other countries. The foundation subjects, on which the Centre is based, are important also outside of engineering education and many of the resources and approaches to education that will be developed will also be of value for other education programmes. To fulfil this ambition, we have devised a varied plan for dissemination (see Action Plan). We will arrange workshops and give tutorials addressing specific topics in order to communicate our work and ideas, and also to get input from peers and stakeholders for further work. Continuous impact and feedback will be secured by actively engaging the three panels within the Centre. The Student Panel, the Teacher Panel and the User Panel will secure collaboration with and dissemination to students, the school sector and other parts of the university as well as the work places for which our candidates are educated.

Research on Centre activities will be performed by permanent staff and PhD candidates, focusing jointly on technological solutions and educational aspects. Results from research will be disseminated through traditional channels (journals, PhD theses, conference presentations and proceedings). We plan to collaborate with MatRIC in its established annual conference and other activities. Our international partners are also important for maintaining exchange of experiences and stimulation for further work, e.g. conferences held by various working groups within SEFI.



# COMMENTS

[Body text (150 words)]

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# **INFORMATION ABOUT THE HOST INSTITUTION**

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### **CONTACT PERSON**

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### ABOUT THE CENTRE

Name of Centre Center for Excellence in Sustainability Education - CESE

Is the Centre already established at the time of the application (yes/no)?  $\Box$  Yes  $\,\boxtimes\,No$ 

Please name any consortium partners for the Centre

- Lillehammer University College, Lillehammer, Norway

- Youth Entrepreneurship Hedmark, Hamar, Norway

- Tretorget AS, Elverum, Norway

- Norwegian Environment Agency, The Norwegian Wild Reindeer Centre, Hjerkinn, Norway

# ABSTRACT

CESE's vision is: *Pyramid learning for sustainability*, meaning learning communities focused on students experiencing a complete and integrated knowledge pyramid with: Education, Research, Innovation, and Communication. CESE will create candidates who contribute positively to the required green transition in our society and become entrepreneurs for an improved stewardship of nature ranging from preservation to commercialization of biological resources. To accomplish this we will:

- Develop a Pyramid Learning Community
- Integrate students in all facets of an academic learning community, amongst others by producing study programs and learning paths integrating the complete knowledge pyramid
- Improve our teaching skills
- Develop and disseminate methods for improved learning

Campus Evenstad hosting the Centre is an excellent model to develop and evaluate the success of such learning communities as it highly integrates a large number of students living on campus, focus on on-campus studies, and has high expectations for student and staff presence on campus.

### **APPLICATION DOCUMENT**

### **PROFILE AND VISION**

Centre for Excellence in Sustainability Education – CESE

*Vision: Pyramid learning for sustainability.* With this we mean to develop learning communities, focusing on students experiencing a complete and integrated knowledge pyramid with the four corners:



overall aim is to create candidates for a sustainable society that possess the comprehensive expertise based on the combination of the four disciplines in the pyramid, who will contribute positively to the green transition in our society, and become entrepreneurs for an improved stewardship of nature ranging from preservation to commercialization of biological resources. To accomplish this we will: (1) Develop a Pyramid Learning Community; (2) Integrate students in all facets of an academic learning community by integrating the complete knowledge pyramid; (3) Improve our teaching skills; and (4) Develop and disseminate methods for improved learning.

### BACKGROUND

Campus Evenstad (CE) at Hedmark University of Applied Sciences (HUAS) has an impressive development with regard to academic competence and infrastructure, and is dedicated to host a Center for Excellent in Education. Associate professor Barbara Zimmermann at CE was awarded HUAS' prize for education quality in 2010 for the most innovative teaching on human dimension in nature management, and CE by dean Harry P. Andreassen, was awarded the prize in 2014 for focusing on excellent learning communities. In 1999 CE was evaluated among the 5% most efficient University College departments in Norway, due to high student production, research, and communication activity<sup>1</sup>. Lately (25.03.2015) Kyrre Lekve (State Secretary of the Ministry of Education 2007-2012) stated in the Norwegian radio that *Campus Evenstad is an excellent example where you can do high quality education and research even if you are small*<sup>4</sup>. The relevance of our studies and guaranteed job opportunities have been confirmed by students in the media, as well as by the establishment of companies based on our student's work. CE's quality has also been described in regional newspapers, by Fullbright students (3 the last 6 years), and international students<sup>b</sup>. CE focuses on sustainable development of the anticipated green transition of our society which has a large economic potential in Europe (expecting more than 22 million



<sup>&</sup>lt;sup>a</sup> Read about the interview at NRK national radio on 25.03.2015: <u>http://hihm.no/om-hoegskolen/nyheter/eldre-nyheter/2015/liten-vs.-stor.</u>

<sup>&</sup>lt;sup>b</sup> Job opportunities; Imsa Knowledge Company; Regional media 1; Regional media 2; Fullbright student 1; Fullbright student 2; International students

jobs<sup>2</sup>). Green transition is based on biological resources<sup>c</sup> found in CE's surroundings (Fig. 2). Our vision of hosting CEES is founded on the inter- and transdisciplinary approach to the sustainability principle (Fig 3). Below we structure our proposal according to the assessment criteria.



**Fig. 2.** CE surrounded by real life exposure to our disciplines (ecology, forestry, agriculture and wildlife). CE has been upgraded for more than NOK 200 mill since the photo in 2006.

# DOCUMENTATION OF EDUCATIONAL QUALITY IN EXISTING PROVISION Input factors

Academic, educational and managerial competence. The vision of CESE fits well to HUAS' vision: *To develop knowledge for and with the industry and community as a basis for obtaining university status*. As a response to this The Faculty of Applied Ecology and Agricultural Sciences has an **education** profile called *Sustainable use of farmland*,

*forest and wilderness areas* which is relevant as a knowledge base to CESE and a core area of education at HUAS. The Faculty is located at CE and Campus Blæstad and is managed from CE. It has ca 440 students (ca 220 at CE) and 75 employees (ca 60 at CE). CE focuses on on-campus studies, and expects students and staff to spend their working hours on campus, with class schedules from Monday till Friday and field excursions in the surroundings. The surroundings are important to us because we want to combine theory and practice in real life learning arenas. With regard to internationalisation we manage the Nordplus-network Nordnatur for improving the quality of studies at the bachelor - and master levels together with Nordic and Baltic agricultural universities (www.nordnatur.net), and a National Research School funded by the Research Council of Norway (RCN) called The International Research School in Applied Ecology (IRSAE; www.irsae.no) with more than 120 European PhD-candidates. At any time 30-50 students on campus are international, as are ca half of our PhD-candidates and 20% of the academic staff. We are members of international research groups, such as Skandulv (http://www.slu.se/skandulv).



HUAS also manages PERL which is a partnership for Education and Research about Responsible Living (<u>www.hihm.no/perl</u>) with more than 140 institutions from 50 countries. On the basis of its longstanding engagement in education and research about

**Fig. 3.** Sustainability as an interaction between ecological, economic and social sciences. However, the exploitation of resources depends on basic values (ethics) and can be pushed by technological and agronomic developments. The realization of sustainability depends on transdisciplinary collaboration in the triple helix.

<sup>&</sup>lt;sup>c</sup> The transition is based on bioeconomy. The Norwegian government has initiated the development of a National bioeconomy strategy, the County management in Hedmark and Oppland (the county hosting Hedmark University of Applied Sciences and the neighbouring county) has initiated the development of a regional bioeconomy strategy, Hedmark University of Applied Sciences has initiated the development of a bioeconomy strategy headed by the dean Harry P. Andreassen.

responsible living, HUAS was in 2015 given the privilege to establish an UNESCO Chair and UNITWIN Program on Education about Sustainable Lifestyles.

**Research** is the basis for all our academic activity on CE. Our research profile is called *Applied Ecology* meaning an interdisciplinary approach to the use and production of biological resources<sup>3</sup>. Faculty involve 8 professors, 8 associate professors with PhD's and 5 university teachers in permanent 100% positions. We employ 2 more professors in 2016. Three associate professors, 6 field assistants/research technicians on external funding and 18 PhD-candidates admitted to the PhD in Applied Ecology contribute to R&D. We get highly qualified applicants to our available positions and produce substantial research (annually >1 and in 2013 and 2014 >2 papers in international scientific journals per scientific employee), often developed in research groups with Norwegian and international students. Bachelor and master theses are research-based and often published <sup>e.g. 4</sup>. Our publications are co-authored with the most rewarded scientists in ecology nationally and internationally <sup>e.g. 5</sup>. Research and seminars are used to improve the quality of publications as the proportion of level 2 publications is still low. The last years we have been granted more than NOK 10 mill from The Research Council of Norway (RCN). External funding for R&D accounts NOK 22 mill on campus, more than 50% of the yearly economic turnover.

With the **innovation** profile *Sustainable business* we mean the development of products and business related to natural resources that result in a social or economic gain, with as little ecologic pain as possible. We are establishing Evenstad Innovation Center (EIC) dedicated to this innovation profile with an initial funding from SIVA<sup>d</sup>, Hedmark County Council and Stor-Elvdal municipality<sup>e</sup>, run by national organisations in the steering board (The Norwegian Farmer's Union, Norforest Consulting, The Norwegian State-Owned Land and Forest Enterprise).

The innovation profile gives rise to considerable **communication** interacting with society and working life. Our students meet potential employers in national professional meetings and conferences, or in our own events, such as the National small game seminar, the Regional business seminar and the Wolf cafeteria. We collaborate with the regional high school introducing research competence among pupil and staff. In 2017 we will also establish a Competence Centre for Renewable Energy together with the municipality and Statsbygg<sup>f</sup>, and The Norwegian Moose Centre together with local landowners and become new arenas for communicating research.

<sup>&</sup>lt;sup>d</sup> From <u>www.siva.no</u>: Siva is a public enterprise owned by the Norwegian Ministry of Trade and Fisheries. We are part of the public funding agencies for innovation and work closely with Innovation Norway, the Norwegian Research Council and the Norwegian Patent Office. SIVA facilitates innovation by building, owning and developing infrastructure for industry, startups and research environments. <sup>e</sup> Hosting campus Evenstad

f The Government's property owner manager

HUAS has put considerable focus on **education expertise** and is about to establish a permanent Teaching and Learning Centre (TLC) in 2017. In 2013 CE employed a fulltime vice dean for education with pedagogic competence who is ensuring the quality of our education and teaching.

CE has ample **managerial competence** with large projects, such as the Research school and the Boreal forest ecosystem project with 15 partners in the consortium and a total budget of NOK 23 mill over 3 years. Yearly, we invite members of the triple helix to R&D proposals managed by the campus (see attached CV's).

The campus has been well supported by HUAS' leaders and steering board. Since 2006 the **infrastructure** on campus has been improved for more than NOK 200 mill, and the last improvements will finish the summer of 2016 with the world's most environmentally friendly building. The new building is intended to avoid fragmentation of staff and students by encompassing all administration and scientific staff (including PhD-candidates) in the same building. This will also create ample space for group rooms and the student's learning arenas on campus. The campus has housing for 117 students, a student social house, a gymnasium, outdoor facilities and may host 25 guests.

*The management and the academic community* are actively engaged in and supportive of the educational mission of CESE. The academic management developed the first ideas of the pyramid, and was immediately supported by the rectorate at HUAS. HUAS' yearly student satisfactory survey illustrates the association between the student outcome and well-functioning infrastructure, service and information, and student social environment<sup>6</sup>. These results have motivated the development of CESE. All staff members, including scientific staff, technicians and administration have been dedicated to group-work around the knowledge pyramid and learning community. The group-work will be discussed in a staff seminar in Oxford this summer attended by 50 of the employees. The staff meets for monthly pedagogic seminars and students and campus leaders meet biweekly in the student council, amongst others discussing campus progress plans. *Provision of resources are adequately deployed* and reported yearly for HUAS' steering board (which includes 2 student representatives). The dean is part of HUAS leader group which advices the rector on the provision of resources. The large research projects at CE with external partners is often organised with steering boards that control that provision of resources is adequately deployed. We plan a steering board for CESE (see organisation below).

#### **Process factors**

**R&D** permeates the development of teaching and students' learning. Our own R&D is determinant for our study programs. Hence, research results are implemented in teaching. R&D is introduced to the students the first year when they initiate ideas about their research-based

bachelor or master thesis. Their progress is followed tightly in an electronic learning path in the Learning Management System until the thesis is delivered. TLC contributes with R&D information on teaching and student learning, learning tools and pedagogic alternatives. Teaching and learning methods utilize learning arenas with real life experience where students meet researchers, business and management<sup>7</sup>. For instance: (1) we established a Centre for Wildlife and Business (EVONS) in 2010 collaborating with public management and private enterprises to initiate relevant research for innovation (7 employees today). Our students can do a practice period in EVONS and be involved in business meetings with potential contractors, or practice their knowledge in host companies; (2) Forest management is taught in real life situations as CE manages a forest for a forest company; and (3) Conferences where bachelor students present their business plans in public, e.g. the yearly National Forest Conference in Østerdalen. Other learning arenas are in the laboratory, data labs, the slaughterhouse for game, or in the field. These learning arenas are connecting theory and practice and will be further developed in CESE. Student learning is assessed and monitored in various ways depending on the course. One good example is the learning path for bachelor - and master thesis where students assess each other under professional supervision, get feedback on their plans and hypotheses in open seminars with staff and students, and get final oral and written feedback from external examiners. The criteria for, and method of assessment and marking are presented and discussed with students in advance<sup>g</sup>. Student engagement and ownership of learning is promoted through HUAS' quality assurance system which includes a mid-way evaluation within each course, discussing learning outcome between teacher and student. Most teachers also use a final course evaluation and HUAS conducts a yearly student satisfaction survey analysed by the dean at CE<sup>6</sup>. The last 10 years 82-95% of the students at CE have answered that they are content or very content with study and study place. At CE the results of the survey are presented and discussed with all students and staff, and immediate action can take place. Already on the first school days students are involved in the strategies on campus and the significance of research, quality and responsibility. CE leaders meet all new students to break barriers between students and management and to discuss expectations. Through this we introduce students to the learning community and how we want to succeed together. To visualize our focus on quality, a grant is given from an external committee to 3 bachelor and master theses found to be the most relevant topic for the industry. Additionally, we honour all students that deliver their bachelor or master thesis in due time with sunglasses to indicate that their future is so bright. These actions contribute to build a culture of quality, and have increased posting of theses in due time from ca 33% 5-6 years ago to 88% in 2016.

<sup>&</sup>lt;sup>g</sup> Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG). (2015). Brussels, Belgium.

#### **Outcome factors**

*Relation between student achievement and learning aims.* The starting competence of students at CE (39.6-40.6 the last 3 years) is around the mean for Norwegian studies at university colleges and is close to comparative studies at Norwegian University of Life Sciences and Nord University. Also the yearly production of ECTS credits per student resembles that of equivalent students of the two universities. Some teachers conduct weekly tests related to learning aims and outcomes to improve the connection to student achievements.

*Educational provision is relevant* for instance as learning arenas with business and public management is necessary to create candidates that quickly can be committed to relevant issues in a professional position. The bachelor content and design is planned to qualify for master studies and the master for PhD-studies. Sustainability issues related to biological resources will increase its relevance in the future and already today some of our students are guaranteed work<sup>b</sup>.

### THE CESE CENTRE PLAN

#### Innovation

*CESE is important to higher education and fits well with international developments in higher education* because it develops methods for integrating the complete knowledge triangle with a focus of being relevant for the future society in the pyramid (communication), giving students a unique learning outcome. The pyramid encompasses all higher education independent of academic discipline. The novice student enters the pyramid through the corner of education. By a successive learning process, the student moves into the three interconnected dimensions of innovation, research and communication. An educated professional will meet societal needs with a voluminous and interwoven understanding and skills. The pyramid stimulates higher education sector as it moves the institution's focus from filling students with knowledge to develop skills towards a sustainable knowledge-based future. Pyramid learning opens for the new pedagogies necessary to meet society in the Knowledge Age <sup>8</sup>. According to the New Learning Paradigm, professionals well equipped with the 21<sup>st</sup> century skills do not only hold the core skills (reading, writing and arithmetics), but also learning and innovation skills, career and life skills, and digital literacy skills <sup>9</sup>. The job readiness of a candidate in this context can be described as a function of the sum of these skills <sup>10</sup> and is well encompassed in our pyramid learning approach.

*Intended novelties and transformations of current practices.* Educational quality is a collective capacity on campus <sup>11</sup>. We will develop this further to include the whole community consisting of the students, administration, technical staff and the central administration and management at HUAS. This will fulfil infrastructural needs, service and information, social and emotional environment. We will all contribute to «capacity building» and we will all develop knowledge,

skills and general competence to create an education that improves the learning outcome for the students. These will also ensure the social capital on campus <sup>12</sup> creating close relations between teachers, students and colleagues which is determinant for high quality teaching <sup>13</sup>. The learning community will give the student membership, influence, fulfilment of individual needs and shared events and emotional connections<sup>h</sup>. Campus Evenstad is indeed a good model to develop and evaluate the success of such learning communities because it is a community of its own with a large number of students living on campus; we are developing expertise in all four corners of the pyramid, on on-campus studies where students and staff are present on campus, and all depend on each other. However, awareness of this development requires an exciting cultural change among all staff as we today are mostly focused on research and education. The pyramid learning requires an openness and will to accept and learn about innovation as an important dimension of our community for future students. To a large extent research, innovation, and communication will be integrated in all learning outcomes in all courses where it belongs naturally, and definitely be apparent in the study curriculum. We are still not able to grasp these interconnections and the consequences for teaching and campus development. Such a complete learning environment <sup>14</sup> will require a universal design of teaching material and a higher awareness among staff on their positive contribution to service and information and the social environment.

*Students are active in the development and innovation processes* by being members of the CESE's steering board and the creative reference group (see organisation below). Already the first day of school start we will introduce students to CESE and invite them to participate in the development of the centre. The student council is involved in curriculum planning, course planning, implementation and evaluation.

*Important milestones to realize the ambitions* are described in the attached action plan. *An SFU Centre Award* will make it possible for us to (1) realize our ideas about pyramid learning, learning communities and new teaching methods on campus; (2) develop innovation and communication as part of our study curriculum; (3) disseminate our results and create methods and courses so we can share our experience with other institutions and disciplines to improve and generalise future learning methodology; (4) do research on the outcome of CESE with regard to the learning outcome's relevance for the society; and improved capacity building among staff; and (5) realize a *Pyramid app* for institutional strategic development that allows evaluation of how the institution's academic profile is understood (see next paragraph).

http://www.evergreen.edu/washingtoncenter/

#### **Evaluation and impact framework**

We will evaluate the impact by studying various variables through time. For the student **perspective**: We will establishing an internal evaluation of (1) competence among incoming students; and (2) learning outcomes relative to aimed learning outcomes in the curriculum among graduating students. As we realize the centre we expect 2 to increase and stabilize among students independent of incoming competence. We will also measure (3) the number of student contributions in research production, conferences, in the media, and establishment of companies/patents. We will continue with the Student satisfactory survey and expect increased student satisfaction, less variation among years in satisfaction with regard to learning outcome, student social environment and service and information. The staff perspective: We will expect an even higher affiliation to the working place through the existing time of CESE. We will also evaluate and expect an increase in R&D production, popular dissemination of results, improved results in student evaluation of courses, and a higher participation in student social events. The institutional perspective: We will evaluate CE with regard to (1) the number of primary applicants to our studies; (2) formal incoming competence of our students; (3) the proportion of graduating students that are in a relevant job situation 6 months after graduation, We will also develop a *Pyramid app* to evaluate (4) academic reputation by asking our students, stakeholders and others yearly about how they define CE in the knowledge triangle/pyramid. Today we expect incoming students to score us close to the education part of the triangle, stakeholders between education and research, while others in the society may score us close to research. Through time we hope to change this towards the middle of the triangle or to the core of the knowledge pyramid. We will also ask staff to score themselves in the pyramid and expect a change trough time towards communication and innovation. We will use these scores for strategic development of CE. We will also ask graduating students to see how their score changes through their education. The stakeholder perspective: Increased success of R&D in association with stakeholders, a higher number of invitation to R&D projects by stakeholders, increased job opportunities for our students (as registered in national lists, <u>www.nav.no</u>).

*CESE will contribute to and stimulate institutional development* by sharing pyramid learning through the TLC which also consists of coordinators from all HUAS' faculties. TLC will share a staff member between TLC and CESE which will ensure institutional development through seminars across disciplines. HUAS is experienced as a multiple campus institution (5 campus) and we have well incorporated routines to learn across campus.

*CESE will gauge value for money* primarily by being relevant for society, by producing candidates that get relevant jobs, that contribute positively to a green transition in a sustainable

society, and that are entrepreneurs and managers of natural resources and obtain more R&D projects for public authorities and industry. CE will increase its reputation and the positive contribution of our students in the society will increase the society's use of us, e.g. obtain more R&D projects for public authorities and industry. CE's ambition is to become a National competence centre for sustainability by being in front academically, by defining sustainability, and in front for stakeholders by operationalising sustainability.

*CESE will be sustainable post funding* by obtaining higher production and increased result component of the financial model. We will have higher success on external funding, specifically from RCN and EU as we will be able to combine research and innovation and collaborate interand transdisciplinary. Post funding, products from CESE, e.g. courses, course material and similar may be payment-based. TLC will also have a competence that can support post-funding activities. **Dissemination** 

*CESE will share developed knowledge and practices* across campus within HUAS, within green education in Norway, among National higher education institutions, and internationally through our networks (Nordnatur, IRSAE and PERL). Internationally, PERL will be an important collaborator for sharing knowledge in their conferences and publications. We will develop an active and interactive web-page, course material and web-based courses in open access, arrange conferences, contribute in other's conferences, and collaborate with other Centres for Excellent Education. We will contribute to the international scientific environment of education research by employing a PhD student working on the outcome of pyramid learning as well as publications from other researchers following the outcome of our initiatives.

*CESE will collaborate* with PERL (see above) and The Centre for Studies of Educational Practice at the Faculty of Education and Natural Sciences at Campus Hamar (SEPU - http://eng.hihm.no/ project-sites/sepu) which is the National leading research centre for innovation in education. SEPU will be involved in research with regard to our achievements, co-supervise a PhD-candidate and contribute to the development of our learning community and education skills in seminars and workshops. To achieve an interdisciplinary knowledge base we will collaborate with philosophers, environmental psychologists, and economists at the Faculty of Social Sciences and the Faculty of Economics and Organizational Sciences at Lillehammer University College. With regard to innovation we will collaborate with Youth Entrepreneurship (http://www.ue.no) to develop the students creativity and believe in themselves, Tretorget (http://www.tretorget.no/) which is a Centre for innovation and achievements for the wood processing value chain, that runs development projects and have a business incubator and provide consulting (www.tretorget.no), and the Centre for Innovation in Service and the Centre for Travel Research (related to nature based tourism) at Lillehammer University College. Norwegian Environment Agency contributes in communication and nature interpretation.

*Dissemination approaches differ with target groups.* Across Faculties at HUAS, dissemination arenas are the planned annual CESE-seminar, the annual HUAS Quality Conference, TLC and the internal course on higher education pedagogics for newly employed staff. Across national and international higher education (HE)-sector, we will invite HE-institutions and partners of our educational networks (Nordnatur, IRSAE) to our annual CESE conferences and seminars and organise courses and visits on campus. We will share our methods and experiences at national and international conferences of education, in peer-reviewed journals and popular scientific articles. We will specifically seek for collaboration with other Centres of Excellence to exchange experiences and synergize efforts. Another target group are regional elementary and high schools which will be invited for collaboration.

*The academic leadership is engaged in disseminating CESE.* The last 6 months campus leaders have already communicated ideas about the learning pyramid to HUAS' steering board, various departments at Hedmark County Council (county politicians, international sector, bioeconomy strategy, business development), County Governor of Hedmark), the hosting municipality administration and politicians, 200 leaders in the forestry industry in Norway in the Østerdals-conference, Eastern Norway Research Institute, Karlstad University in Sweden, staff at Norwegian Environment Agency, Innovation Norway in Hedmark county, NITO labour organisation for ingenieurs and technicians, local labour party, 120 visitors to our Wolf cafeteria, 100 participants of our regional business seminar, some non-governmental institutions and high schools visiting the campus.

### ORGANISATION AND ACTIONM PLAN OF CESE

Please see attached budget and action plan.



# INFORMATION ABOUT THE HOST INSTITUTION

Host institution NTNU			
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## **CONTACT PERSON**

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TItle Professor	
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# **ABOUT THE CENTRE**

 Name of Centre

 Centre for Engaged Education through Entrepreneurship (ENgage)

 Is the Centre already established at the time of the application (yes/no)?

 □ Yes ⊠ No

 Please name any consortium partners for the Centre

 NTNU School of Entrepreneurship, Nord University Business School, NTNU Experts in Teamwork, NTNU TrollLABS and Spark NTNU



# ABSTRACT

ENgage will develop education for students from all disciplines and professions who will constantly challenge accepted truths and innovate for the better, in both the private and public sectors. ENgage is a consortium consisting of the NTNU School of Entrepreneurship, Nord University Business School, NTNU Experts in Teamwork, TrollLABS and Spark NTNU. These excellent educational programs are each characterized by learning in which students develop projects in the real world and reflect upon their processes. Students in these programs commit to engaging in their learning, taking responsibility for their own learning, and sharing knowledge within a learning community of fellow students, previous students and faculty. ENgage will combine, develop and disseminate action-based learning, student-to-student learning, collaborative skills, rapid prototyping and student engagement. We will provide train-the-trainer courses and activities for students in all disciplines in order to increase the number of students in higher education with entrepreneurial skills.



# **APPLICATION DOCUMENT**

The application must be written in English and follow the requirements set in this template. It must not contain more than 10 pages in Times New Roman, 12-point types, with lines spaced 1.5 and margins of 2 cm. Within this format, the applicant must provide:

#### a) Documentation of educational quality in existing provision

The applicant must comment and critically reflect on themes and questions set out in the criteria, and compare their existing provision with similar provision within the same subject/discipline area, both nationally and internationally. Through this, the applicant must document that the academic community qualifies as a Centre for Excellence in Education.

#### b) A centre plan

The applicant must comment and critically reflect on themes and questions set out in the criteria. The Centre Plan must outline the vision of the Centre, its strategy and plans. It must present the plans for the dissemination of knowledge and practices to its own institution(s) and to other educational communities as well as an evaluation and impact framework.

### **Appendices**

The following appendices must be included (and no other):

- 1. A list of references
- 2. A budget for the Centre for the first five-year period, including motivation for costs (see guidelines at <u>www.nokut.no/SFU/utlysninger</u>)
- 3. An action plan for the Centre, including milestones (no more than three pages)
- 4. CVs of the proposed Centre Leader and two to five key members of the Centre team (each CV must not exceed two pages)

All appendices must be in English.

### **Practical information**

The rector of the host institution must sign the application.

The deadline for submitting applications is set in the announcement of the call.

All applications will be published on the NOKUT website, alongside the expert panel's feedback.

# **APPLICATION DOCUMENT**

#### Centre for Engaged Education through Entrepreneurship (ENgage)

The world is constantly changing, with increasing pace and intensity. These changes have profound consequences for human life—for the climate and environment, technological opportunities, business practices, public policy, safety, education, and society as a whole. This complex environment calls for citizens who have the ability to identify challenges, the will to act upon these challenges, the knowledge to acquire the resources and skills needed and the confidence to be the driving force for change, regardless of resistance. These people are the agents of change, the entrepreneurs, willing and able to make changes, engaging challenges with creativity and fearlessness. There is an urgent need to educate capable change agents and increase the number of students with entrepreneurial skills (see Ministry of Trade, Industry and Fisheries, 2015).

We must educate a new generation of self-aware students who have the ability to diagnose their own needs for skills and knowledge throughout their professional lives, as well as knowing how to use their expertise to see and meet the needs around them. These abilities must also include the willingness to be an agent of change, regardless of context: an entrepreneurial mind-set. This calls for a radical change in how universities expose students across all disciplines and professions to training in entrepreneurship, preparing them for important roles as change agents in business and society. These students are not content with merely taking a job and accepting established truths. Instead, they constantly challenge existing norms and innovate for the better, for themselves, their organizations, and society, not only for the few, but for the many. A broad ability to interpret situations and implement change is not the result of one pedagogical concept but several.

How will we educate these change agents? This can be accomplished through: (1) a world-class entrepreneurial training program, (2) providing entrepreneurial insights via action-based learning methods to all students independent of discipline or profession, (3) developing and testing new learning models to encourage entrepreneurship, (4) documenting the long-term effects of using innovative learning methods in various contexts, and (5) disseminating these insights to higher education institutions inside and outside of Norway.

#### The consortium as a solid basis for ENgage

The core partners in the ENgage consortium are NTNU School of Entrepreneurship (**NSE**), Nord University Business School (**Nord**), NTNU Experts in Teamwork (**EiT**), NTNU TrollLABS (**Troll**) and Spark NTNU (**Spark**). The consortium also includes several leading national and international

associate partners: Chalmers School of Entrepreneurship (Sweden), Technishe Universität Berlin (Germany), North-Eastern University (Boston, USA), Young Entrepreneurship (N), Technoport (N), TrondheimTech (N), Nordtek and the Scandinavian EiT-network.

NSE was founded in 2003 at the Department of Industrial Economics and Technology Management (IØT/NTNU) based on a 30-year history of entrepreneurship education and research. In addition to the action-based Master's program, which admits students from all disciplines and professions, NSE runs a course for 1200 MSc students each year. Nord has provided courses and specializations in entrepreneurship at the Bachelor, MBA, MSc, and PhD levels since 1985 and has graduated 20 PhDs in entrepreneurship and innovation over the last 10 years. Nord offers a complementary context for entrepreneurship education, with rich natural resources and a dispersed population compared to the strong hub for technological research at and around NTNU. *EiT* is a compulsory course in which students apply their academic competence in interdisciplinary project work to learn collaborative skills that can be transferred to the work place. Over 2000 students take the course annually, facilitated by 80 professors and 160 learning assistants (students) from all disciplines and professions. TrollLABS is an experimental living lab/workshop with a vast machine park and production, materials and mechatronic facilities, as well as rapid prototyping resources. TrollLABS provides three courses with more than 200 students in the area of design thinking and product development, often using experimental project-based teaching. Spark NTNU, founded in 2014, facilitates idea development and venture creation with students from all study programs at NTNU. This is a project run by students and supported by faculty members and industry partners. Approximately 230 start-up teams have received guidance through Spark. Currently, about 70 startup teams, with students from 36 different study programs, receive guidance from 17 student mentors drawn primarily from the senior class of NSE.

The strong outreach of the consortium reaches students in most disciplines and professions and across different campuses. ENgage also has international reach. The associate partners include several leading international institutions, and Nordtek alone represents 120,000 students, teachers and researchers from 27 Nordic technical universities. In addition to the associate partners, the consortium has strong collaborations with leading US, UK and Indian institutions and shares experiences and knowledge with the Balkans, Ukraine, Russia, Sri Lanka, Nepal and East Timor. The founders of the Scandinavian EiT network, the organizers of the national Climate Launchpad final, the managers of the Global Entrepreneurship Monitor in Norway, and the 2016 organizers of the premier international research conference in entrepreneurship (BCERC) are all members of the

consortium. The consortium also has a strong *academic* record that provides a solid basis for the centre, including two-thirds of the entrepreneurship publications in Norway (Damvad, 2011). The key faculty of ENgage have published extensively in relevant areas such as entrepreneurship education, entrepreneurial growth, teamwork and collaborations (see attached CVs).

To ensure that resources are provided, applied and monitored, the centre will have a *management group* consisting of the centre leader, Professor Roger Sørheim, WP leaders, students, and partner representatives. WP leaders include WP1, Monica Rolfsen; WP2, Martin Steinert; WP3, Øystein Widding; WP4, Gry Agnete Alsos; and WP5, Lise Aaboen. The management group has considerable experience establishing, developing and running programs and courses based on innovative learning methods, as well as developing research and cooperative projects with various industries, and participating in international networks (see attached CVs). ENgage is strongly supported at the Department, Faculty and Rector levels by all partners. ENgage will establish an advisory board with representatives from university management, industry, alumni students and international experts, including Professors Helle Neergaard (former president of ECSB) and Hans Landström (founder of CIRCLE and Sten K. Johnson Centre for Entrepreneurship).

### Complementary successful educations as the starting point of ENgage

Figure 1



The ENgage partners demonstrate excellent practice-focused education. Each partner uses complementary pedagogic foundational techniques to create learning processes for their students. The scientific fields and the teaching areas are diverse, but the underlying philosophy is similar (see Figure 1). All partners emphasize knowledge as resulting "from the combination of grasping and transforming experience" (Kolb, 1984:41). In the experiential learning process, students learn about a particular

subject, but they also learn about their own learning process (Kolb & Kolb, 2012). Many elements from challenge-based learning (e.g., Crawley et al. 2007) are present in these educational programs: the students solve open-ended, needs-driven problems through interdisciplinary teamwork.

By combining forces, the ENgage partners go beyond challenge-based education. Our students not only solve open problems but they also identify new problems and opportunities. Moreover, our students do not stop at delivering solution proposals; they also implement the solution and test it among users by obtaining direct, real-life feedback from external stakeholders, such as firms, investors and policy makers, in addition to traditional evaluation methods such as assignments and presentations. Student-to-student learning, which is already integrated in various physical arenas in the consortium, also plays a crucial role in students' education. In these arenas, older students assume the role of mentors for younger students. There is a strong culture of honest and constructive feedback from other students, faculty and stakeholders. For instance, the culture of contributing, *being engaged* and *supporting each other* is deeply rooted in the NSE faculty and current and past NSE students through conscious facilitation over many years. The approach of faculty is described by the students as a "hands-on approach where they have confidence in us finding and walking the road ourselves, and if we don't, we will come back and ask." Table 1 summarizes current learning practices in the consortium.

ENgage Partner	Main current practices
NSE	How the students learn: Combining their experiences from their start-up with theory and
Action-based	the experiences of other students in a co-located community.
entrepreneurship	Focus: Team ownership of the action-based project. Being entrepreneurs in the real
education	world.
EiT	How the students learn: Reflecting on specific collaborative situations in their teamwork,
Development of	giving feedback and taking actions to improve their collaboration.
collaborative skills in	Focus: Facilitation and collaborative exercises to increase awareness of the group
interdisciplinary teams	dynamics.
Troll	How the students learn: Practicing rapid prototyping and design thinking in teams in
Rapid prototyping,	designated facilities.
Design thinking	Focus: The process and physical artefacts of the fuzzy front end of product development
	as part of challenge-based learning.
Spark	How the students learn: Mentoring by another student as well as providing advice to
Student-to-student	other students and reflecting on the experiences together.
learning	Focus: Student-to-student facilitation of team ownership of the challenge-based project.
	Being entrepreneurs in the "real world" based on that project.
Nord	How the students learn: Reading, reflecting and using the literature in their own start-up
Research-based	processes, guided by active researchers. Work with real entrepreneurs.
education	Focus: Student-to-student and team-based studies, reflections and application in practice.

NSE has been evaluated by different evaluators with remarkably good results. NOKUT's student barometer scores NSE far above average in learning, relevance for work-life learning environment and total evaluation (4.4 to 4.9 out of 5). The learning goal at NSE is to develop an entrepreneurial mindset, academic knowledge and entrepreneurial skills. NSE has two main outcomes of *achievement*: objective outcomes in new ventures, and a psychosocial outcome with change in the mindset or intentions of the students. This change in mindset was confirmed in surveys in 2012 and 2016 (Aadland and Ansteensen, 2016). As an alumni student stated, "NSE gave me a clear top competence in the labour market. The ability to see opportunities and move instantly on these to

exploit and utilize these is something I think I manage better than others, and I thank NSE for this".<sup>1</sup> About 50% of NSE students continue in their own ventures after graduation, and 31 of 48 companies created at NSE in the period from 2005 to 2015 still exist. The remaining graduates become change agents in established firms: "The foundation I obtained at NSE gave me a grounding for a career as a business developer, both as an entrepreneur, consultant, and now also in the banking industry".<sup>2</sup> NSE was elected the best Norwegian service provider by the 2014 Nordic Startup Awards. In April 2016, NSE students were selected as (1) the most innovative student project and (2) digital innovator of the year by Universum. NSE projects have won the national business plan competition Venture Cup seven years in a row.

EiT was awarded the Education Quality Award from Ministry of Education and Research in 2002 and by 2005, NIFU STEP concluded that EiT demonstrates significant success in providing "generic" skills in the field of "socio-communicative skills". Of the entrepreneurship graduates at Nord, 21% start their own business (Kolvereid & Åmo, 2007), and there is a statistically strong relationship between participation in the program at Nord and entrepreneurial intention (Heuer & Kolvereid, 2014). Eight limited companies have so far been established based on ideas established and coached into being by Spark. The Troll course in collaboration with CERN was one of NTNU's candidates for the NOKUT education prize in 2015.

### Plans for the activities of ENgage – 'The Centre Plan'

Entrepreneurial mind-set and acting as a change agent is important in all contexts. The university sector (Pucciarelli and Kaplan, 2016), nursing (Holleman et al. 2009) and the public sector (Arundel et al. 2015) are just a few examples. Simultaneously, higher education is changing: entrepreneurship education has moved in the direction of value creation for society at large (Blenker et al., 2011; Neck & Greene, 2011; Sarasvathy & Venkataraman, 2011), with output factors such as development of human capital (Martin et al., 2013) and beliefs about entrepreneurial aptitude (von Graevenitz et al., 2010). Thus, a strong foundation in entrepreneurship education is more applicable than ever for transforming current practices of higher education by developing a comprehensive approach to action-based education.

The vision of ENgage is to increase the number of students in Norway and around the world with entrepreneurial skills and the mind-set to become change agents in all contexts. The ENgage partners

<sup>&</sup>lt;sup>1</sup> NSE student graduated 2014 and currently on an internship in a large international media house.

<sup>&</sup>lt;sup>2</sup> NSE student graduated 2012 and currently a business developer in the Norwegian banking industry.
contribute with variations in action-based, challenge-based and experience-based learning models as a basis for interdisciplinary interactions and complementary skills and approaches. This is a strong foundation for developing entrepreneurial skills among students in all types of study programs. The SFU Centre Award will enable ENgage to: 1) develop, test and document new learning approaches in existing programs, courses and initiatives, and more importantly, 2) greatly enhance momentum in engaging all types of students and faculty in the development and dissemination of new learning initiatives, helping them to adopt a more engaged and entrepreneurial mindset. ENgage is a key actor for defining the content and quality of action-based education. The legacy of ENgage is to instill elements of action-based learning in all types of study programs in higher education in Norway. This means a permanent transformation of learning approaches adapted by faculty and students.

Figure 2



The centre's work is organized in 5 WPs (see Figure 2). WPs 1, 2 and 3 provide content based on collaborative skills, venture creation and rapid prototyping. These three WPs are deeply rooted in the current activities of the consortium. The centre will enable, and benefit from, the coordination gains based on the interactions

between these three WPs. WP4 develops tools for transforming teaching in all disciplines and professions towards a more action- and practice-based approach. WP4 is based on the combined activities in WPs 1, 2 and 3 but the activities in WP4 will be completely enabled and developed by the centre and therefore represent a large portion of the additional capacity provided of being an SFU awardee. WP5 documents the activities in the other WPs, measures their learning effects and disseminates them. The plan is to spread the entrepreneurial mind-set broadly during the first five years and then use the following five years to anchor the transformed practices in the different contexts. The *key steps* to fulfil these ambitions are connected to engaging students and providing teachers with the tools they need to facilitate learning. Train-the-trainer courses, summer camps and the initiation of Sparks at other campuses are important milestones (see enclosed action plan for details). Each single activity is not alone sufficient, but their combined content and momentum will lead to fulfillment of ENgage's ambitions.

## WP1 – Developing collaborative skills in interdisciplinary teams

Teamwork is about being creative and efficient together. Individuals must learn to understand their own unique contribution to a group to further develop their collaborative skills. Collaborative skills are a pivotal feature of innovative interdisciplinary teams (Sawyer, 2007) and are part of the general skills required by all Norwegian students (Ministry of Education and Research, 2012). WP1 explores in depth the elements that characterize collaborative skills in interdisciplinary teams, methods for acquiring collaborative skills in an experience-based context, and ways of assessing these skills among students. It is known that group learning fosters higher-order skills and shared knowledge construction and contributes to students' engagement in learning, but there is still little knowledge on how such activities should be designed (de Hei et al., 2016).

## WP2 – Venture creation methods in a research setting

Design thinking and prototyping are central to the success of new product innovations, and various formal and informal learning loops are fundamental to better understand and leverage this early phase. With WP2, the centre will enhance understanding and application of early-stage tangible and intangible learning principles, particularly related to creating, ideating, testing and learning from human–human, human–object and object–object interactions. One part of WP2 is to develop teaching methods that enable students to generate more innovative solutions faster (e.g., Kriesi et al., 2015). To increase the connection between research and commercialization, WP2 engages students in using research from their university to develop new products and viable spin-offs, for instance through prototype creation and design-thinking approaches. In addition, ENgage will give the students insights into development from product to commercialization. Thus, WP2 will be an important part of ENgage in terms of product development and methods for innovation, but it will also teach students the first steps towards creating viable businesses. Furthermore, in interaction with WP5, student projects become data sources for research on the methods and tools in product development, as well as their application in the innovation process.

### WP3 – Development of venture creation programs

Internationally, there is a small but growing number of venture creation programs. WP3 will identify, map and describe leading venture creation programs using an action-based approach, i.e. teaching "through" entrepreneurship as opposed to "about" entrepreneurship or "for" entrepreneurship (Lockyer & Adams, 2014; Lackéus, 2014; Rasmussen & Sørheim, 2006). The mapping of best practices will be related to organization, content, student engagement and output. ENgage and Chalmers School of Entrepreneurship will establish an international forum of venture

creation programs that will facilitate knowledge dissemination across venture creation programs from different contexts, thereby improving the teaching methods of ENgage. This forum will manifest ENgage as a worldwide hub of teaching excellence, which in turn will benefit the dissemination efforts. Although WP3 focuses on specialized entrepreneurship education and sharing of methods with other programs seeking venture creation as an output, a key issue in WP3 will be how these programs can contribute to a permanent change of mindset in broader groups of students. This means adaption of methods but also exploring how these programs can stimulate broad change in the culture and mind-set of all students in higher education.

WP4 - Increase the number of students in higher education with entrepreneurial mind-sets and skills Based on insights from WPs 1, 2, and 3, the aim of WP4 is to create new teaching methods in entrepreneurship education, teamwork courses and product development, thereby increasing students' engagement in their own field of study. Students will develop and apply their knowledge in a variety of field-specific contexts for the rest of their working lives. Action-based approaches to developing the skills needed to become change agents in any field must be context-sensitive and utilize the theories of that particular field of study. WP4 will develop the tools for transforming the teaching in different study programs into more action- and practice-based approaches. The projects in WP4 focus on entrepreneurship in different contexts and finding appropriate approaches for introducing action components in different disciplines and professions. WP4 is of vital importance in fulfilling the vision of ENgage: to increase the number of students in Norway and around the world with entrepreneurial skills and the mind-set to become change agents in all contexts.

### WP5 - Documentation, research and dissemination of knowledge

WP5 will orchestrate the resources and projects in ENgage and create a common ground by combining knowledge, accumulating knowledge, and identifying the needs for complementary knowledge. To ensure the quality and effectiveness of the knowledge base, we will document shortand long-term effects of the use of innovative learning methods in various contexts. For example, it is important that engaged action actually leads to student-to-student learning. Student-to-student interaction, however, does not necessarily lead to student-to-student learning (Havnes et al. 2016). The actual effects of entrepreneurship education are lifelong and difficult to capture (Boyd & Vozikis, 1994; Moberg, 2013). For short-term measurement purposes, we will use established measurement instruments focusing on entrepreneurial intentions (e.g., Kolvereid, 1996; Tkachev & Kolvereid, 1999) and entrepreneurial self-efficacy (e.g. Chen et al. 1998), building on the theory of planned behaviour (cf. Ajzen, 1991). The competence to measure and study effects already exists in the consortium. WP5 organizes the dissemination activities (see description below) that are of key importance for all WPs (see enclosed action plan).

### Dissemination and institutional development

The most important part of the dissemination strategy is student engagement. Student engagement cannot be forced or taught in a course but it is vital for student learning to take place when using action-based methods, regardless of discipline or profession. The following tools are core in accomplishing broad student engagement. (1) *Interaction with SparkNTNU* to set up Spark organizations at other universities. SparkNTNU is currently helping the students at Gjøvik set up an organization similar to the one in Trondheim. (2) *Desksurfing* exchange where students can visit and work at another student incubator for a period of time. This facilitates knowledge exchange across geographical distance. NSE and Chalmers School of Entrepreneurship are already exchanging students through desksurfing. (3) *Four different student summer camps* where students come together to develop an investor-ready firm from an idea.

We complement student engagement with train-the-trainer courses for teachers and forums for department leaders (as well as faculty management and program directors) in which they will learn how action-based education will make their study programs more relevant and more attractive to students. In addition, we will utilize traditional knowledge dissemination tools (see Table 2) in new combinations: solving a case study may require that a student also listen to a podcast, visit the centre website and find articles from media and scholarly journals. As highlighted in Table 2, the dissemination strategy is partly based on resources that already exist in the consortium. Furthermore, the academic leadership of the centre is already engaged in disseminating the generated knowledge and experiences through the extensive outreach activities at NSE. The academic leadership will facilitate and coordinate dissemination activities within ENgage.

What	How	<b>Current Resources in the Consortium</b>
Centre	Collects all centre resources and makes them	NSE already has a website.
Website	publicly available. Informs about centre activities.	
Train-the-	Teachers are provided with the tools they need to	Related courses are already offered by the
Trainer	facilitate action-based learning.	consortium.
Case Studies	Norwegian case studies, including exercises that	Start-up stories from NSE and Spark. Projects
	about their own context using methods from the centre.	transformed into cases.
Organizing	Workshops and other activities for mutual sharing	Technoport gathered more than 700
Conferences	of knowledge and experiences will be arranged as	researchers, investors, entrepreneurs, students
	part of current forums for relevant stakeholders. A	and business leaders in 2016. EiT is founder
	new international EE Conference will be	of the conference Its21, which will be used as
	developed.	an arena of dissemination.

Attending Conferences	Presentation of results from the activities in the centre and discussion with stakeholders. Mutual sharing of knowledge and experience. This includes conferences for education	Many engaged students are skilled presenters. NSE students have won several pitching competition awards.
International	development such as CDIO and ICED.	EiT is the centre of the Scandinavian
Networks	an international networks of venture creation programs as described in WP2. Collaborate with the Nordtek workgroup on Entrepreneurship Education.	Network for development of interdisciplinary education and collaborative skills. NSE organizes Climate Launch Pad and part of Climate KIC. NSE is an active member of N5T.
Journal Articles and Books	Publish results from the centre for international outreach and legitimacy.	Nord together with NSE provides 2/3 of the entrepreneurship publications in Norway.
Media Articles	Raise awareness about the centre and its activities through media.	NSE had 89 media articles from 2015 to April 2016 featuring the program, the students and the start-ups.
Visits to ENgage	Welcome visitors to the centre to see, experience and collaborate.	Ministers and industry top managers visited NSE monthly from 2014 to 2016.
Podcasts	Large-scale student-to-student learning. An entertaining way to spread concentrated information and insights. Builds a community of listeners.	The associated partner Trondheim Tech owns the infrastructure for this. Students have stories to tell.

ENgage will contribute to *institutional development at NTNU and Nord* through further development of current activities, as well as developing new activities (see Table 3).

Institutional	Easthan Douglanmont of	Development of New Activities
Institutional	Further Development of	Development of New Activities
Development	Current Activities	
NTNU	FRAM, where students	Will activate students from all study programs to interact with
	interested in entrepreneurship	PhD students and researchers in the large research centres. This
	from all study programs meet	interaction not only results in innovation projects but it also
	and learn from each other.	changes the mind-sets of students, researchers and teachers.
	Student-to-student learning.	ENgage will develop additional structural channels in dialogue
	Already at EiT, Spark and NSE.	with university management. As explained in connection with
	Already offers courses with large	WP4 and WP5, study program leaders and institute leaders will
	outreach, where developments	be offered train-the-trainer courses to implement the learning in
	can be used.	their study programs.
Nord	More systematic links between	Activate the entrepreneurship approach to education across
	research and education.	different study programs, such as the MBA program (>500
	Enhancing the team-based	students) and across all Nord University departments.
	approach to education.	Develop better quality monitoring systems and documentation
	More systematic support of	of results from education programs and initiatives.
	student engagement.	



## COMMENTS

[Body text (150 words)]

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# **Excellent Information Technology Education (ExcITEd)**

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### About the centre

Name of Centre Excellent IT Education (ExcITEd)

Is the Centre already established at the time of the application (yes/no)?

□Yes ⊠No (Not formally established, but some activities and collaboration between partners is already started)

Please name any consortium partners for the Centre NORD University

## Abstract

ExcITEd aims to enhance tertiary IT education in Norway. Within the direct scope of the centre are 17 study programs at the NTNU and 2 at NORD University, and ExcITEd will collaborate closely with the relevant Program Boards. The aim is to increase the students' learning and thus graduate more and better candidates through higher student engagement. Approaches include increased focus on project based education, earlier involvement of students in research and development activities, increased focus on self- and peer-assessment and reflection, both among students and teachers. The centre will also have a strong effort on trying out and partly developing various IT tools for learning, since IT teachers and students have special competence for making advanced contributions in this area. There will be a strong dedication towards dissemination for action, developing open learning resources and experiences to be usable also for IT programs, teachers, and students outside the centre.

## Comments

The restriction on the number of CVs (centre director + 2-5 key persons, i.e., max 6) felt quite limiting for us, as the application spans two partners, NTNU and NORD, and there are persons involved in the proposal at all campuses of the newly merged NTNU. There are many more CVs we would have liked to include, for instance Prof. Letizia Jaccheri (now HoD, involved in the H2020 project UMI-Sci-Ed and many outreach activities), Prof. Alf Inge Wang (inventor of the game-based learning platform Kahoot! and other learning games), Prof. Monica Divitini (having experience from several EU and Norwegian Research Council projects on e-learning), Prof. Rune Hjelsvold (Vice-Dean Education, NTNU/Gjøvik and intiation of the CoPCSE community of practice in computer science education), and Robin Munkvold, Head of Studies at NORD University, Steinkjer.

## **Excellent Information Technology Education (ExcITEd)**

### Importance

Norway has a growing demand for IT professionals, projected to outgrow the educational production to an estimated shortage of 10.000 by 2030 [21]. Similar trends can be seen elsewhere, like in the EU [20] and US [4]. Despite positive career prospects, many young shun a career in IT, due to lacking awareness or prejudice against the IT profession [17, 29], with girls affected more [12]. The Digital Agenda for Norway<sup>1</sup>, Digital Agenda for Europe<sup>2</sup> and the US Bureau of Labor Statistics<sup>3</sup> call for more and better candidates from IT studies, and ExcITEd is a response to this acute need.

### **Profile and Vision**

Our vision is to put Norway in the forefront of innovative IT education and make IT an increasingly more attractive study choice for young people, by focusing on three objectives:

- 1. <u>Enhance the learning in our study programs</u> through increased student engagement and crosscampus collaboration and co-reflection among students and staff.
- 2. <u>Enhance motivation and career-readiness of the candidates</u> by increased collaboration with potential employers in the design, delivery and quality assurance of the education.
- 3. <u>Attract diverse talent to IT studies and profession</u> by motivating for and improving the knowledge of IT and its possible career paths among Norway's pre-university youth.

## Documentation of educational quality in existing provision

After a recent merger with colleges in Trondheim, Gjøvik, and Ålesund, NTNU alone has 17 different IT study programs in the scope of ExcITEd. NORD University at Steinkjer has two study programs in IT. All in all, ExcITEd will directly have impact on more than 2000 full time students.

**Input Factors:** (1) *Strong and ambitious leadership committed to educational quality*. The IME faculty renewed its ICT studies through the Dean-initiated project FRIKT (2013-15), making the first years more engaging, motivating project courses being one notable result. The Rector-initiated project NTNU Teaching Excellence (www.ntnu.edu/teaching-excellence) addresses various aspects of learning and assessment. The University of Tromsø and NTNU jointly proposed a system for recognition of pedagogical competence, to make this more significant in hiring and promotion decisions. NTNU demonstrated willingness for change by embracing the Government's request for mergers in higher education. IT, with partly overlapping educations across the campuses, is a discipline with high

<sup>&</sup>lt;sup>1</sup> <u>https://goo.gl/707myu</u> update: <u>https://www.regjeringen.no/no/aktuelt/norge-trenger-en-ny-digital-agenda/id2402093/</u>

<sup>&</sup>lt;sup>2</sup> <u>http://europa.eu/pol/pdf/flipbook/en/digital\_agenda\_en.pdf</u>

<sup>&</sup>lt;sup>3</sup> http://www.bls.gov/ooh/computer-and-information-technology/home.htm

potential for cross-campus synergies and educational improvement from the merger. Hence, leaders on all levels - Rector, Dean and Heads of Department - are strongly committed to the success of ExcITEd. The same applies to NORD, which has gone through a similar merger. In the implementation of its quality assurance system for education, NTNU has shown a strong commitment to support educational evaluation and leadership, and partners in the merger have already implemented the same system. (2) Long-lasting attention towards recruitment, retention and the gender gap. The Dept of Computer Science (IDI) started a project in 1997 to recruit and retain more females, later adopted by the whole faculty (www.ntnu.edu/girls). Also, high-school girls are invited to summer camps at NTNU, inspiring many girls to consider an IT career. "If I hadn't participated in the technology camp, I wouldn't have been studying IT now" (current female student)<sup>4</sup>. More recently, we initiated a leadership program (www.ntnu.edu/welead/about) for women in IT. The KID network (kid.item.ntnu.no) of enterprises targets undergraduate students of both genders to increase motivation and retention. KID offers industry-related guest lectures, excursions and mentorship resources to highlight the relevance of theory and show the variety of work-roles available. Our students are involved in recruitment work, making promotional material<sup>5</sup> and visiting their former high-schools and education fairs to tell about their studies. Youngsters are introduced to programming through "coding clubs", with heavy presence in Trondheim and Gjøvik (kidsakoder.no/kodeklubb/). Instructors are mostly NTNU students. NTNU Gjøvik is supporting the local high school in setting up an IT competencies program for high school students who would like to specialize in IT (cf. http://goo.gl/jkd4SJ). (3) Professors with strength in research and innovative teaching. ExcITEd has several professors with high publication and citation records and good external connections, resulting from involvement in national and international projects<sup>6</sup> and organization of conferences<sup>7</sup>. In addition to core IT publications, many ExcITEd professors have published papers about didactics, e.g., empirical evaluations and experience reports from trying out various teaching approaches. Just taking IDI/NTNU, 100+ such papers have been published in peer-reviewed international outlets from 1992 onwards<sup>8</sup>. (4) *Highly competent students*. As for admission threshold, IDI/NTNU has the best

<sup>&</sup>lt;sup>4</sup> Documentary of the girls in science and technology at NTNU: <u>https://www.youtube.com/watch?v=oA8IuCsbuEU</u>

<sup>&</sup>lt;sup>5</sup> An example recruitment video made by our Informatics students: <u>https://www.youtube.com/watch?v=BmQzErWKYnI</u>

<sup>&</sup>lt;sup>6</sup> We have several ongoing projects funded from various sources like, the Norwegian Research Council, NTNU, IME and the EU H2020 SEAC "Innovative ways to make science education and scientific careers attractive to young people" program; with an ultimate goal to improve teaching quality, (cf. https://excit-ed.com/projects/ and financial resource Appendix 2)

<sup>&</sup>lt;sup>7</sup> The national conference for ICT in teaching and learning (NKUL) is organized every year from IDI/NTNU: <u>www.nkul.no/</u> ExcITEd is a major player in the newly established Education & Didactics in IT conference: <u>http://itkonferanse.hials.no/en/</u> European Conf. on Games Based Learning '15: <u>http://goo.gl/hqpGXS</u> Serious Games Conference '13: <u>http://goo.gl/AEeYVK</u> <sup>8</sup> List of publications in innovative pedagogies: <u>https://excit-ed.com/publications/e-learning-and-innovative-pedagogies/</u>

Computing students in Norway<sup>9</sup>. Students at the various campuses have contributed to this application through focus groups and questionnaires, and will be making even more important contributions when the project gets going. (5) *Industry support*: Norwegian IT industry is in dire need of people and would like to see us succeed, the mentioned "KID" network one evidence of this.

**Process factors:** (1) Research-based education. Teachers in ExcITEd hold PhDs and are active researchers in their fields. Also, students are stimulated towards research, starting with fun, informal research in undergraduate mini-projects, then gradually progressing towards their master theses. In our courses, we put into practice various forms of active learning, such as inquiry-based learning and follow up with a 'capstone' experience based around a major project. The M.Sc. students in Gjøvik, for instance, are introduced to the research in their field through a series of "Introduction/Specialization to ..." (www.ntnu.edu/studies/macs/programme-components) courses in which research papers are thoroughly examined in round-table discussions led by the students. (2) Strong commitment to Q/A. In addition to NTNU's default approach of student reference groups per course, IDI gains a lot of additional feedback from our students, via guizzes and polls in lectures or through the LMS, online Q/A forums per course and questionnaires (for single courses, and for each term). IDI's leadership meet once per semester with student representatives (10 students, one per class of the 5-year CS program, and one per class of the 3+2 year Informatics program) to get feedback on how the semester as a whole has worked out. Also, IDI has been running alumni surveys (2007, 2011, 2015) asking former students what types of jobs they had, which topics from the curriculum had been useful to them, and whether something should receive increased attention in our education. (3) Drive towards new learning and assessment methods: IIE/NTNU (Dept of Informatics and E-learning) received the NOKUT Education Quality award in 2011 for the "p-lab", a space for student active learning<sup>10</sup>. The Spring 2015 offering of IDI's Software Engineering course (4th semester) was the first trial of flipped classroom in a large cohort (300 students) in a Norwegian university (https://goo.gl/10L1Gs). The 2016 offering has gone further in the direction of creative team projects (http://zab2016.wix.com/zab2016). IIE has been a pioneer in distance and continuing education in IT (e.g., MOOC IT in learning), and both IIE, IDI and NORD have experience with the creation and use of instructional videos. Currently, there are several project-based learning courses during the studies, from mini-projects with a cognitive apprenticeship approach in the first semesters [11, 32], and larger team projects with increasing authenticity later [23, 31]. At NORD, students have projects from the first semester; their GameLab

<sup>&</sup>lt;sup>9</sup> In 2015, our 5 year program in Computer Science required 55.2 points for admission directly from high school, and our three year Bachelor program in Informatics was in second place, requiring 47.7 points: <u>http://goo.gl/nHtw3x</u>
<sup>10</sup> http://www.nokut.no/no/universitet-og-hoyskoler/utdanningskvalitetsprisen/tidligere-utdelinger/vinnere-2011/

course gives students an experience resembling a regular job in a video game development company (cf. film.nord.no and games.nord.no). Innovation and entrepreneurship is encouraged, many of our students have created world class startups and applications (e.g., https://getkahoot.com/, http://wordfeud.com/, www.mazemap.com/ to mention a few). Both partners have attracted funding from Norgesuniversitetet for a number of innovative education projects<sup>11</sup>. (4) *Student involvement and engagement:* In large classes in the first years of study, older students contribute as assistants in the lab (1/6 or 1/3 of a full time job), and NTNU offers pedagogical modules for these learning assistants<sup>12</sup>. Our large courses use peer-instruction environments and Q/A forums (e.g., piazza.com, Confluence Wiki), many questions answered within a few minutes due to contributions from student assistants or classmates. Students' organizations give courses that supplement the department's offerings (e.g., https://online.ntnu.no/events/), and organize competitions (e.g., https://idiopen.idi.ntnu.no).

**Output Factors:** (1) High throughput: IDI graduated 162 master candidates in 2015, produces more than 1000 study years annually, and the 5 year Datateknologi program is one of the biggest study programs at the NTNU when it comes to credits from its courses and its students<sup>13</sup>. (2) High student satisfaction: NOKUT's Studiebarometeret.no gives overall satisfaction scores of 4.5 (of max 5) for NTNU's 5 year integrated Master in Computer Science, and 4.8 for the highest scoring Bachelor program at the Kalvskinnet campus (average for IT programs in Norway: 4.0). (3) High job relevance: Studiebarometeret.no similarly gives 4.5 and 4.7 for job relevance of the mentioned studies (country average in IT: 4.2). IDI/NTNU has run alumni surveys (2007, 2011, 2015) asking what topics candidates needed most in their careers, showing good alignment between study programs and job needs. Most of our candidates secure a job at least half a year before graduation. (4) Innovation: Our students have received recognition by getting various awards like the "Norwegian Game" Award, "young entrepreneur of the year" award and the "tech achievement of the year" award. Applications like "Fun Run" (developed by six students, reached #2 on the US iTunes Top Apps list) and "Wordfeud" (2013 revenue: 28.6 MNOK) exhibit the world class successes of our student innovations. The lecture quiz tool Kahoot! - now used world-wide - started as a project by IDI's Prof. Wang, further developed by a student in a Master thesis. ExcITEd researchers have recently acquired EU projects in mobile learning, social innovation for learning and STEM education (cf. Appendix 2). Such

<sup>&</sup>lt;sup>11</sup> <u>https://norgesuniversitetet.no/prosjekter</u> and select NTNU or NORD in the search box on the right.

<sup>&</sup>lt;sup>12</sup> Learning Assistant Training (LAOS) program: <u>http://www.ntnu.edu/ipl/laos</u>. Use of Teaching Assistants is standard procedure for many courses at the NTNU, not just IT, but IDI is at the extreme end of the scale. The first semester IT course employed 105 assistants (Autumn 2015), far more than other courses of similar class size.

<sup>&</sup>lt;sup>13</sup> Source: DBH: <u>https://dbh.nsd.uib.no/dbhvev/student/eksamen\_emne\_rapport.cfm</u>, and click Universiteter, then Norges teknisk-naturvitenskapelige universitet and scroll down to Datateknologi

international quality research projects provide interesting topics and cases for student summer jobs, master theses as well as research experience for undergraduates. (5) *Student-industry relation:* It is common for NTNU students to work with IT companies on Bachelor or Master theses projects, solving industrial problems. In Gjøvik, all IT students are invited to the free seminar "X Session" (<u>www.hig.no/nyheter/arkiv/2014/x\_session</u>), where alumni share their work experiences. In Steinkjer, IT students have a company simulator project course (Game Lab – <u>http://spo.hint.no/about-us/</u>) from the first semester, with a co-supervisor from industry.

## **Centre Plan**

**The structure** of the centre is indicated in the figure. The *Executive Board (EB)* will consist of the centre director (Prof. Sindre), administrator (100%), and project leaders of our five sub-projects P1-P5. EB will coordinate the centre's activities and regularly assess that progress is according to plan. The *Steering* 



*Committee (SC)* will consist of one representative from NOKUT, one for NTNU centrally, one from the IME faculty, student representatives, heads of involved departments, and representatives from the study program boards. The *General Assembly (GA)* consists of student representatives from all courses and study programs affected by ExcITEd innovations, and all the employees involved in the centre. GA will have an annual meeting giving status across sub-projects and generate ideas for further innovation. The *Dissemination and Evaluation Committee (DEC)*, lead by the centre director, will have the overall responsibility for dissemination and quality evaluation. The *Advisory Board (AB)* will consist of representatives from industry (e.g., members of our KID network) as well as international experts: Dr. Arnold Pears (Uppsala U.), Dr. Peter Hubwieser (TU Munich), Dr. Ole Iversen (Aarhus U.), Dr. Mark

Guzdial (Georgia Tech), and Dr. Barbara Erickson (Georgia Tech). The educational innovation work of ExcITEd is organized in five projects, although there is a lot of synergy between them. In the proposed projects we follow active learning for engaging students in the process of learning through activities, as opposed to passive learning [9]. Our approach emphasizes critical thinking, skills development and often involves group



work. Project-based learning, peer instruction and inquiry-based pedagogy are central to ExcITEd.

**P1: "Informed decision"**. This project will *increase the knowledge of IT and the IT profession for pre*university students in particular, and help them consider an IT career on a more informed basis. Some choose IT studies for the wrong reasons (e.g., love to play computer games), some disregard IT in spite of having talent, e.g., for lack of role models, prejudice about the studies and profession, or fear that they will not master it – the latter most prevalent in girls [5]. A new elective programming course in middle school to start 2016/2017 is a promising follow-up on the increased interest for programming and will give the young insight in exciting technology. Helping teachers make courses like this successful can reduce prejudice against IT, but it is also important that courses and other activities where kids learn IT provide role models of both genders and a view of the breadth of jobs that an IT education can qualify for. Current Activities: NTNU has a teacher education in Natural Sciences that includes a specialization in mathematics and informatics. NORD University has 4 courses relevant for IT teachers. IIE offers a MOOC in ICT for teachers. NTNU's resource centre for STEM-education (Skolelaboratoriet: www.ntnu.edu/skolelab), offers continuing education for teachers and support for science education in schools including programming workshops organized by IDI (e.g., Kodeløypa: www.ntnu.no/skolelab/kodeloypa). Internationally, we are involved in the recently started EU project UMI-Sci-Ed<sup>14</sup> to promote IT education in schools. *Further Activities:* P1 will establish a network that will promote and support IT education in schools (cf. the UK Computing At School - CAS network [3], Georgia Computes network [15]) as well as support other IT initiatives for the young [8, 10, 13]. The network will bring together different stakeholders, including our industry network, to create synergy and new forms of collaboration that will influence and strengthen our IT education for teachers and the practice of teaching IT in schools. To provide role models P1 will include an ambassadors program, where our IT students, faculty and alumni of both genders will visit schools to tell about their work and lives, as well as produce video narratives with similar content. **Outcome:** By the end of our project, IT shall be a more popular study choice among Norway's young – and for girls in particular – than it is today, and high school students shall consider IT career on a more informed basis than today.

**P2: "Projects of Becoming"** acknowledges that our arriving freshmen have really embarked on two challenging projects: in the short term to become a student, in the longer term (3-5 years) to become an IT professional. P2 *supports first year students in becoming successful managers of these two projects.* Many freshmen are still searching for what to study and what to become, this is of particular importance in IT [14]. Hence, they need to see purpose and role models, not just introductory courses with focus on theory. Many students struggle with the transition from high school to university [28]

<sup>&</sup>lt;sup>14</sup> UMI-Sci-Ed (2016-2019), Exploiting Ubiquitous Computing, Mobile Computing and the Internet of Things to promote STEM Education, H2020 – SEAC – 10 – 2015.

and "first year experience" is identified as crucial in the success of higher education (cf. first year experience conferences: http://goo.gl/wobwuk). Current Activities: The centre includes study programs that have different approaches to handle first year experience, adapted to the size and profile of the program as well as the campus facilities. NTNU has a two-week startup program for new students called Teknostart / Realstart and study programs at IDI follows up with projects in some of the courses of the first and second semesters [11, 32]. Study programs at IIE, Gjøvik, Ålesund all share a focus on project work in first year of study, and the centre in total represents rich experience in motivating and engaging students in the first year including support from industry partners on motivating for a career and support from student organizations on social aspects. Further Activities: The centre will work systematically towards implement in all IT study programs an introductory year that creates engagement for IT, help students develop good working habits and motivates for further studies. Due to the large number of study programs in the scope of our centre, we will learn from each other and initiate different parallel sub projects, based on needs, contexts and suggestions of the students and teachers in each program. This will include adapting course content and creating innovative learning activities for first year students, adapting and developing physical and digital learning environments that encourages social and active learning. We will also focus on identifying and developing support for students that have a high chance of dropping out. *Outcome:* P2 will contribute to an optimal first year experience and give insights of how IT studies should be organized to engage students and help them develop good working habits. Empirically-refined approaches and best practices for introduction to IT studies will be openly documented.

**P3: "Learning through Construction"** aims to *maintain and further develop students*' *interest and excitement by creative design of IT artefacts.* The past decade has provided students with many environments and community spaces for learning through construction as well as promoting self-discovery and innovation. *Current Activities:* At all involved campuses, there are several project courses where students build IT artefacts in real or realistic settings. NORD has a GameLab already in the first semester, where student teams spend one day a week working in a video game company. NTNU has several team project courses, some with real customers, and also a HackerSpace (hackerspace.ntnu.no) where students can explore self-driven construction projects. In Kalvskinnet campus, the Concurrent lab (https://www.ntnu.no/iie/forskning) employs real-time collaboration systems (e.g., shared screens and projectors) for learning and construction. Further Activities: ExcITEd aims to integrate "*learning through construction*" more systematically and strongly into the

course-work of the students in all semesters of each program. Partner in the centre will collaborate and share experience and guidance through the planned Community of Practice and the centre will support various forms of cross campus collaboration on course and learning activities development. ExcITEd will investigate how different construction spaces and setups support learning, by collecting empirical student data. *Outcome:* P3 will increase the use of "learning through construction" and improve our understanding of how this learning method increases students' interest and excitement for IT.

P4: "Sharing and Diversity" aims to develop highly efficient cross-campus learning spaces. Following recent university mergers at NTNU and NORD, ExcITEd currently has 19 study programs within its direct scope. Diverse profiles of the study programs enables the partners to cater both to different student preferences and different segments of the job market. Due to similar underlined content knowledge, teachers should collaborate across campuses to reuse learning resources and ensure comparable learning outcome and grading. Equally important is to benefit from the diversity by offering courses across multiple campuses. Current Activities: Ongoing projects explore synergies and establish communities among staff across campuses, like in data communications courses in Ålesund, Gjøvik and Trondheim, as well as the established Computer Science Education Community of Practice. *Further Activities:* The centre will promote and support pilot projects for cross-campus learning. For courses with similar contents and learning objectives across campuses, we will explore and study how learning activities can be run in parallel on multiple campuses while still maintaining the qualities of on-campus learning activities. For specialization courses offered only on one campus we will utilize MOOC-style distance education that further can be offered to a wider community. We will extending the currently developed technologies [8, 27] for capturing students' progress and providing automated feedback for self-reflection and -evaluation. **Outcome:** P4 will result in course development and experience and knowledge in cross-campus education. P4 will also develop a number of tools, some specific to one course, others usable across many different courses and programs – not only in IT.

**P5: "Career Readiness"** aims to *strengthen and expand the education-work connectivity by providing students' with "real-life industry-driven" learning.* As indicated from the ACM/IEEE joint task force on IT curricula [1, 2, 6], the critical element in the success of an IT program is the involvement and active participation of industry. Well established industry participation supports various activities including advice from an industry perspective, student and faculty industry internships, integration of industry. *Current Activities:* ExcITEd partners have a long tradition for projects as an essential component in the education, some of them with real customers [16, 23, 30]. Many of our students get valuable experience

through internships and summer jobs in our industry network. *Future Activities:* P5 will monitor best practice project-based teaching from other IT educations world-wide, as well as the expected competences from the IT industry (https://goo.gl/XtFfj8). We will intensify our collaboration with the industry so that more students can get relevant summer jobs. Similar to the concept of minimum viable product in lean software development [7], we will collaborate with industry in setting up the *minimum viable competence* for various IT-related summer jobs. ExcITEd will build "students-industry hubs", in order to help qualifying students for summer jobs and getting them in touch with potential employers. *Outcome:* P5 will strengthen the education-work connection. Gap analysis between the job market's expectations and current learning outcomes will be used to guide program and course development. Student-industry connection will ensure a smoother transition from education to work for students.

**Evaluation:** ExcITEd will systematically gather both qualitative and quantitative data on student satisfaction and learning outcomes from the centre's educational interventions, as well as data from alumni, instructors, NOKUT (e.g., Studiebarometeret) and the industry. Learning analytics will be used on top of various channels (e.g., learning management systems, students' progress records). ExcITEd has already established various evaluation activities, through focus groups with students, reference groups with course representatives, interviews with the IT industry and standardized surveys [25, 26]. ExcITEd started this year to use and further develop methods and tools for systematic evaluation, for example we used international standardized surveys to assess students' learning experience, industry's expected skills and information about our alumni's skills development (https://excit-ed.com/quality-assurance/). Drawing from the experience of our international collaborators (e.g., [27, 15]), ExcITEd will further develop its experience on systematic quality assurance and make publicly available an evaluation kit to others. Thus, the evaluation of the center will heavily rely on combined indices, and the impact of the center will be assessed and included in the yearly report.

#### **Dissemination and Internationalization**

Dissemination activities will be in focus from day one of ExcITEd and throughout the project, tailored to various stakeholders and practitioners (e.g., policy makers, instructors, learners). In line with our long tradition of publishing about innovative IT education<sup>15</sup> we will intensify our peer-reviewed publications, targeting high prestige international journals and conferences. As a national centre, we will also contribute to national conferences like NIK, NOKOBIT, NOKIOS, and NKUL, the annual conference organized by NTNU which attracts more than 1000 educators. Notably we will keep our

<sup>&</sup>lt;sup>15</sup> IT education: <u>https://goo.gl/k74o6z</u> e-learning and innovative pedagogies: <u>https://goo.gl/MvQtXW</u>

high involvement in the recently established Norwegian Conference on Didactics in IT education (UDIT) and the national STEM Education conference (<u>http://www.realfag.eventweb.no/</u>).

ExcITEd already collaborates with and learns from the experience of the Swedish Centre for Pedagogical Development in Technology Education from a Student Oriented Perspective (contact: Director Prof. Arnold Pears), the state prize on education and culture award winning group on Didactics of Informatics at TU Munich (contact: Director Prof. Peter Hubwieser), the Contextualized Support for Learning centre at Georgia Tech (contacts: Director Prof. Mark Guzdial and Dr. Barbara Ericson) and the FABLAB@SCHOOL initiative in Denmark (contact: Director Prof. Ole Iversen). ExcITEd has collaborated with them during several international initiatives, like editing special issues in the area of IT education in schools<sup>16</sup> and co-leading international ACM-driven working groups in IT education (reports: [18, 19]). The leaders of these international centers will intensify their collaboration with us and participate on the Advisory Board of ExcITEd (letters of support: https://goo.gl/uNDJ5r). In addition, ExcITEd participates in EU COST action as well as an Erasmus + Knowledge Alliance proposals (cf. Appendix 2) with a focus to build an international network in the area.

Dissemination for awareness and understanding will be conducted at ExcITEd, but our emphasis is on *dissemination for action*, targeting audiences in a position to influence and bring about change within various organizations. Activities will take the form of demonstrations, seminars, tutorials and popular courses in major events (e.g. Norwegian Science Week, NKUL, Researchers Night, UDIT, MakerFair), as well as the establishment of a website, newsletter, and publications in diverse media (including the SFU magazine). In addition, the center will provide seminars to both pre- and in-service teachers at NTNU teachers' departments, in order to ensure the dissemination of ExcITEd to Norwegian schools. NTNU has already initiated a Community of Practice for Computer Science Educators (CoPCSE)<sup>17</sup>, which we intend to maintain and promote to a national level. Last but not least, we will disseminate openly available, high quality learning resources that inspire action by learners themselves, be they IT students or other students, in our departments or elsewhere, learning just for themselves or in order to teach others, be they pre-university kids with programming as a hobby or newly retired who seek to understand the world of their grandchildren, be they Norwegian citizens or immigrants or refugees. IT competence is globally needed and can come useful whatever country you end up living in.

<sup>&</sup>lt;sup>16</sup> Special Issue on Computer Science Education in K-12 Schools: <u>http://dl.acm.org/citation.cfm?id=2767124&picked=prox</u>

<sup>&</sup>lt;sup>17</sup> https://www.ntnu.no/wiki/display/copcse/Community+of+Practice+in+Computer+Science+Education+Home

## Appendix 1

## **List of References**

List of published work related to IT education: <u>https://excit-ed.com/publications/it-education/</u>

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## **ABOUT THE CENTRE**

Name of Centre Centre of Excellence in Film and Interactive Media (CEFIMA)
Is the Centre already established at the time of the application (yes/no)?
Please name any consortium partners for the Centre [text]



## ABSTRACT

Describe briefly the aims as well as the current and planned activities of the Centre (150 words)

The vision for **CEFIMA** is innovation in NFS' present teaching and learning programmes in filmmaking to fully incorporate digital technology and interactivity as a means of artistic expression. Digital technology has long been adopted in all phases of film and television production, but artists are just now beginning to explore its full potential. The challenge is to prepare students to exploit the new technologies for telling meaningful stories that help us understand both intellectually and emotionally an increasingly complex world. The core of CEFIMA actions will be students' tests and exercises using new digital media in the creation of innovative storytelling. To this we bring the unique teaching and learning practice in cinematic storytelling developed at NFS over the last 20 years, recognised for its responsiveness to the changing demands of society and a rapidly evolving industry.



## **APPLICATION DOCUMENT**

The application must be written in English and follow the requirements set in this template. It must not contain more than 10 pages in Times New Roman, 12-point types, with lines spaced 1.5 and margins of 2 cm. Within this format, the applicant must provide:

### a) Documentation of educational quality in existing provision

The applicant must comment and critically reflect on themes and questions set out in the criteria, and compare their existing provision with similar provision within the same subject/discipline area, both nationally and internationally. Through this, the applicant must document that the academic community qualifies as a Centre for Excellence in Education.

### b) A centre plan

The applicant must comment and critically reflect on themes and questions set out in the criteria. The Centre Plan must outline the vision of the Centre, its strategy and plans. It must present the plans for the dissemination of knowledge and practices to its own institution(s) and to other educational communities as well as an evaluation and impact framework.

## **Appendices**

The following appendices must be included (and no other):

- 1. A list of references
- 2. A budget for the Centre for the first five-year period, including motivation for costs (see guidelines at <u>www.nokut.no/SFU/utlysninger</u>)
- 3. An action plan for the Centre, including milestones (no more than three pages)
- 4. CVs of the proposed Centre Leader and two to five key members of the Centre team (each CV must not exceed two pages)

All appendices must be in English.

## **Practical information**

The rector of the host institution must sign the application.

The deadline for submitting applications is set in the announcement of the call.

All applications will be published on the NOKUT website, alongside the expert panel's feedback.

## **APPLICATION DOCUMENT**

## The Norwegian Film School (NFS): Background

The Norwegian Film School (NFS) was founded in 1997 as "an art school of the highest standard in the field of film and television"<sup>1</sup> on a par with international schools, and is an autonomous faculty within Lillehammer University College (LUC). Its mandate from the government is to identify, nurture, and develop the talent of budding filmmakers and prepare them to work effectively in the national and international film industries, while at the same time bringing new inspiration and vigour to the industry.

From the outset, NFS established partnerships with the other Nordic film schools and the international association of film and television schools, CILECT<sup>2</sup>. The Nordic region in CILECT, NORDICIL, presently coordinated by NFS, brings Nordic students and teachers together 3 to 4 times a year to have high profile seminars, to exchange "best practice" and to create a network for both students and teachers. In recent years the exchange of artistic research in film education has developed at the initiative of NFS<sup>3</sup>. In GEECT - the European branch of CILECT - activities concentrate on teaching and learning practices in specific disciplines. NFS is planning to host a GEECT-seminar in 2017 on educating film teachers (se below). This initiative is a follow-up on the NFS-publication "Training the trainers" (2005, by Richard Ross<sup>4</sup>) that was the first published coherent material within CILECT on how to teach film students in all the different disciplines. In addition to network-based activities, NFS has over the years developed bilateral collaborations and shared workshops in producing, screenwriting and cinematography.<sup>5</sup>

As the only national artistic film education in Norway, NFS seeks collaborations with other national arts educations in Norway. At this time, two MA-students in film music composition from the Norwegian Academy of Music (NMH) are integrated in NFS's master programme and there are continual collaborations with students from the National Theatre Academy at KHiO, who receive practical training in acting for film on production exercises on NFS's study. Recently NFS, KHIO and NMH launched an alumni project together with "Talent Norway" and private sponsors called "Art Excellence"<sup>6</sup>. The aim is to support great talents from the art educations in Norway in their challenging transit from school to professional career.

### **NFS OFFERS:**

- **3-year artistic-professional Bachelor of Fine Arts** (BFA) Degree in 9 disciplines The biennial intake is 54 students. The course is open to Nordic students and students in command of Norwegian and English. 352 students have graduated since the school's foundation in 1997.<sup>7</sup>
- 2-year artistic-professional Master of Fine Arts (MFA) Degree in 8 disciplines, open to

Nordic and international students; biennial intake 12-16 students – opened 2015.<sup>8</sup>

• **3-year artistic-professional Diploma, Norwegian Artistic Fellowship Programme** (Doctoral level) - 3 completed, 2 underway.<sup>9</sup>

## **Input Factors**

NFS is an 'exclusive' school: only 8.8 % of applicants gain entrance, and it offers an unparalleled track into the industry; and all shortlisted applicants are not only interviewed extensively but participate in assessed workshops at NFS designed to measure individual aptitude for the course of study, levels of achievement, potential and interpersonal skills.

All faculty are experienced film industry professionals hired on 4-year contracts, recruited from the Norwegian and international film industries, who combine teaching with continued professional activity. Professors and Head Tutors work closely with the Head of Studies for BFA and MFA and are supported by dedicated co-ordinators managed by a Head of Administration, all reporting to the Dean. There are a total of 10,9 full-time equivalent (FTE) faculty positions, currently filled by a total of 6 Professors and 22 Associate Professors.<sup>10</sup> NFS devotes approximately 4 FTEs per year on guest tutors - approximately 150-200 individual experts per year. With only 6 students per discipline in the BFA, and a total of 14 in the MFA programme, NFS maintains a high-intensity ratio of 1 tutor to 4,6 students. For NFS both the quality of the teachers and the intensity in follow-up of students are crucial input factors. NFS has from the beginning had close ties to the Norwegian film industry, and this is maintained through industry participation in workshops and exercises, placement for students, and industry representation on the NFS Advisory Board.

## Teaching based on artistic research and development (AR)

NFS has succeeded in attracting high-profile filmmakers from the national and international film community to use part of their time as teacher at NFS, ensuring that faculty are continually updated on practices and developments in the industry and bring inspiration and experience back to the school. For example, NFS Head of Cinematography, Professor Kjell Vassdal, cinematographer on Norway's first 3D-feature *Blue Mountain – the Hunt for the Magic Horn* (2011), led students (and alumni) in exploring the technical and storytelling potential of stereoscopic cinema just 3 weeks after the shooting. Head Tutor in Editing, Professor Niels Pagh Andersen, editor of Joshua Oppenheimer's Oscar-nominated, widely-screened documentaries, *The Act of Killing* (Denmark 2012) and *The Look of Silence* (Denmark 2014), used these as case-studies to give students insight into the practical and creative processes of finding characters and stories in disturbing material (a depiction of the Indonesian killings of 1965-66).

NFS has actively participated in developing the national Norwegian Artistic Research Programme since its inception in 2005. To date three candidates have successfully completed the Research Fellowship Programme – screenwriters Ståle Stein Berg  $(2009)^{11}$  and Siri Senje  $(2013)^{12}$ , and director Trygve Allister Diesen  $(2011)^{13}$ . Currently NFS has two candidates in the Programme: cinematographer Cecilie Semec (*The Modern Movie Image from a Cinematographic Perspective* - 2014-2017) and digital visual designer Rafal Hanzl (*Modes of Expression: The Impact of Digital Tools on Storytelling in the Feature Film* - 2015-2018), both of which have direct relevance to the proposed work of CEFIMA. This form of AR is crucial for ensuring students are receiving the most advanced and up-to-date education.

In 2011, the Norwegian Artistic Research Programme established a Project Programme to fund post-fellowship (post-doctoral level) and advanced artistic research projects of high international standard, at participating institutions.<sup>14</sup> To date, NFS has received support for director Erik Poppe's research project *The Subjective Lens*<sup>15</sup>, on 'the performance of the self', completed in 2016; Associate Professor in Editing Einar Egeland's project *True or False: Mind and Emotion in Film Editing*<sup>16;</sup> and Pagh Andersens *Order in Chaos*<sup>17</sup>. In 2016, Professor of Directing Rumle Hammerich commenced his research on *The Film Director's Vision: Tacit Knowledge, Intuition, or Method?* with funding from LUC. All NFS AR projects<sup>18</sup> involve other faculty and students at NFS. Crucially they also inform and enhance student learning through new workshops and courses, maintaining the flow between industry, artistic research and teaching and learning.

### Pedagogical input

The choice of using practitioners as teachers at NFS implies a challenge: filmmakers rarely have pedagogical experience and the need to supply their high professional competence with pedagogical insight is obvious. NFS has taken this challenge seriously from the outset and today NFS has a prominent international role in research and dissemination of pedagogy in film school teaching. "Training the trainers" (NFS, 2005, see above) was widely distributed to film schools all over the world – and still is today. In 2013 NFS launched a new international project, that builds on the content of "Training the trainers": "The Artist as (Film School) Teacher",<sup>19</sup> which aims to meet new challenges by creating specialised seminars supported by tailor-made study materials for both face-to-face and online exchanges. The initial outcome will be a formally approved course for Nordic film school teachers starting September 2016<sup>20</sup>. NFS plans to develop this project further on a European level including new pedagogical challenges that will emerge from CEFIMA projects.

### **Process Factors**

### Learning approach

The belief that arts education is fundamentally about developing the competence of artistic expression of the individual artist is the driving force behind NFS' pedagogic and didactic approach<sup>21</sup>. In this context, learning is about the ability to apply skills and knowledge gained in an

increasingly conscious and sophisticated way in the creation of the artistic work. In addition, NFS programmes are informed by the fact that filmmaking is a collaborative process, where individuals working in different artistic disciplines must cooperate in order to realise a coherent artistic vision. A key element in NFS' success is giving the students insight into this and providing a protected space in which to test themselves, gain insight, and find their role in this complicated process.

All common exercises (called "*pen tests*") emphasise students' 'right to make mistakes' and the belief that the conscious application of constraints is a key to freeing creativity<sup>22</sup>. The faculty set a number of constraints the students must operate within, and the exercises are explicitly not finished films but give the students experience with particular elements of filmmaking<sup>23</sup>. A key element of the success of the *pen tests* is the system of feedback used through the *statement of intent*, a document developed both by the team as a whole and the individual team member. It describes, clearly and concisely, what the team/team member wishes to achieve with the story they are telling, how they intend the audience to react when viewing their finished product, and which tools of the craft they intend to employ to achieve this intent. In the screening / evaluation of the exercise these statements of intent are read aloud and all discussion is strictly focused on whether or not it was achieved, and looking at reasons for why/why not.

### **Culture of learning**

Artistic education (and, indeed, artistic activity) requires a unique personal investment. In order to gain a competence of artistic expression, students must open their sensory and emotional centres; areas often considered personal or private. This makes a collaborative artistic work like film, especially challenging, as filmmakers must learn how to communicate and share the contents of their sensory and emotional cores. NFS works systematically with this by creating a *culture of learning* that enables the students to make and share the personal investment necessary to achieve artistic development at a high level. This contains several elements:

- *Sharing*: students and staff develop a common vocabulary for discussing and debating the creative act of production and cultivate a shared understanding of the art of filmmaking through theory and philosophy of art sessions. Expectations of each other and the school are shared systematically in a variety of forums.
- *Trust:* 'The right to make mistakes' and experiment demands security. Productions are never shown outside an educational setting, with the sole exception of the graduation films. All projects are evaluated according to strict criteria, and in the NFS atmosphere of trust students discuss their mistakes and failures frankly with peers and tutors. Some of the most important learning experiences come from discussing how mistakes can be rectified.
- Achievement: NFS is an 'exclusive' school and offers an unparalleled track into the industry.

Success at school and career achievement both by alumni and faculty inspire new generations of students to apply and to push themselves to fulfil their potential.

• *Responsibility:* In a relatively small and intimate school, each student can expect all members of the NFS staff and community to support them in their development and learning.

### Active involvement of students

A key element in the success of NFS programmes is the extensive feedback and evaluation. Each student gives feedback to every class, workshop, exercise, and other element of their education; in some semesters as many as 8-10 evaluations. Most of this feedback is written, and is designed to encourage the student to reflect on their own participation and learning as well as judge on the effectiveness of learning activity they are giving feedback on. This feedback is continually monitored by faculty, the Dean, and Head of Studies and is actively used to adjust the course of the educational programmes for the class in question, as well as planning the comparable course for the next cohort. A result of this is that no two cohorts at NFS have identical experiences, and students are aware that their feedback has a direct and significant impact on their own course of study.

There is no formula for excellent education in filmmaking. Over the years, the NFS approach has developed through a commitment to *experiential learning*<sup>24</sup> throughout all levels of NFS. Not only do students learn from experiences and apply that learning to the next challenge, but the faculty and staff do too. NFS brings approach to teaching and learning into the CEFIMA.

## **Outcome Factors**

**Relationship between student achievement / learning aims and learning outcomes** DNF is a sought-after school at home and abroad, and selection has to be exacting. In the period 2001-2015 only the top 8,8 % of applicants for the BFA, showing high artistic achievement and aptitude for the course, were accepted. Most enrolled students have previous experience in production, and all are highly motivated. In the same period, 2001 – 2015, all but one student successfully completed their degrees. The number of international applicants has risen from 9,2% in 2009 to 20,1% in 2015. In May, 2016, 25% of BFA and 50% of MFA students were international.

### Evaluation of NFS teaching and learning by the students

Students at DNF are satisfied with their education. According to NOKUTs *Studiebarometeret*<sup>25</sup> 2014, NFS-students give 4,7 out of 5,0 for quality of teaching and learning programmes (national average 3,8) and 4,8 out of 5,0 for "general satisfaction" (national average 4,1).

### Evaluation of NFS study programme by NOKUT

In 2008-09 the NOKUT Quality Assessment evaluation of LUC states: 'The committee has, at the bequest of LUC leadership, conducted separate interviews with faculty and students from[NFS].

The impression of the committee is that this department has a good and systematic approach to quality, and is engaged in comprehensive quality assurance of their teaching and learning programme'.<sup>26</sup>

### NFS student achievement of expected learning outcomes

NFS's best external indicator of achieved competence in artistic expression is successful communication with audiences, through the examinable graduation films. These continue to win international awards - e.g.: Nominated/shortlisted for the most prestigious 'Student Academy Award' four times (2003, 2011, 2012, and 2014)<sup>27</sup>, won 2011 with *Tuba Atlantic*. Other significant awards include first prizes and nominations at leading short film festivals.<sup>28</sup>

### The labour market and wider society

Alumni surveys conducted by NFS in 2008 and 2016<sup>29</sup> show that 90% of all alumni are working in the film- and TV-industry or related industries. In 2014-2015 alumni filled 93 main positions in 47 feature films & TV-series productions. Between 2010 and 2015 Alumni won 24 nominations for the Norwegian national professional 'Amanda' film awards, and garnered other international success.<sup>30</sup>

### The industry & press evaluation of DNF

"The School contributes to a revitalising of Norwegian film through the recruitment of professionals in all areas." "The Film School has, through the addition of around 240 competent heads of department played an important role in first rejuvenating Norwegian film, and second taking Norwegian film to the international market." (Film producers John M. Jacobsen, Sigve Endresen and Aage Aaberge, *Dagbladet* 7 February 2012).

"It took a surprisingly short time after the first group of students graduated until several of them debuted with feature film and contributed to the revitalization of Norwegian film. [...] You will not find another film school anywhere in the world to measure up to these results." (Kjetil Lismoen, *Aftenposten* 24 november 2011)

In a *Hollywood Reporter* survey of international film schools in 2014 (still to date the only ranking of international film schools published), NFS ranks as the 5<sup>th</sup> best film school in the world.<sup>31</sup>

"The facilities at the school are at a top level. The teachers are professional....and dedicated. The students are talented, ...dutifully engaged. The school is at world class level, and clearly deserves its status as one of Europe's indispensable film academies." (Pavel Jech, Dean FAMU, Prague Czech Republic)<sup>32</sup>,

The Centre of Excellence in Film and Interactive Media Arts (CEFIMA)

### Importance of CEFIMA

During the last 20 years, production, distribution and exhibition of film & TV has responded rapidly

to advances in digital technology<sup>34</sup>, but creators have not yet taken full advantage of the artistic potential of digital media. This is a real challenge to arts education in general and to film schools in particular. The aim of CEFIMA is to enhance teaching and learning so students become capable of embracing the enormous storytelling potential of new digital technology and enriching our understanding of an increasingly complex world. Introducing innovative elements to educational programmes enables students to develop their artistic competence to produce original content for the emerging interactive, immersive and non-linear media, which offer new job opportunities<sup>35</sup>; and to prepare graduates to contribute creatively to computer-supported linear storytelling for the big screen<sup>36</sup>, where they are required to fill new artistic as well as technical roles. To meet the needs of our future industry & society, as more people use more new digital delivery-platforms<sup>37</sup>, the challenge is to *expand storytelling into the emerging digital media*, connecting know-how from the oldest audio-visual format – filmmaking – to the *new interactive media*, *with their immersive capabilities* and to prepare students for careers in this rapidly-changing landscape.

No equivalent institution has faced this challenge, which an SFU Award will enable NFS to meet through five key steps. CEFIMA will develop a seedbed for a new generation of professionals, with knowledge both of the artistic potential of creative digital media and of the affordances of emerging production practices, with emphasis on *innovative media content forms*. Despite huge advances in the past three decades, the computer is still a relatively new medium with unexplored artistic potential, sustaining diverse content which is currently more familiar to engineers and geeks impelled by 'technology push' than to storytellers. CEFIMA will identify enabling technologies and tools to really benefit artists and the production environment - but its work will always be 'content led': focusing on creating worthwhile, original stories for a growing market.

### **Active involvement of Students**

The core of CEFIMA actions are students' tests and exercises using new digital media in the creation of innovative storytelling. The NFS culture of feedback, evaluation, and learning will, alongside expert advisors from the industry, ensure the students' contributions of extra-curricular experience of interactive media as well as feedback on teaching impact directly on devising and implementing practical exercises in narrative content, interface design, interaction and aesthetics. 3<sup>rd</sup>-cycle Artistic Research candidates will focus in-depth practice-as research projects on storytelling in the emerging digital media. All this activity will continuously feed back into Head Tutors' and Heads of Studies' ongoing review and revision of the curriculum, to keep the NFS at the leading edge of a rapidly changing artistic, production and market environment. The NFS maintains international group exchanges, through which, in addition to professional and artistic insights, students bring home and spread ideas about education. Through CEFIMA, NFS will

monitor student learning and adjust programmes in order to ensure graduates are best prepared for future careers in the evolving national and international industries.

### International developments in higher education and the work of CEFIMA

Interactive media and game-design are taught to a high standard in a number of Higher Education Institutions at home and abroad<sup>38</sup>, but none of these focuses precisely on the practice (as opposed to the theory and history) of interactive storytelling, although Stockholms Dramatiska Högskola and the National Film and Television School, UK, among others, have introduced a measure of interdisciplinary exchange between interactive media and pre-existing courses. NFS will be unique in focusing on storytelling, as it does throughout its programme, in creative digital media. Through CEFIMA, NFS will be able to lead practice-based teaching and learning which integrates immersive and interactive dramaturgies into all 9 existing disciplines at BFA level, and to add specialist BFA and MFA programmes, as well as fostering Artistic Research. Dissemination and discussion of the NFS methodology and outcomes via the CEFIMA online community will lead to their wider impact and adoption in the higher education community (see *Action Plan*).

### Key steps in realising the ambitions of CEFIMA

The first CEFIMA project will research and develop the Norwegian Film School's teaching,

learning and artistic research through the following (for details, see Appendix 3: Action Plan):

- (1)Enhance teaching and learning in filmmaking and digital media by integrating new elements with existing disciplines.
- (2)Develop, through student and staff testing, new programmes in immersive and interactive digital media storytelling.
- (3)Develop a teacher-training programme aimed at artists and professional practitioners to prepare them for the teaching and learning environment, that includes digital media technology and interactive storytelling
- (4)Multiple strategies of dissemination, which also involve feedback aimed at enhancing future activities.
- (5)Implement Artistic Research at all levels into the Art of Immersive and Interactive Storytelling, with direct connection to the study programmes.

### Outcomes and impact of SFU Award that would not be achieved without support

The SFU Award will enable NFS to develop the convergence of competences from two subject areas to their mutual benefit - *Film & Television* and *Immersive & Interactive Storytelling* - so far only bordering on each other, from new distribution platforms for linear storytelling to the artistic potential of immersive forms like gaming, virtual reality and augmented reality, to bring about a completely new approach to artistic content creation in teaching and learning and in professional

practice, in this increasingly important market sector. CEFIMA will add new educational AR expertise to existing faculty, to explore, design and support innovative teaching and learning in the new disciplines emerging from digital technologies. It will create a community of students, peers, and stakeholders, enabling participative course design, rapid dissemination of outcomes and feedback. Developing new educational approaches and strands will lift quality and innovation in interactive and audiovisual storytelling and production in Norway and the wider environment as well as giving graduates a stronger entry into professional life. Collaborations and exchange of information and practices with higher education establishments, interactive production companies and television companies at home and abroad will require travel, workshops and to host guest leaders and tutors, all needing support from SFU funding. Sharing plans and experiences, and bringing the results of NFS AR-based curriculum-design, some now only in printed form, into face-to-face sessions and easily updated online formats will impact a new and wider group of stakeholders both nationally and internationally, which cannot be achieved without SFU funding.

### Contribution by CEFIMA over time

CEFIMA research and development in teaching and learning will be iterative and continuous over time. The Head of CEFIMA will review activities quarterly, report to the Dean of NFS and brief the Heads of Studies, who will incorporate discussion of progress into curriculum- and staff-meetings, at which Professors and Tutors will present and note student contributions. Project Managers will feed project outcomes back to the development team, so that ideas emerge and evolve, informing the development of teaching and learning and stimulating innovative practices in the wider institution through audio-visual storytelling. Project Managers will monitor closely and co-ordinate the work of artistic researchers investigating educational advances as well as creative and artistic aspects of emerging digital media, industry needs and new tools; and will develop new modes to train tutors. Faculty will chair and record - using both written and novel *audio-visual* means - formal and informal debate in-house, to be enlarged through the CEFIMA dedicated Interactive Website, Discussion Forum, Blog, Vlog and Social Media. Developing and moderating online a community of stakeholders and interested parties, in Norway and worldwide, will bring ongoing input and new insights both to the NFS and to LUC.

### Exit strategies: sustainability of CEFIMA post funding

As CEFIMA's initial research for the new BFA and MFA in Immersive and Interactive Storytelling yields results and the curriculum develops, central funding from LUC will cover NFS overheads and provide resources and facilities to support exercises, workshops, rapid prototyping experiments and other projects. Commercial companies with whom links have been developed through CEFIMA are likely to make in-kind contributions of hardware and software, both for beta testing

and to establish brand loyalty. The Award of the SFU is expected to enable NFS to achieve the fundamental paradigm-shift which will place it at the leading edge of anticipated convergences and new practices, merging them seamlessly with the School's teaching and learning. Connections forged under the aegis of CEFIMA with related higher education establishments and commercial companies will continue to bear fruit, and graduates from the new programmes will feed back new knowledge into NFS.

#### Dissemination

Moving-image based interactive modes of reporting on and engaging others with CEFIMA, and disseminating outcomes and new knowledge will be central. Assoc. Prof Fredrik Graver, Head of Studies BFA, will monitor and update processes and progress. CEFIMA will raise awareness through Reports; Briefings; Audiovisual Documentaries; Newspaper Articles and NFS Graduation Screenings. It will share knowledge, practices and understanding with stakeholders and interested parties through the Interactive Website; Roadshows; Presentations and Demonstrations; Subject-specific Newsletters; Conferences and Expos and published Conference Papers/Refereed Journal Publications/Book Chapters (see *Action Plan* for details of target groups and actions).

### Academic leadership's involvement in dissemination

Most of NFS Professors will devote 15% of their time to CEFIMA activities. They will contribute actively to all aspects of the dissemination strategy above, detailed in the *Action Plan*, both directly by presenting and publishing outcomes and more widely by activating professional networks and peers in higher education. They will use their specialised professional skills to produce high-quality short information films, documentaries and teasers about the work of CEFIMA for the Website and wider distribution. Using existing and building new national and international networks will be a key factor in this.

### **Management of CEFIMA**

The Centre will be an integrated part of NFS. The head of Centre will be Assoc. Professor Fredrik Graver, supported by an Advisory Board with student, alumni, staff, and industry representation. The leadership of the Centre will also include the following Project managers Professor Jan Lindvik and the Head of Studies for BFA (TBA), Digital visual designer Peter Hjorth and Professor Henning Camre. The Centre leadership will refer to the dean of NFS and to the Board of NFS. In addition to existing faculty and guest teachers, CEFIMA will draw on international experts within the field, and industry representatives, and international educational partners. Administrative and technical staff at NFS will be backing the Centre activity. The Centre is strongly supported by LUC for whom this development of NFS is an integrated part of "Strategic Plan - LUC"<sup>39</sup>


# COMMENTS

[Body text (150 words)]



# INFORMATION ABOUT THE HOST INSTITUTION

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# **ABOUT THE CENTRE**

Name of Centre Centre for Interprofessional Interaction with Children and Youth

Is the Centre already established at the time of the application (yes/no)?  $\hfill Yes \hfill No$ 

Please name any consortium partners for the Centre



#### [text]

# ABSTRACT

The objective of the Centre is to enhance collaboration between educational programmes addressing children and youth's well-being, health and education, in order to improve services offered to children and youth. Scholars, students, practitioners and stakeholders in the field state the need of increased interaction between these professions.

In Norway, interprofessional collaboration is usually confined to health and social services. Yet a broad array of professional efforts are crucial to the everyday lives of children and youth – hence the need of widening the educational scope. The Centre responds to this by including students from teacher education, based on the important role kindergartens and schools play in the life of children and youth, thereby creating innovative, interprofessional practices in a Norwegian context. Drawing on recent international best practice in students as partners, a key feature of the Centre is the co-design and co-production of learning resources by students, staff and practitioners.



# **APPLICATION DOCUMENT**

The application must be written in English and follow the requirements set in this template. It must not contain more than 10 pages in Times New Roman, 12-point types, with lines spaced 1.5 and margins of 2 cm. Within this format, the applicant must provide:

#### a) Documentation of educational quality in existing provision

The applicant must comment and critically reflect on themes and questions set out in the criteria, and compare their existing provision with similar provision within the same subject/discipline area, both nationally and internationally. Through this, the applicant must document that the academic community qualifies as a Centre for Excellence in Education.

#### b) A centre plan

The applicant must comment and critically reflect on themes and questions set out in the criteria. The Centre Plan must outline the vision of the Centre, its strategy and plans. It must present the plans for the dissemination of knowledge and practices to its own institution(s) and to other educational communities as well as an evaluation and impact framework.

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The following appendices must be included (and no other):

- 1. A list of references
- 2. A budget for the Centre for the first five-year period, including motivation for costs (see guidelines at <u>www.nokut.no/SFU/utlysninger</u>)
- 3. An action plan for the Centre, including milestones (no more than three pages)
- 4. CVs of the proposed Centre Leader and two to five key members of the Centre team (each CV must not exceed two pages)

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# CENTRE FOR INTERPROFESSIONAL INTERACTION WITH CHILDREN AND YOUTH

## **1** Introduction

The objective of this Centre for Excellence in Education is to enhance collaboration between students from those professions focused on maintaining children and youth's well-being, health and education, including the perspective of children and youth as active participants in the professional work affecting them<sup>1</sup>. The key instrument to achieve this objective is to build innovative, interdisciplinary arenas of cooperation, based on student as partners<sup>2</sup>, both within educational programmes and through practice placement periods.

Establishing a Centre for excellence with this objective, provides added value to the existing high quality education that is offered in these professions by HiOA today - at the same time it represents an innovative practice that other HEIs could adapt and adopt. The societal impact of the Centre will be strong through making the services offered to children and youth more sustainable and coherent.

Numerous occasions occur during childhood and youth where children/youth are dependent on cooperation with and between welfare state professionals in order to optimize their conditions for daily life, wellbeing and learning, as well as health and social care<sup>3</sup>. Without adequate interprofessional collaboration, children's social participation and continuity in everyday life may be jeopardised. At HiOA the Centre will target students from child welfare, early childhood education, health professions, social work, and teacher education.

Many reports and political documents <sup>4</sup> state that it is necessary to increase the level of interaction between professions, in order to deliver successful early services in education and social and health care to meet the needs of all children and youth as they grow up. Scaffolding children and youth at risk, and children and youth with special needs, is likewise an important task. Within health and social services, interprofessional collaboration has been an issue for some time, both nationally and internationally. However, collaboration with staff at kindergartens and schools, is remarkably rare. Two notable exceptions are at Kingston University, London, UK, where the Institute for Child Centred Interprofessional Practice promotes interprofessional education (IPE) for teachers, social workers and health care personnel<sup>5</sup>, and at University of British Columbia, Canada, where they hold innovative workshops to enhance interprofessional collaboration between students from nursing, education and social work<sup>6</sup>.

Even if the need for jointly organized and interprofessional practices (IPP), are widely recognized in political documents in Norway, research regularly documents severe shortcomings

in this area<sup>7</sup>. Research also documents that children's participation in a range of professional practices is mostly lacking, even if children and youth in Norway have legal rights to have a say in matters of their concern<sup>8</sup>. These are interconnected challenges, and research points to the fact that children, when asked, often emphasize what they perceive as a lack of interest among professionals for life domains existing outside that of an intraprofessional knowledge base<sup>9</sup>.

This calls for new thinking, new research and new practices in the educational trajectories of the student groups in question, through interdisciplinary approaches that enable students to interact, during their years in higher education and eventually in their future jobs.

#### 2 Documented Educational Quality in Existing Provision

HiOA is the third largest higher education institution in Norway, with 19 769 students and a large portfolio of study programmes covering all three cycles. The majority of the first cycle programmes prepare a significant number of students for many different professions in which they will meet children and youth, and where they will need the skills and competences that the activities of the centre aim to enhance.

In reply to the questions in the call, we choose to document quality within the relevant programmes through student evaluations and surveys measuring student satisfaction; supported by evaluations from lecturers, an employer survey, and our quality assurance system (QAS)<sup>10</sup>, recently reviewed and accredited by NOKUT. QAS builds on HiOA's surveys *First-year students*, *Final-year students*, *Graduate survey* and *Employer survey*,<sup>11</sup> as well as on the national student survey *Studiebarometeret*<sup>12</sup>, course evaluations and *Database for statistics on higher education*<sup>13</sup>.

Results from *Studiebarometeret* show that many of the relevant study programmes at HiOA match or are above the national average when compared to similar study programmes offered by other HEIs in Norway in the following categories: *Coherence between courses, achievement of learning outcomes, engaging, experience with R&D activities, work relevance and follow up on students' feedback*. International comparisons are more difficult to make as several of the relevant study programmes are educations particular to Norway, with national curricula that are dissimilar to international programmes in such a way that additional studies are required before students educated abroad can practice their professions in Norway, or the study programmes abroad are not conducted on a tertiary level.

## **Input factors**

HiOA's *academic competence*, is solid with 1300 academic staff with 500 man-years, including 600 staff holding a PhD, 70 research groups and several hundred research projects.<sup>14</sup> There are a

number of scholar-led research projects and groups, and publications disseminated that focus on themes relating to children and youth<sup>15</sup>. Much of this work has been carried out at HiOA's two research centres: the Centre for the Study of Professions (SPS)<sup>16</sup> and Centre for Welfare and Labour Research (SVA),<sup>17</sup> comprising four research institutes: NOVA – Norwegian Social Research<sup>18</sup>, AFI – Work Research Institute<sup>19</sup>, NIBR – Norwegian Institute for Urban and Regional Research<sup>20</sup>, and SIFO – Consumption Research Norway<sup>21</sup>.

The *educational competence* of academic staff is ensured in accordance with the national guidelines<sup>22</sup> through the UHPED course (15 ECTS) mandatory for all teaching staff. Other relevant educational competencies are those in digital teaching and learning, and in student engaged teaching and learning. The University College leadership has launched the digitilisation project, comprising 'the Learning Lab', a centre for learning and teaching through the use of ICT<sup>23</sup>. Furthermore, the Programme for Excellency in Qualifying for Professions (FPK), SPS has created a portal<sup>24</sup> that promotes available teaching and learning tools, methods and resources at HiOA, such as LATINA/lab<sup>25</sup> and MOOCA-huset<sup>26</sup>.

*Managerial competence* in terms of ensuring quality in education is also a part of QAS. The management closest to the academic staff is the head of studies appointed to each study programme, and is responsible for programme evaluations, for allocation of resources and for the academic staff, including their continued professional development.

The Centre builds on activities and goals proposed by the Quality in Education report (2014-2015),<sup>27</sup> in line with the HiOA's Strategy 2020<sup>28</sup>, and on a variety of parallel initiatives. One example is the *Barn oss i mellom*<sup>29</sup> (Children among us) project, initiated and run by HiOA students across professional educations. The project aims to increase students' competencies on how to cooperate across professions for the benefit of the child. The project hosted its first conference in April 2016.<sup>30</sup>

The centre also builds on research and educational projects<sup>31</sup> initiated by the academic communities at HiOA, in particular on the work of the interdisciplinary research group *The Lives of Children and Professional Practice*<sup>32</sup>, awarded a grant by HiOA in 2013. The network *Children and Youth across Professional Boundaries* is also included in this group and has been hosting an annual conference since 2010, inviting colleagues from all professions to discuss and share best practices<sup>33</sup>. The Centre also builds on the pilot project *A Team around the Teacher*, exploring various means for collaboration between teachers, public health nurses and social workers, carried out in 2014 and 2015. Additionally, courses on children and youth are held as part of study programmes across the three cycles.

The *application has been developed* in close cooperation with stakeholders (kindergartens, schools, youth organisations, hospitals, students from HiOA, pupils' representatives<sup>34</sup>, the municipality of Bærum and the district of Grorud) and is strongly supported by the HiOA leadership and Faculties. Planned activities and use of resources have been approved by all levels of management. The HiOA leadership has guaranteed institutional input to match the funding requested under the call.

#### **Process factors**

The most explicit examples of *links between research and education* are found in the second cycle. But there are also significant links in the first cycle where all programme designs include a bachelor degree thesis, giving the students a direct chance of engaging in R&D activities under the supervision of academic staff who may include the student in their own projects. Third year Social Education students can choose their specialisation by applying to one of nine academic projects led by lecturers or to one of several projects suggested by HiOA's external partners. *Ungdataverkstedet*, a recently piloted course where master students are taught through workshops and write their thesis using data collected each year, is offered by NOVA<sup>35</sup>.

A general insight into the links with research is given in *the Final-year student*, with 64% of Early Childhood Education and Care students reporting that they have participated in projects together with academic staff at HiOA. 97% of Child Welfare students, report that their teachers have presented their own research work while teaching.

The *practice field* is also important to us emphasising the close cooperation and exchange of new knowledge and new practice between education, research and the practice field<sup>36</sup>. One way of ensuring interaction with the practice field is by using secondments. Practitioners have been appointed for such positions, answering needs expressed in the programme evaluations. Students state that hearing professionals discuss cases from different viewpoints leads to particularly valuable learning, and guest lecturers from the practice field teach in many of our courses on themes, including how to cooperate with interpreters in the city region of Grorud. Conferences and seminars are held encouraging public debate and informed dialogue with stakeholders, among these, a seminar arranged by The Ombudsman for Children in Norway and HiOA for future professionals working with children and youth. <sup>37</sup>

In *Studiebarometeret*, students report that a wide variety of *student engaging learning and teaching methods* are used across the programmes; with project work, case based learning as well as digital teaching and learning methods, being reported to contribute mostly to the student's learning. Other methods include the use of Barnevernsproffene<sup>38</sup>, i.e. youth with own experiences

with the Child Welfare services, taking part in role play, films and communication skills training, to promote relevant learning outcomes. The use of flipped classrooms and pod casts are highly rated by students. Digital stories are used s e.g. as a method for reflection during workshops following training periods. Internationalisation activities are promoted to enhance the competencies needed by students upon entering their professions, not least in terms of crosscultural understanding.

In course evaluations students are asked how satisfied they are with the *assessment including both coursework requirements and examinations*. 87% of the Early Childhood Education students report that they are very satisfied or highly satisfied with the methods in which they were assessed and monitored. 83% state that they experienced co-relations between teaching and learning, assessment and monitoring. These findings are supported by evaluations within other programmes.

Upon accrediting QAS, NOKUTs committee commented "The committee can see…..that HiOA sets great store by the *feedback from students* in their systematic quality assurance work. The committee is of the opinion that HiOA accentuate student participation as an important part of the quality culture of the institution"<sup>39</sup> and "Students' feedback is used actively both through the evaluation of courses and through analysis of the surveys and of the results from the Study Barometer".<sup>40</sup> These comments are supported by the results in the *Final-year student*. As many as 96 % of the nursing students (Kjeller) agreed to the statement: "By evaluating courses, students contribute to the enhancement of the quality of the study programme". An example of how *students influence the programme design* is seen in nursing where a founder camp was moved from the first to the last year after students and staff reported that it came too early.

## **Outcome factors**

In addition to student evaluations on *achieved learning outcomes*, almost the entire cohort of Social Work students state that they are highly satisfied with their learning outcome achievements. Nursing students report a high degree of achievements of the learning outcomes through a very varied use of learning and teaching methods, thereby also documenting that there is a consistency between the described and achieved learning outcomes.

The bachelor programmes include one or more periods of supervised professional training during which the student *prepares for the labour market*. These periods include interaction between the student, the supervisor and HiOA. The Teacher Education programme holds seminars to reflect upon this tripartite cooperation, evaluations are over all good. The majority of the Child Welfare students, 87%, are satisfied or very satisfied with their supervised professional training

period. They are particularly satisfied with the quality of their supervisors and with the cooperation between the HiOA and the practice place. 96 % of the nursing students rate their training period as highly relevant or relevant for their future work.

The *Graduate survey* and the *Employer survey* are used to measure the *relevance of the study programmes* showing that nine out of ten graduates have landed a relevant job, 63% of them already before graduating. *All* teachers have landed a relevant job within 6 months of graduation whereas 99 % of the nurses and 85% within social work and child welfare have done the same<sup>41</sup>. However, teachers and some health professionals do not feel well prepared for the jobs for which they were educated. The teachers report that they were not adequately prepared for the communication with parents, and early childhood education teachers report that they would have liked to know more about how to take care of children with special needs and how to cooperate with the child welfare services.

The Employer survey supports this as 36% of rectors participating in the survey, report that they are not satisfied with the competencies the teachers have in communicating with parents. The same applies for employers of child welfare officers where the employers are very satisfied with the employees' knowledge on children's development and conditions for development, but not with cooperation with other offices and professions. This is what is to be addressed by the activities of the Centre. The majority of the student population at HiOA still attends Bachelor degree programmes (88% in 2014-2015) qualifying them for work as professionals. <sup>42</sup> Even so, both teacher and health professional graduates believe they will *continue their education*, but mainly through *further education programmes*. However, 14% of the graduates had already proceeded to further studies, 72% on the *second cycle*.

## 3 Centre plan

The main innovative contributions of the Centre will be *to develop excellent learning/ teaching activities* that facilitates a 1) joint theoretical background and 2) communication skills to support the participation of children/youth, and 3) interprofessional collaboration within the fields of education, health care and child welfare. The teaching and learning activities proposed in the centre plan are in accordance with student evaluations of pilot projects that will be further developed and made accessible for all of the Centre's targeted student groups. Students will be engaged in co-construction of cases together with staff and practitioners, and students will also co-produce learning-resources like digital video-cases meant for both workshops and the Centre Website.

The Centre's work will be organised into 9 work packages (WPs). Even though the innovative work divided into WPs will be closely interwoven, structuring the Centre's activities into work packages will be beneficial with a view to evaluation and further educational developments.

# WP 0: Coordination and administration

The overall coordination and management of the Centre cf budget and action plan.

## WP 1: Joint knowledge platform: Childhood and youth in a diversified society

Through joint seminars, the Centre will provide bachelor students with an extended, theoretical and research-based platform concerning childhood, children and youth living their everyday lives and growing up in a late modernity welfare state.

*Learning outcome:* The students will share a) *a general understanding* of childhood, children and youth, and of the processes of growing up in a socially, culturally and economically diversified society, b) *ways of exploring* girls' and boys' everyday life situation and subjective understanding of this, and c) an *initial understanding of interprofessional work*.

# WP 2: Communication with children, youth and their families

Inter-/professional R&D-based seminars and group work taking place throughout the bachelor programmes will provide the students with regular opportunities to work on communication and interaction with children/youth and their families.

*Learning outcome*: The students are *oriented towards and are capable of communicating with children and youth* in ways that explore the child's everyday life situation, safeguard the child's meaning making processes, secure the child's participation in his or her 'case', and investigate the child's need for inter-/professional support in collaboration with the child or youth and her or his family.

# WP 3: Interprofessional learning

Interprofessional bachelor seminars will focus specifically on R&D-based interprofessional work, both theoretically and through practical work in interprofessional groups with digital cases and cases in 'real life' practice.

*Learning outcome*: The students are able to establish a joint general platform as a springboard for their specific and interprofessional competencies in active cooperation with the child/young person.

# WP 4: Arenas and methods for learning and teaching

HiOA has many innovative small-scaled teaching and learning projects, which will form one basis for the Centre's development of extensive, interprofessional and student engaed education.

Further, the Centre will play a crucial role in creating a learning environment in line with the digitalisation project. Digital tools will be combined with face-to-face activities<sup>43</sup>. The Centre will thus establish two cornerstones in its innovative work on education: one based on digital learning tools and one based on learning in practice. The learning and teaching activities aimed at satisfying the learning outcomes of WP 1, 2, and 3 include:

- A recurrent organisation of students in interprofessional learning groups throughout the bachelor degree studies.
- Adaption/up scaling and further development of methods of learning and teaching already introduced in pilot projects in intraprofessional courses or themes
- Development of a *digital resource portal across faculties* (cf activity plan)
- Development of principles of and opportunities for *interprofessional learning in practice*. A new and ground-breaking collaboration will be established with Bærum, a neighbouring municipality to Oslo; Grorud, a district in Oslo; Oslo University Hospital, and Akershus University Hospital which offers specialist health care to the inhabitants of Bærum and Grorud. Bærum and Grorud represent a wide demographic variety in terms of social class, cultural backgrounds and ethnicity. Designing a network of productive interprofessional practice situations in close cooperation with the practice partners will be one of the main innovations offered by the Centre (cf activity plan)

## WP 5: Enhancement of competency for HiOA staff and involved practitioners

The research literature on IPE and IPP points to a general tendency to underestimate the efforts necessary to develop competencies and a positive culture for IPE and IPP<sup>44</sup>. Working regularly on staff culture and competency is therefore a crucial part of the Centre's activities,<sup>45,46</sup> The Centre will develop meeting places connected to W1-W4, where staff and practice supervisors can learn together and from each other. Partnership will be built between faculties and fields of practice by engaging people in face-to-face learning groups. These groups will use case-studies and practice-oriented material that can be complemented with E-learning<sup>47</sup>. The Centre's international professors will play a central part in this WP.

*Learning outcome:* The staff and the practitioners share a) a joint understanding of interprofessional practice and communication with children/youth, b) necessary knowledge about conceptions, frames of knowledge and work in other professions, and c) methods for learning and teaching interprofessional work.

## WP 6: Further education, Master and PhD programmes

Students in relevant further educations programmes such as Public health nursing, Physiotherapy for children and youth, Child welfare from a minority perspective will be included in specific WP 4 activities as be fitting their specialisations. As experienced practitioners themselves, they will add value to group collaborations with bachelor students and to the further development of the Centre's peer learning portfolio.

*Learning outcome*: The students are able to establish a joint general platform as a springboard for their specific and interprofessional competencies in active cooperation with the child/young person.

At Master and PhD level, courses will be offered in English in order to enhance international collaboration in this field of teaching and learning. Students will be recruited to do interprofessionally relevant research run by research groups and centres at HiOA. Master students will also be offered the opportunity to serve as group facilitators for interprofessional bachelor groups. The Master and PhD students will play an important role in the Centre's international orientation since they will have the opportunity to spend time at network institutions abroad.

## WP 7: Evaluation

The Centre will engage two PhD students to do their projects on evaluation, one quantitatively and one qualitatively based. The last one will particularly investigate the students' competencies in IPP with practitioners and children/youth.

The students' and staffs' experiences of their developed competencies in interprofessional collaboration will be investigated qualitatively connected to the course units and, for the students, also quantitatively by including relevant questions in HiOA's existing surveys: The *Final year Student*, and the *Graduate Survey*. The *Employer survey* will give valuable information as to the societal impact of the Centre activities. In addition stakeholders representing the districts of Bærum and Grorud will participate in annual evaluations of the interprofessional activities carried out in the fields of practice. Through the Centre's international network and internationally affiliated professors, prominent experts of the field will continually supervise its models of teaching and learning, thus benchmarking and also contribute to the international impact of the innovations produced. See the action plan for detailed timeline for evaluation activities.

# WP 8 Dissemination

The Centre will be made visible through a carefully designed web-site, providing up-to-date information on the different activities and events, and issuing a monthly digital newsletter. Various learning resources will be published, such as digital stories produced for case based learning.

These resources will target students, staff and the practice communities linked to HiOA and to many similar HEIs .

Workshops targeting staff, students and practitioners linked to relevant HEIs, will be held every term. Participants will be invited to co-construct new knowledge based on experiences from educational activities at the Centre. Both students and staff at HiOA will participate in facilitating workshop activities, which purpose is to reflect and create understanding of how to develop successful, interprofessional collaboration, and to highlight the transferability of these activities to other HEIs. To ensure further development of the strong relationship between the Centre and stakeholders outside HEIs, these groups will also be included in workshops.

Staff at the Centre will participate actively in international networks, the objective being to publish research internationally. In addition, the Centre's International Research Network will be involved in workshops and conferences at HiOA. Conferences will be held annually, in order to share research based information on educational activities at the Centre with the academic community and to relevant stakeholders. The Centre will also cater for open lectures, aimed at stakeholders, the academic community and the general public. Such activities are an important contribution to the public discourse relevant to the field. The Centre will generally be a vanguard in IPE, IPP and user participation, which are elements called for not just when it comes to work with children/youth but with people of all ages in need of professionals' support in education, work-life, health care and social services. Thus the Centre's innovations are expected to fertilize HE outside the child related study programmes and create permanent and robust changes in student engaging and interprofessional teaching and learning.

## International Relations

The International Research Network is part of the Centre in order to ensure close relations to the international field of research and educational activities. Contacts are established with relevant staff and management at Kingston University and at University of British Columbia. Scandinavia is represented by staff at Roskilde University, Denmark.

# Added value

Despite the fact that there are already initiatives and institutional goals regarding interprofessional collaboration at HiOA, experiences document that the transgressive nature of these ambitions makes it challenging to transfer them to educational activities throughout the institution. Establishing a centre with staff with allocated time to coordinate and develop these activities on a large scale, will provide HiOA with a solid platform, from which excellence in education, targeted at large programmes in professions with huge societal impact, can be developed and spread to others.



# COMMENTS

The attached Action plan consists of three pages as directed by the Call, but to ensure readability, two of the pages are in the form of an A3 Gantt chart.



# **INFORMATION ABOUT THE HOST INSTITUTION**

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# **ABOUT THE CENTRE**

Name of Centre Centre for Excellence in Rehearsing Praxis in Teacher Education (cePraxis)

Is the Centre already established at the time of the application (yes/no)?  $\hfill Yes \hfill Xo$ 



Please name any consortium partners for the Centre [text]

# ABSTRACT

Describe briefly the aims as well as the current and planned activities of the Centre (150 words)

Stord/Haugesund University College's proposal for **Centre for Excellence in Rehearsing** *Praxis* **in Teacher Education (cePraxis)** is the result of lengthy efforts to address the well-recognised gap between practicum and academic coursework.

*Praxis* requires sound judgment about what is to be done, and highlights the teacher as a reflective, critical, moral and thoughtful professional. We aim to encourage the enhancement of *praxis* in the lived conditions of practice for the individual teacher, and the formation and development of social, cultural and material conditions that make educational *praxis* possible within teacher education. Our vision is therefore to develop and study the *Rehearsal Space* both as a physical space and a metaphor for professional development with clear visions of good education, and coherent teacher education programmes where opportunities to rehearse praxis will be the core activity. The Centre will thus lead innovations, research and excellence in order to develop teacher education.



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# **APPLICATION DOCUMENT**

# CENTRE FOR EXCELLENCE IN REHEARSING *PRAXIS* IN TEACHER EDUCATION (CEPRAXIS)

## 1. Profile and vision

Stord/Haugesund University College (SHUC) proposes a Centre for Excellence in Higher Education (CEE) named the Centre for Excellence in Rehearsing Praxis in Teacher Education (cePraxis). While practice is often perceived as being based on rules and technical and rational procedures, the focus on praxis serves to highlight the teacher as a reflective, critical, moral and thoughtful professional. Our proposal for cePraxis is the result of lengthy efforts in the Faculty of Teacher and Cultural Education at SHUC to link the two learning arenas; Practicum and University College. The cePraxis will focus on the rehearsal of teaching, and reflects a shift in focus from the general development of the individual towards becoming a teacher to a stronger focus on quality aspects in the content and forms of activities in practicum, as well as the quality of interaction between what goes on in the classroom and in teacher education subjects and curricula. In this, we are in line with the international trend in teacher education research that stresses substantive rather than structural features (Darling-Hammond, 2006; Klette & Hammerness, 2016). The proposal for cePraxis is solidly based on previous work at SHUC and on research in teacher education. Linking theory and practice in dynamic relationship and rehearsing the enactment of particular classroom practice in order to develop visions for good teaching will be a central aspect of cePraxis in our teacher education programs (Klette & Hammerness, 2016; Boyd & Grossman et al., 2006; Grossman et al., 2008; Feiman-Nemser, Tamir & Hammerness, 2014).

We have chosen **cePraxis** as the name of the centre. The concept of *praxis* is related both to ancient and modern theories on communication (Aristotle, 1981, p 209; Biesta, 2004; Kemmis & Smith, 2008) and to an understanding of essential characteristics of the teaching profession, for example as expressed in Priestly, Biesta and Robinson's (2015) theory of teacher agency. Aristotle sees *praxis* as the art of action; it is understood as the practical kind of reasoning connected to a person's *phronésis*, his ability to make sound judgements (Aristotle, 1981, p. 209; 1991, p. 34). In this way, *praxis* requires judgement about what is to be done, and the concept offers a holistic understanding of teaching. Teacher agency is not something people can *have*; it is what people *do* (Priestly et al. 2015). Priestly, Biesta and Robinson provide an ecological perspective on agency and stress how teacher agency should be understood, not only in terms of the individual capacity of teachers but also in respect of the cultures and structures of education.

The vision for cePraxis is:

To develop and study a Rehearsal Praxis Model (RPM) for teacher education, suitable for developing visions about good education, for developing coherence in teacher education and for developing opportunities to enact praxis. The Centre will thus lead innovations, research and excellence in order to develop teacher education.

We envision the establishment of **cePraxis** with the overarching aim:

To develop and study a third space for learning teaching, based on two overarching concepts: *rehearsing* and *praxis*.

This implies that we aim to gain a deeper understanding of how *praxis* can inform and guide the actions of educators (teachers and teacher educators). We aim to encourage the enhancement of *praxis* in the lived conditions of practice for the individual teacher, but also aim to encourage the formation and development of social, cultural and material conditions that make educational *praxis* possible. We also aim to conceptualise the *Rehearsal Space* as a framework for professional development.

#### **1.1 The Rehearsal Space as a central vehicle for** *praxis* in teacher education

Teacher education in Norway has been criticized for the gap between theory and practice where academic coursework are loosely linked to school-based fieldwork (NOKUT, 2006; Munthe, Malmo, & Rogne, 2011). The establishment of **cePraxis** proposes the *Rehearsal Space* (RS) as one method of encouraging this integration. The RS comprises both methods and physical space; it is a way to meet practicum in a space between the well-recognised divide in campus-based teacher education and teacher education in practicum. When the pre-service student teachers (PSTs) rehearse teaching practices such as providing explanations, orchestrating classroom dialogues in different subjects or trying out methods from educational drama on peer students, the traditional campus teaching is changed into a dynamic learning space. In a focus group interview<sup>1</sup> a PST stated that: "I learned a lot! When I rehearsed on my class [of pre-service teachers] they came up with lots of questions that I hadn't thought of, and this meant that I was better prepared because it turned out that my students asked the same questions!". This kind of rehearsal provides the teacher educator with opportunities to supervise the PSTs in their teaching practices, and thematise both subject and pedagogical knowledge. In this way, the RS provides PSTs with formative feedback. The

<sup>&</sup>lt;sup>1</sup> Excerpt from a focus group interview with one group of PSTs that participated in the IMTE project, a research program (2012–2016) where rehearsing has been a central theme. More on IMTE later.

Rehearsing Praxis in the RS also contains the opportunity for analysing video clips of PSTs before and after teaching in practicum with a view to insights and improvement. Another PST states: "Then you see yourself on video afterwards and you get to see what you actually were doing, you observe how you speak and how you use your body language and how you react on different inputs. I think it is very informative". In this setting, the teacher educator and peer PSTs can discuss theoretical aspects that demonstrate the link between theory and practice including how practice can also generate teacher knowledge.

The RS is both a physical space and a metaphor for the Rehearsal Praxis Model that is adopted within this space. The RS in SHUC is at one level a physical room furnished with technical equipment for video or audio recording and with a wide range of ICT equipment for experimenting with every form of rehearsing or analysing teaching. This room then affords the opportunity to facilitate coached rehearsals, structured as, on one hand, approximations and educational simulations, the PSTs being themselves, trying out different teaching strategies and educational tasks, and, on the other hand, approximations where they take on different roles and try out being in someone else's shoes. The purpose of these processes is to make room for polyphonic rehearsals and exercises in order to explore subjects, themes and media in didactics. The RS is thus an arena for the PSTs' spontaneous and premeditated handling of examples of content, activation forms, media and artefacts in and across practices.

Thus, the vision of **cePraxis** will be achieved through establishing some closely integrated principles. We want to establish *praxis* as a collegial learning culture among our academic staff where we aim to develop shared responsibility for PSTs, courses and programs. Being a small Faculty, we have a long tradition of interdisciplinary cooperation on all levels, and want to build on this tradition. To do this we want to engage staff and PSTs in the renewal of the broader learning environment and further develop and enhance the RS. We want to develop our physical, social and virtual spaces for sharing experience and ideas, and will optimise the physical and digital learning environment to foster learning across the educational domains. It is also necessary to set learning goals that engage PSTs actively in their pursuit of competence, and integrate development of problem-solving, deep learning and learning-to-learn skills in the curriculum. This also means that we will increase hands-on experience with research, management and education. Another important element is to develop quality assurance and evaluation as tools for monitoring progress, recognising and rewarding excellence and spreading 'best practice', and also to encourage and conduct learning 'experiments' and document and report outcomes. We want to develop links to other similar centres, and enable the learning and sharing of experience within **cePraxis** and beyond through

virtual sites and tools, working groups/workshops and an open teacher education conference. An ultimate goal is to increase and systematise communication with employers, end-users and teacher education alumni to better understand society's needs and to communicate the contributions of rehearsal-based teacher education praxis. This will result in a **dissemination** of knowledge through new study plans, new plans for practicum, audio- and video-based course material and examples of methodologies built on the sequences that constitute the RS. Additionally, all researchers involved will use knowledge gained in the **cePraxis** in their ongoing research, and publish results at relevant conferences and in journals.

The **RS**, as a model for teacher education, is suitable for developing what Klette and Hammerness (2016) describe as key features of powerful teacher education; *visions* of good education, *coherence* in education and opportunities to *enact teaching*.

#### 2. Quality in establishing educational activities

#### 2.1 Reasons why the academic community qualifies as a unit for sustaining a CEE

We shall point to two incentives to redefine teacher education at SHUC that have been particularly important in developing *praxis* as a key concept. The first is from a four-year research project carried out at SHUC: *Improvisation in Teacher Education: curricular and Practice in Dynamic Interplay* (IMTE); the second is from a long tradition of focusing on aesthetic learning processes in teacher education, and the PST active learning methods following this focus.

#### IMTE

In 2012, the SHUC awarded funding from the NRC program "Strategic Projects – University Colleges" for a research project on improvisation as a pedagogical skill in teacher education (IMTE) (2012–2016). The IMTE project has contributed to redefining the place and role of practicum in teacher education by choosing a narrow, but important, topic in the teaching practice, *improvisation*, as a focus point. From this narrow focus, all parts of practical training have been brought in to play: class management as a necessary frame for teaching, planning teaching as a necessary structure for teaching, conducting classroom dialogues as the central activity, and the individual PST developing professional and personal repertoires as prerequisites for teaching. It has been interdisciplinary, with most subjects involved in the project, and four PhD projects that throw light on different parts of the project are underway. A large part of the collegium has been involved in the IMTE project, and several publications that take different approaches to the field, based on empirical investigations, are either in the review (Holdhus, & Vist, in progress; Vangsnes, &

Økland, in progress; Vangsnes, in progress) or the publishing phase (Holdhus et al., in progress).

## Aesthetic learning processes

The second source for developing *praxis* as a core concept in our centre is the aesthetic learning processes as a specific means to understanding through work inspired by arts subjects. The aesthetic and creative dimension is a central factor in several of our educational programs, from preschool teacher education to our master program Master in Creative Subjects and Learning Processes. An example is our initial teacher education (1-7) program, which has a successful focus on aesthetic learning processes, a focus that supports teacher agency and enrichens educational purposes other than simply qualifications (Priestly et al., 2015). SHUC has had a strong emphasis on PST productions, for example, through the Write an Opera (WAO) method, which is an artistic production method developed by the Metropolitan Opera in New York and the Royal Opera House in London. Every year, for the past 20 years we have created WAO productions as part of our teacher training. The method has been shared with many kindergartens, schools and national organisations, and has at SHUC been extended to Write a Science Opera (WASO), a methodology for teachers and teacher educators that is currently being comprehensively described and refined in Erasmus and Horizon 2020 programs<sup>2,3</sup>. Since 2015, this program has established itself internationally through staging Global Science Operas in 2015 and 2016<sup>4,5</sup> with participating schools and universities in over 30 countries.

#### The cePraxis will also benefit from previous and current R&D at SHUC

The Faculty participated in the national PLUTO project (2000–2004), aiming to build creative and effective arenas for the professional exchange between practicum and College University. The PLUTO project, and its successor "Holistic Learning in the Education Program" (HIL) (2000-2005), were linked to the use of ICT as a teaching and learning tool. The Faculty also participated in the development of assessment competencies among teachers, funded by the NRC program "PraksisFou" (2007–2010). We have two master programs: ICT in Learning and Master in Creative Subjects and Learning Processes.

## **2.2 Result factors**

<sup>&</sup>lt;sup>2</sup> http://prosjektsider.hsh.no/waso/ <sup>3</sup> www.creations-project.eu

<sup>&</sup>lt;sup>4</sup> www.globalscienceopera.com

<sup>&</sup>lt;sup>5</sup> https://scholar.uib.no/bioceed/iscope

#### Student satisfaction

In a national survey<sup>6</sup> SHUC PSTs' general satisfaction with their education and their assessment of its job relevance, the PSTs at the master level of the Faculty of Teacher and Cultural Education posted a very high overall score of between 4 and 5, where the top score is 5, during the past five years. The bachelor's level programs have an overall score at or above the national average score of  $2015^7$ .

The SHUC PSTs are most satisfied with the relevance of their study programmes, and least satisfied with the involvement of the PSTs. In teacher education 5-10, PSTs also seem less satisfied with the practical part of their studies, with an average score of 3.1 out of 5 on this index.

#### **Completion rate**

The completion rate depends on both the retention rate and the amount of ECTs produced per PST per year. Looking closer at the retention rate of the teacher training programmes, we see that dropout is higher in the teacher education 5–10 than in the teacher education 1–7, but we notice a positive trend from 2011–2015. The students at the Faculty of Teacher and Cultural Education produce an average of 53.4 (out of 60) ECTs per year. This is the highest level among the three faculties of SHUC<sup>8</sup>.

#### 2.3 Process factors

There are numerous examples of excellent educational interdisciplinary processes and performances related to praxis in the Faculty:

a) The European Commission awarded the ECHE-ERASMUS Charter for Higher Education<sup>9</sup> 2014–2020 to SHUC; b) We have an international strategic plan<sup>10</sup>; c) Research and implementation of creative and aesthetic learning process in science teaching CREAT-IT<sup>11</sup>; d) Established a Research Program for Creativity and Culture Education<sup>12</sup>; e) Participation in Falturiltu, an annual festival highlighting new Norwegian literature and culture for children. As part of this festival, our PSTs produce an opera based on the WAO method; f) PSTs produce and perform many productions for schools and kindergartens every year; g) SHUC arranges an annual Learning Environment conference<sup>13</sup>. The PSTs view the conference as a valuable opportunity to exert influence; h) The

<sup>&</sup>lt;sup>6</sup> studiebarometeret.no

<sup>&</sup>lt;sup>7</sup> In 2015/16 the national average score in teacher education was 3.8. Overall, the national average score was 4.1.

 $<sup>\</sup>frac{8}{2}$  The national average ECT per PST is 57.9 for students in teacher education 1–7, and 54.3 in 5–10.

<sup>&</sup>lt;sup>9</sup> http://ans.hsh.no/internasjonal/charter/erasmus.docx

<sup>&</sup>lt;sup>10</sup> http://ans.hsh.no/adm/studie/Om\_HSH/HSH%20International%20strategy%20december%202014.pdf

<sup>&</sup>lt;sup>11</sup> http://www.hsh.no/fou/fouprogram/k-ped/creatit

<sup>&</sup>lt;sup>12</sup> https://kulturped.wordpress.com/

<sup>&</sup>lt;sup>13</sup> http://www.hsh.no/nyheter/index.php?arkiv=201301000002239

PSTs at the Faculty arrange an annual R&D student conference<sup>14</sup> as part of our teacher education program. Through this, the PSTs experience how research can be presented and discussed, and how teacher education can be R&D based; i) The Faculty of Teacher and Cultural Education arranges the Rommetveit Seminar<sup>15</sup> bi-annually, named after our campus and the famous professor Ragnar Rommetveit, who was born and lives in the campus garden.

#### 2.4 Input factors: Academic resources, staff competence and leadership

**CePraxis** will be located within the Faculty of Teacher and Cultural Education, which comprises around 75 permanent teaching staff. Meanwhile, SHUC is currently in merger negotiations with Bergen University College and Sogn & Fjordane University College. Being a CEE will have tremendous value in establishing the new common platform for teacher education across the three institutions. The Head of our Faculty, Sigurd Sandvold, will be chair of the Centre Management Board (CMB). Associate Professor Vigdis Vangsnes will be the CEE leader and leader of Work Package (WP) 1, Associate Professor Sissel Høisæter will be the CEE deputy leader and leader of WP 2 along with Assistant Professor Gry Anette Tuset, Professor Magne Espeland will be the leader of WP 3 and Professor Knut Steinar Engelsen will be the leader of WP 4.

## 3. Potential for innovation and dissemination

The **cePraxis** will support teacher education that results in: a) PSTs and teacher educators that can design, develop, enact and reflect upon good teaching that is based on *praxis*; b) A practical and theoretical contribution to the knowledge base in teacher education.

#### 3.1 Core activities

**CePraxis** will have four WPs focusing on networking, rehearsing, research, innovation and dissemination:

- > WP 1 Networking other Rehearsing Praxis centres internationally and nationally
- > WP 2 Rehearsing Praxis as Teaching and Performative Communication
- > WP 3 Rehearsing Praxis as Educational Research
- ➢ WP 4 Organisational Development

#### WP 1: Networking other Rehearsing Praxis centres internationally and nationally

Our objective is to network with other RP centres in order to connect and facilitate the exchange of ideas, structures and experiences.

<sup>&</sup>lt;sup>14</sup> https://hogskolenhsh-

my.sharepoint.com/personal/vea\_hsh\_no/\_layouts/15/guestaccess.aspx?guestaccesstoken=7EYh3n2MqPDx3eK47M HKym8%2fFr9ybQUsiPWzCuKuuCM%3d&docid=0549fc7b63b9242ef833a4c53884227ec

<sup>&</sup>lt;sup>15</sup> http://www.hsh.no/nyheter/index.php?arkiv=201105000002060

**Task 1.1**: **CePraxis** will develop a dynamic and interactive **website** as a virtual competence centre and establish links to other RP centres. One goal is to maintain updated webpages including videos, streaming of RS workshops, videos from other R&D activities, etc.

Task 1.2: CePraxis will organise workshops that will connect, stimulate and share good, innovative praxis and enhance teaching through collaboration and exemplary practice.

Task 1.3: CePraxis will establish an annual conference that will bring together educators and PSTs from RP centres nationally and internationally.

Task 1.4: CePraxis will establish exchange visit programs for educators and PSTs.

#### WP 2: Rehearsing Praxis as Teaching and Performative Communication

As part of the RS, PSTs will receive feed forward from peers and teacher educators, which will allow them to evaluate and try out new teaching strategies. This will help our PSTs to expand their repertoires and be able to view their teaching from different perspectives.

**Task 2.1**: Rehearsals as teacher education *praxis*. The aim is to enact core practices at the micro level, and will involve representing, deconstructing and approximations of praxis such as rehearsals (Grossman et al., 2009).

**Task 2.2**: Educational events as teacher education *praxis*. The aim is to build models for designing teaching and to design educational events with help from devising processes and methods like *from idea to performance*.

**Task 2.3**: Media and tools as educational resources. The aim is to set up an exploratory digital tool pack where the potential of emerging new technologies in education is explored and assessed, focusing especially on Rehearsing Praxis.

 • 4: Collective analysis & reflection on praxis
Analysing Enactment and Moving Forward
Introducing about the Activity
Preparing for and Rehearsing the Activity
• 3:Enactment of praxis in classrooms

The model below (Figure 1) summarises the phases of Rehearsing Praxis:

Figure 1: The Rehearsing Praxis cycle. (Inspired by the cycle for collectively learning to engage in an authentic and ambitious instructional activity (McDonald et al., 2014, p. 382) and the cycle of enactment and investigation model

#### (Lampert et al., 2013))

#### WP 3: Rehearsing Praxis as Educational Research

We have decided on educational design research (EDR) as a form of scientific inquiry because of our commitment to develop theoretical insights and practical solutions simultaneously, in real-world contexts, together with stakeholders (McKenney & Reeves, 2012, p. 7). Two PhD and one postdoc candidate will be appointed and supervised to conduct research on **cePraxis**. EDR progresses through three main phases, each of which involves interaction with practice and contributes, directly and indirectly, to the production of theoretical understanding and the development of an intervention, which matures over time.

**Task 3.1**: Reviewing as analysis and exploration. Further examine the international and national field related to Rehearsing Praxis.

**Task 3.2**: Action as design, construction and reflection. Produce research-based contributions to how we enact, compose, analyse and value our teaching in collaboration with our PSTs. **Task 3.3**: Impact as theoretical and practical understanding. Develop our ability to link theory and practice and expand the PSTs' teaching repertoire.

**Task 3.4**: Implementation and spread. Implement the RS across programs and institutions and communicate knowledge during the annual conference, on the website and at regional workshops.

#### WP 4: Organisational Development

**CePraxis** will develop teacher groups that share responsibility for education across related subjects, arrange annual teacher conferences and develop a web forum for presenting and discussing methods and experience.

**Task 4.1**: Conferences and dissemination. Follow up on our already-well established annual student conference. Produce an annual newsletter.

**Task 4.2**: Implementation in educational programs and strategy documents. Structure all educational programs at our Faculty around the RS by the end of the five-year period.

**Task 4.3**: Workshops for teacher educators. Arrange internal workshops and workshops for visiting teacher educators.

#### 3.2 Strategic plan for development and innovation: Rationale and description

The **cePraxis** will focus on developing teacher education in several steps (see attached action plan for details): a) Networking with other RP centres; b) Integration of core ideas in already-existing courses and programs at the Faculty from spring 2017; c) Further developing the RS model; d)

Further developing the interdisciplinary cooperation that promotes deep learning and critical thinking; e) Presenting the model at national and international conferences and expanding the model for use in other teacher education University Colleges, and to other professional programs like health education and engineering.

## 4. Organisational plan

#### 4.1 How the centre will be governed and managed

A Centre Management Board (CMB) will have responsibility for the budget, policy and strategy of the **cePraxis**. Head of Faculty Sigurd Sandvold will be the chair. Other members will be teachers and PSTs, and external members from other universities and employers. The **cePraxis** leader will be a member of the CMB. The Centre Executive (CE) comprising the centre leader and administrator will have responsibility for ensuring that the **cePraxis**' policies and work packages are carried out. The CE will provide the CMB with monthly progress reports. An International Advisory Board (IAB) will be appointed to provide the CMB with advice and evaluations, and will comprise international authorities in teacher education. The IAB will meet annually to be updated on the latest activities and suggest improvements. **CePraxis** will be led by Associate Professor Vigdis Vangsnes, who is employed at SHUC on a 100% permanent contract. **CePraxis** will account for 50% of the leader's workload. A Centre Administrator will be appointed on a 50% contract. Coordinators to carry out the tasks required for the work packages will be appointed by the steering group and will all report to the centre leader.

#### **4.2 Collaborative partners**

Our research group will be complemented by our Professor IIs; Professor Ruth Leitch at School of Education, Queen's University Belfast and Professor Liora Bresler at College of Education, University of Illinois. In addition we will collaborate with international and national institutions with similar approaches to teacher education, our practicum schools and the two institutions with whom we will most likely merge.



# COMMENTS

[Body text (150 words)]



# **INFORMATION ABOUT THE HOST INSTITUTION**

#### Host institution

The Norwegian University of Life Sciences, Department of Landscape Architecture and Spatial Planning

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# **ABOUT THE CENTRE**

Name of Centre

SITRAP - Centre for integrated and transdisciplinary education in planning

Is the Centre already established at the time of the application (yes/no)?  $\Box$  Yes  $\boxtimes$  No

• Please name any consortium partners for the Centre The Norwegian Institute of Bioeconomy Research (NIBIO) Centre for the Study of Professions (SPS) - Oslo and Akershus University College of Applied Sciences (HiOA) Finance Norway The Norwegian Centre for Design and Architecture (DogA) Magasinet KOTE



The Oslo Region Alliance Centre for continuing education, NMBU

# ABSTRACT

Describe briefly the aims as well as the current and planned activities of the Centre (150 words)

The vision of the SITRAP is to educate a new generation of professionals to take a leading role in planning and implementation of the Green Shift.

The Center's main goal is to conceive, implement and develop trans-disciplinary learning methods, which integrate academic thinking with professional methodologies and allow students and as future professionals to break down sectorial barriers and act beyond disciplines. SITRAP will be a catalyst for developing and testing innovative learning and teaching methods through the cooperation of educators and researchers within NMBU, the ILP and the department's many external partnerships , the centre will build on the rich variety of existing study programs at NMBU and encourage the transdisciplinary sharing of content, methods and competences. SITRAP will be a major contribution to the ongoing process of building up the principal education in planning in Norway to an international level.



# **APPLICATION DOCUMENT**

- a) Documentation of educational quality in existing provision
- b) A centre plan

## **Appendices**

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The following appendices must be included (and no other):

- 1. A list of references
- 2. A budget for the Centre for the first five-year period, including motivation for costs (see guidelines at <u>www.nokut.no/SFU/utlysninger</u>)
- 3. An action plan for the Centre, including milestones (no more than three pages)
- 4. CVs of the proposed Centre Leader and two to five key members of the Centre team (each CV must not exceed two pages)

# **APPLICATION DOCUMENT**

**SITRAP - Centre for integrated and transdisciplinary education in planning** Department of landscape architecture and spatial planning (ILP), NMBU

The vision of the SITRAP Centre is to educate a new generation of professionals to take a leading role in planning and implementation of the Green Shift. The Green shift is among all a transition from an oil-based economy to a bio economy, from a car dependent urban development to walkable cities, from mono-functional land use to biodiversity and multi functionalism.

The Center's main goal is to conceive, implement and develop trans-disciplinary learning methods, which integrate academic thinking with professional methodologies and allow students and as future professionals to break down sectorial barriers and act beyond disciplines<sup>1</sup>. According to the Government, the Green Shift is a demand to act within a period of 30 to 50 years<sup>2</sup>. Within such a paradigm shift, planners will play a key role in proposing creative solutions to the societal challenges in the face of increased uncertainty and unpredictability. Climate change is undoubtedly the greatest challenge modern planning have faced since the 19<sup>th</sup> century<sup>3</sup>. Back then, it was huge public health and welfare problems caused by industrialization and urbanization. Planning has since contributed to increased global prosperity, at the expense of the environment. Urban sprawl, automobile dependency and the resulting air pollution and CO<sup>2</sup> emission continue to affect our cities' long-term resilience and new solutions and unconventional approaches are needed to sustain human welfare and livability. A "new urban agenda"<sup>4</sup> is required that addresses these interconnected and systemic challenges, as underscored by the United Nations in its "2030 Agenda for Sustainable development,"<sup>5</sup> where environmental and urban development goals are side by side with social sustainability goals like the reduction of social and economic inequalities, good working conditions and responsible consumption and lifestyles.

SITRAP aims to play a key role in transferring and interpreting the ambitious goals of the world's community for their implementation in the Norwegian and Scandinavian context. This proposal has the ambition to redirect planning and design practice in Norway from sectorial to transdisciplinary, from top-down to bottom-up, and from problem solving to strategic visioning. This requires that we challenge higher education in planning<sup>6</sup>, the role and responsibilities of planning professionals as such<sup>7</sup> and to stimulate students' ability to envision new and ambitious solutions to complex problems<sup>8</sup>. SITRAP will be a catalyst for developing and testing innovative learning and teaching

methods through the cooperation of educators and researchers within NMBU, the ILP and the department's many external partnerships<sup>9</sup>, the centre will build on the rich variety of existing study programs at NMBU<sup>10</sup> and encourage the transdisciplinary sharing of content, methods and competences. SITRAP will be a major contribution to the ongoing process<sup>11</sup> of building up the principal education in planning in Norway to an international level.

## To reach our goal we have outlined five strategies:

- 1. To expand problem-based and place-based teaching through the piloting of new courses in 'planning for the Green shift' engaging students from a various disciplines.
- 2. To establish an arena for knowledge and experience sharing that promotes reflective understanding of the "wickedness" <sup>12</sup> of the Green shift across researchers, students, professionals and politicians.
- 3. To do a formative evaluation of four existing master courses in order to gain a deeper understanding of transdisciplinary education in planning through a systematic assessment of students' learning experience and outcomes, which will be documented and disseminated widely.
- 4. To involve students in evaluation and dissemination of the centers vision and work.
- 5. To increase interaction with the planning practice field to gain knowledge of the leadership skills required of planning, design and management professionals.

**The center's action plan** displays an annual cycle of events, activities and procedures that will allow it to achieve the above-mentioned goals. See: Action Plan, appendix.

# Documentation of educational quality in existing provision

*Input factors:* ILP offers these study programs: Land management and Law (EIE), Landscape Architecture (LA), Urban and Regional Planning (ByReg), Property Development (EIEUTV), Public Health (FoHV) and Landscape Engineering (LING). ILP has approximately 2750 applicants competing every year for 250 spots in its programs. Additionally, the department houses a Research School encompassing 35 PhD students and a continuing education serving the Norwegian community of planners and designers' needs for professional development (699 study points, 120 fulltime equivalents in 2014-15).

A recent external examination of the ByReg program found an education program of high societal relevance, with a solid base in a high quality research environment, with increasing activity and a logically structured program with a clear model for progression. Both teachers, students and Program committee showed great commitment to the education program.<sup>13</sup>

This examination reflects the reputation of all other degree programs at ILP, as reflected in many of our past external evaluations<sup>14</sup>. In recent years, the department has also strengthened its research activities. The integration of cutting-edge research into our education enriches the students' curriculum, giving their work international relevance and greatly increasing their marketability on the competitive job market. The international breadth of ILP's education is reflected in the LED-Landscape Education for Democracy program.<sup>15</sup> Side by side with its international outreach mission, ILP is conscious of our responsibility to so serve our national community <sup>16</sup> also recognized by AESOP <sup>17</sup> as a sign of quality of our master in planning.<sup>18</sup>.

*The permanent staff* counts 51 teachers/ researchers and 80 % of the department's employees are permanent faculty, 25 % of them have the rank of professors. Our unique trait as a research and teaching community is the *high degree of multidisciplinary staff*. Most of our faculty have backgrounds in Landscape Architecture, Architecture, Planning and Law, but the department includes also land consolidators, economists, sociologists, geographers, psychologists, political scientists, engineers, natural resources managers, information technology and computer scientists, as well as artists.

Our research and education have gained great recognition within the planning profession in Norway and beyond<sup>19</sup>. In 2013, our redeveloped Master in Urban- and regional planning was awarded by UMB the prize for excellence in education<sup>20</sup>. NMBU's tradition of integrating research into teaching is felt by our students, as highlighted in a recent survey of University students, which showed that NMBU students feel more included and have greater access to professors than any other university in Norway <sup>21</sup>. This is reflected in the large number of application we receive every year. Our applicants and students' enrolment<sup>22</sup>, graduating PhDs, staff<sup>23</sup>, productivity<sup>24</sup>, and external research funding<sup>25</sup>have grown steadily. Our candidates are sought after and their competence is regarded as relevant<sup>26</sup>, our staff is actively engaged in public debate, as keynote and conference speakers, members of committees and boards of many organizations of societal importance<sup>27</sup>.

The influence of ILP on the larger society is extensive and far reaching, due partly to externally financed grants and scholarships, case-based teaching, service learning efforts in communities around Norway and Europe and the engagement of external examiners in masters thesis and course final examinations. Many of our teaching and research staff are on the board of national and international organizations<sup>28</sup>. ILP is also well represented in the editorial boards of many academic journals<sup>29</sup>. A recent report by NIBR mentions ILP as one of four hubs for research on urban issues in Norway <sup>30</sup>. A recent survey focused on the quality of work environments described ILP as a department with a high degree of collaboration across courses sections, programs and research groups <sup>31</sup>. SITRAP will engage our staff in many of its activities, and a representative of the center

will be included in the departments' leadership. The centre will interact closely with the teaching board and the different program committees.

## Process factors:

Our pedagogy at ILP revolve around design courses where students are assigned design tasks that they resolve by building a customized, personal process, with skill-building courses and other didactic resources –computer labs, 3-d printers and model-making workshops aiding them in this process<sup>32</sup>. However, some of the more exploring teaching take also place outdoor<sup>33</sup> or in The Virtual Reality Lab<sup>34</sup> This requires an understanding of design as increasingly synergistic, strategic, emergent, collaborative, transdisciplinary, multicultural, socially responsible and participatory<sup>35</sup>. This requires that teachers have a high degree of awareness of their own practices and professionalism, and that these are shared, discussed and reflected upon with students and colleagues. While the department has not systematically been researching its own teaching, there is a growing interest in promoting new pedagogies and in assessing their impact in students' learning and motivation<sup>36</sup>. However, the faculty is producing textbooks<sup>37</sup>. Customization of teaching methods is strongly linked to the development of professional methods, which is facilitated by research activities, exploration and experimentation, internal and external evaluations of student works and study programs, formal and informal contacts with alumni, professional associations, and employers<sup>38</sup>.

## Problem based teaching with academic and professional orientation

Our teaching is designed to fulfil the needs for knowledge and skills of high-level professionals. The approach consists in identifying dominant trends that allow to delineate the horizon of practice and address future challenges. Student work is thus based on the ability to analyse, to identify problems, communicate and find solutions and strategies for their resolution. Studio teaching combines lectures, independent studio work under the supervision of teachers, hands-on exercises and assignments, site surveying and study trips, final and midterm presentations, and the students' evaluation of their learning and design processes through the lens of theory. The teaching at ILP spans quite broadly in cooperation with local authorities or other stakeholders such as:

- Landscape planning / design as a method to handle flooding and storm water issues: Cooperation between natural Science environments at NMBU and ILP<sup>39</sup>, research on legal issues related to flooding / stormwater<sup>40</sup> A number of theses related to the research project Exflood<sup>41</sup>, active use of research in courses like LAA 214/215/340.
- Exploring inter-/transdisciplinary methods to develop place making based on local development: In several courses students are encouraged to explore and experiment how they can share there
knowledge with practitioners and even a broader public. The courses are based on themes like local democracy, community and place making, utopia and strategic visioning, suburban landscape and identity, and land use planning. Examples are LAA250/APL250 collaboration with Bærum Municipality and Henie Onstad Kunstsenter<sup>42</sup>, LAA341 a collaboration with DogA<sup>43</sup> in engaging children in the municipalities of Ski, Giske and Bodø in designing more livable social arenas in their respective communities. Another integrated R&D course is LAA 360 «Strategic landscape planning» about participatory methods for identifying landscape resources and community assets - Landscape Resource Analysis (LRA)<sup>44</sup>.

- Exploring CompactAbility is a 3 years research and teaching program where a multi-disciplinary group of ILP students investigates how Ski, Lillestrøm and Asker might transform from railroad towns to compact urban hubs in response to existing regional strategic plans<sup>45</sup>. Involves LAA350/APL350/Master theses.
- <u>Cross- sectoral collaboration</u>: One example is LAA325 developed in collaboration with the Norwegian Roads Authority (SVV) and the Cultural Heritage Agency, through a program called "Our Streets and Squares".<sup>46</sup>

Several of ILP's courses have generated interest from local and regional newspapers<sup>47</sup>.

Problem assessment and project based learning are based on a close interaction between teachers and students, which stimulates reflection upon experience described as "the reflexive practitioner"<sup>48</sup>. One particular quality to take advantage of is the short distance between students and lecturers in such courses. The coaching happens *at the student's drawing table* amidst the student group. This collaborative environment becomes an integral part of each student's professional toolkit. Courses with up to 30 credits also provide us with flexibility to experiment in the classroom by introducing new learning methods and techniques as students become aware of new and unexplored challenges to be addressed.

*Outcome factors:* The extensive use of real-life case studies as the foci of our courses generate rich opportunities to interact with actors and communities. This focus is one of the reasons why 90 % of ILP's graduates between 2009 and 2015 report being employed. About half our alumni cite such casework as giving them an advantage over other job applicants. 65 % reports that they were brought into contact with the working community through their studies, through case-study based education. ILP trains future practitioners who are actively engaged in shifting these communities toward sustainability. Our students feel a sense of responsibility toward society because they understand that their work may lead to real influences and consequences<sup>49</sup>.

The 'transformative' interaction between ILP students and real-life actors have cemented ILP's reputation in the field as an important hub for planning and design education: About 80 % of our alumni agree that the education we offer is in high demand and this is reflected in our good reputation among employers<sup>50</sup>. This also gives us a valuable podium for conveying research and learning outcomes to practitioners, other institutions, and civil society. A Study survey shows an average score of our five-year master programs, which does not match the course evaluations that register a far more satisfaction with the teaching<sup>51</sup>. Several of our faculty members are also nominated, or have won awards for the best lecturer. Our students have received National<sup>52</sup> and international awards for their thesis<sup>53</sup>. Their master thesis often result academic papers, with students as main authors or as co-authors with their teachers<sup>54</sup>. A proof of students engagement is the recent creation of Portal for Nature and Human Health Research in Norway<sup>55</sup> and the publication of +KOTE, a journal run by students and recent graduates of Norwegian and Danish planning and design schools<sup>56</sup>.

# The Centre Plan

#### Innovation within problem-based and site-specific teaching methods in planning education

SITRAP will be a resource hub and future lab for the exploration of new teaching models within ILP. The centre aims at developing new and systematic knowledge about problem-based and site-specific teaching and methods and techniques that can increase transdisciplinary in future planning and design practice<sup>57</sup>. The novelty of the centre's work is both to expand these to other disciplines who participate in planning processes and to gain a deeper understanding of the teaching techniques that enables transdisciplinary understanding and solutions. The centre, which will have its own dedicated staff and steering committee, will follow the annual cycle that interrelate to the academic calendar of the university. SITRAP will report to ILP and study program councils in quarterly meetings/workshops and with the consortium at the consortium meeting. It's operations will be guided by five strategic areas, articulated in terms of *activities, impact* and *dissemination*.

# **Strategy 1:** To expand problem-based and place-based teaching through the piloting of new courses in 'planning for the Green shift' engaging students from a various disciplines.

*Activities:* Two pilot courses (30 credits) will be conducted during the first five-year period for a diverse group of students (ILPs own and other master programs). Students will be asked to identify challenges and develop solutions for the Green shift in close collaboration with communities. The course syllabus will focus on transdisciplinarity, and its pedagogy will be developed in cooperation

with Centre for the Study of Professions (SPS) and the Learning Centre at NMBU, with content and theories related to the Green shift defined in collaboration with NIBIO.

*Impact:* The participants will gain experience in finding solutions across interests and areas of sustainable change, discover the complexity of a particular landscape and collaboratively explore the place's capacity for a 'Green shift,' enabling what Daniel Pinson calls "transdisciplinary curiosity"<sup>58</sup>. Students will learn to lead and coordinate various subject-specific interests while gaining a rich and articulated perspectives on planning for conflicting interests and goals. Both sustainability and transdisciplinary are concepts with holistic ambitions<sup>59</sup>, and the difficulties of overcoming disciplinary boundaries and sectorial practices should not be underestimated<sup>60</sup>. Taking into account such circumstances, SITRAP's work will be able to bridge gaps between education and practice<sup>61</sup> and between political processes and regimes of rights to property and land.

*Dissemination:* The centre will make use of new technologies to disseminate its work through dedicated course web sites and blogs where students work, evaluation reports, conference proceedings, and papers will be made available to the larger public.

*Strategy 2:* To establish an arena for knowledge and experience sharing that promotes reflective understanding of the "wickedness"<sup>62</sup> of the Green shift across researchers, students, professionals and politicians.

Activities: An annual SITRAP conference will kick-off of the academic- year and focus on future challenges and possibilities concerning Green shift issues and transdisciplinary conserns. This public event will be open to scientists, planning practitioners, decision-makers and students and serve as an arena for presenting, discussing and reflecting upon the center's activities and societal impact.

*Impact:* Implementing the Green shift requires an effective information sharing and two-way communication between science and practice<sup>63</sup>. SITRAP's annual conference will help break down existing communication barriers between practitioners, scientists and students, and increase opportunities for networking. Results of students' work will be "returned" to the researchers and help generate new research hypotheses. This exchange between researchers and students will foster mutual learning and open up communication channels that will likely continue to be nurtured once they will enter the profession. While there are several national conferences on sustainability and climate change<sup>64</sup>, the SITRAP Conference will be unique in its focus on *wicked problems* and *transdisciplinary understanding*<sup>65</sup> of how to bridge the needs of the environment and those of politicians, planning actors and communities<sup>66</sup>. The conference will engage all fields of knowledge and academic programs at NMBU—from food production to Green technology, and from the natural

science to economy—with structural consequences on planning, design and management education and practice.

Dissemination: The conference will be live streamed and documented on SITRAP's website.

**Strategy 3:** To do a formative<sup>67</sup> evaluation of four existing master courses in order to gain a deeper understanding of transdisciplinary education in planning through a systematic assessment of students' learning experience and outcomes, which will be documented and disseminated widely. **Activities:** The evaluation of students' learning will occur through pre and post surveys. Aimed at assessing shifts in students' skills, knowledge of the theories of sustainable development, leadership and collaboration skills. The four existing master courses (each offering 20 credits) have been selected because a) they engage in problem-based, strategic design and planning; b) they are linked to research projects; and c) they attract students from different master programs within ILP. Evaluation questions will focus on 1) students learning outcome 2) use of different learning methods 3) level of transdisciplinarity achieved 3) interaction and impact on communities; 4) site (case) ability to implement Green shift solutions.

The evaluative framework and data will serve as foundations for developing new teaching methods and expand our knowledge of how *design thinking*<sup>68</sup> as a problem-solving approach may be adopted by other disciplines involved in planning and design decisions. Design-thinking integrates many different scales of operationalization of the landscape. Furthermore, it involves unique modes of inquiry— listening, asking, understanding, and drafting new possibilities and alternative realities.<sup>69</sup> The concept stems from architecture and urban design<sup>70</sup> but has been adopted by other disciplines like business <sup>71</sup> and education,<sup>72</sup> becoming a research field of its own<sup>73</sup>.

*Impact:* The evaluation of teaching activities in the four courses will inform ILP's design and planning education by: (i) revision of the following year's course program. (ii) inform the discussion of the quality of ILP's education; iii) inform the creation of the new course outlined in strategy: And in addition: (iv) provide new and innovative teaching methods and techniques of interest to the larger community of planning education and professionals;(v) inform new directions for research on Green shift issues and vi) affect the places and communities we will engage as site-hosts for our courses. Our long-term ambition is to focus on *design thinking* across disciplines and educate a new generation of planners who will revolutionize current planning practice by offering them direct experience of the needs to transcend professional boundaries, while becoming aware of the agency of their own discipline<sup>74</sup>.

Dissemination: exhibition of students work, sub-reports, papers and conference proceedings.

Strategy 4: To involve students in evaluation and dissemination of the centre's vision and work.

*Activities:* The center will employ two master's level student assistants who, in cooperation with the magazine + Kote, which will help disseminate the centres' work by focusing one issue every year to document SITRAP's activities and learning. Besides this will the students be important contributors to the discussions about teaching methods.

*Impact:* The direct communication of students' experiences through social media to the entire ILP and NMBU student body and students' run organizations, particularly those enrolled in courses at bachelor level.

*Dissemination:* web page, + Kote, social media;

# *Strategy 5:* To increase interaction with the planning practice field to gain knowledge of the leadership skills required of planning, design and management professionals.

*Activities:* A new course to educate ILP students about professional leadership in planning. The new course will engage concrete case-studies to foster greater cooperation, the handling of planning conflicts, the facilitation of meetings, project management and leadership etc. The activity will be planned and implemented in co-operation NMBU School of Business, The Oslo Region Alliance and SEVU.

*Impact:* The centre will contribute to civil society and the demand for strengthening the planning competency in general. The course will train future practitioners in planning by giving them a deeper insight and knowledge of challenges and methods that can be used when managing, coordinating and implementing complex planning processes involving various disciplines and professional figures<sup>75</sup>. The cases and continuing education will inform ILP's master program curriculum and have an impact on all courses and inform the creation of a textbook on professional leadership in planning, introducing which will be an integral part of our future professional education in planning. The department's competence and understanding of leadership in planning will be strengthened and might help generate a new curriculum/study program in management and leadership in planning. A further impact will be a contribution to the academic debate about planning as a discipline and about the role of the planner in society.

Dissemination: announcement of the course in professional magazines, textbooks

#### International contextualization

Planning and land management contributions to the Green shift depend on a high degree of context sensitivity. The SITRAP's level of expertise is thus a matter of two main factors: deep context

specific knowledge, and broad international horizon of understanding and method. While the ILP as a whole is currently reaching out, by means of student exchange and development of teaching methods through international collaboration<sup>76</sup>, the SITRAP will focus on the Norwegian context. As a first step, the SITRAP will forge an expertise which is both informed by and a contribution to international discourses on sustainable urbanism. A more global perspective will be a logical integration for a step II (2022 -2029).

## Post funding

Establishing the SITRAP will provide resources to systematically gather knowledge and data about pedagogical methods that can help foster a transformative, multi-disciplinary planning and design education. The center will help the ILP form a new generation of planners, who will take a leading role in implementing the Green shift that both the Norwegian and Global society demands. SITRAP will plant the seed of a new creation of a master's degree in transdisciplinary planning.



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## ABOUT THE CENTRE

 Name of Centre

 Centre for Excellence in Action Learning for Sustainable Development (CEALS)

 Is the Centre already established at the time of the application (yes/no)?

 □ Yes ⊠ No

Please name any consortium partners for the Centre



# ABSTRACT

The core idea of CEALS is to establish a dialogue space where higher-education students and teachers meet extra-university stakeholders in a space of shared action, where all participants enhance co-learning while collaborating on handling complex and dynamic sustainability challenges.

With the overall vision of *strengthening the capacity for educating candidates able to contribute to more sustainable societies*, the strategies for CEALS are to use action learning to: A: integrate academic disciplines in a real-life context; B: integrate multiple kinds of knowledge and experience to develop students' competences for observation, participation, dialogue, reflection and visioning; C: prepare students for their transition from academia to transdisciplinary professions.

We will develop new ways of integrating disciplinary and transdisciplinary knowledge within the domains of agriculture, landscape and the environment, build generic action learning competences transferable to other areas of higher education, and disseminate this learning model nationally and internationally.

# **APPLICATION DOCUMENT**

# CENTRE FOR EXCELLENCE IN ACTION LEARNING FOR SUSTAINABLE DEVELOPMENT (CEALS), NORWEGIAN UNIVERSITY OF LIFE SCIENCES

#### What is the overall vision and main strategies of CEALS?

CEALS' vision in short is to design and disseminate educational strategies that foster students' competences to develop more sustainable societies locally and globally. To realise our vision, CEALS will use action learning to:

- A. obtain transdisciplinary integration in a real-life context
- B. integrate multiple kinds of knowledge and experience to develop students' competences for observation, participation, dialogue, reflection and visioning.
- C. prepare students for their transition from academia to transdisciplinary professions in society

# Who are we and what do we see as main challenges in education for sustainable development? We are educators at three NMBU faculties who for several years have been practicing action learning within the areas of agroecology, teacher education and landscape scale planning. In our view, action learning implies that students, teachers and stakeholders in society learn from each other by working together and by reflecting in a real-life context on their experiences (McGill & Beaty 2001, Lieblein et al. 2004). We share a phenomenological perspective on learning (Francis et al. 2013a) and a goal of developing students' knowledge and competences for contributing to more sustainable societies (Lieblein et al. 2012). In line with our approach to promoting teacher–student dialogue (Francis et al 2013b), the present plans for CEALS' activities have been co-developed with our students and key stakeholders.

Sustainability challenges are highly complex with intertwined environmental, economic and social components. Attaining sustainable food production is a prime example. How can we provide food to a growing population in the context of climate change, a dependence on fossil fuels, an accelerating loss of biodiversity and good farmland, and a global shortage of freshwater? The inherent transdisciplinarity of sustainable development thus poses new challenges to educators: to design learning activities that will prepare future professionals with competences to serve our rapidly changing society (Francis et al. 2011). Emphasis on competences is crucial, as knowledge about sustainability and development does not necessarily lead to responsible action. Education for sustainable development needs to address this gap between knowledge and action by fostering competences to close it. Thus, the challenge is to work out a learning strategy that enhances both

the students' understanding of complex situations and their ability to take action.

In our view, action learning implies establishing a dialogue space where stakeholders outside of university can meet students and teachers (Fig. 1). In a common space of shared concern and action, all participants can enhance co-learning while collaborating on improving complex and dynamic situations with sustainability challenges. Students have the opportunity to develop what in our work has emerged as *key competences for facilitators of sustainable development: observation, reflection, visioning, participation, and dialogue* (Lieblein et al. 2012). If students are not given the chance to train these skills during their formal education, later opportunities may be fewer and less systematic.

Collaborating with stakeholders from transdisciplinary professions as an integral part of a university programme serves four main purposes. Firstly, it enables engagement in and learning about complex topics, which cannot be adequately obtained by merely reading or listening. Secondly, it builds a dynamic relationship between university and society. Thirdly, experiencing such collaboration creates enthusiasm, motivation, and energy to delve into theoretical activities. Fourthly, the process builds social relevance and civic engagement into the curricula, which facilitates the transition from students to agents of sustainable change.





#### What is the added value of the Centre?

The huge challenges of our global society create an urgent need for developing the educational approaches that CEALS will design, evaluate, demonstrate, expand and disseminate. The aim is to educate students to become effective agents of sustainable development in the dynamic context of global challenges, particularly those surrounding agriculture, food, environment and society. New and creative ways to achieve sounder and more resilient systems must be developed. We will bring

three distinctive academic environments together to further develop a common model for learning in higher education. The model will give a transdisciplinary, generic approach to the understanding, analysis and action taking with respect to complex situations. The Centre will establish and share a knowledge base on action-oriented education and existing practices with other educational institutions, nationally and globally, and attract funding for future-oriented educational initiatives.

#### Documented educational quality in existing provision

#### 1. Input factors

The Centre staff from the areas of agroecology, teacher education and landscape planning encompass four full professors, four associate professors, one post-doc and one PhD student. There is an annual student population of around 110, including ca. 25 master's thesis students. The teacher education group has an international and documented professional profile that demonstrates educational innovation in using the farm as a learning arena (Krogh and Jolly 2012, Jolly and Krogh 2014). The agroecology group is one of the world leaders within agroecology education. The landscape scale planning group has a key role internationally in the efforts to develop transdisciplinary and action-oriented approaches in its field (Clemetsen 2016). These competences are assets that will contribute to developing integrated and multidisciplinary training and education of students across master's programmes at NMBU.

Through leadership and participation in national and international (EU) R&D programmes and though developing and running several educational programmes, the proposed Centre team has highly relevant experience as leaders, educators and developers, specifically related to action learning.

The development of the Agroecology master's programme demonstrates our capacity for innovative visioning and implementation. Already in 2003, an international evaluation panel concluded: "*The committee wishes to recognise from the outset the significant innovations that have been achieved by the Program in Agroecology. The successful design and conduct of the two core courses PAE302 and PAE303 over a three-year period is, in the view of the committee, a major achievement that should not be underestimated. All innovation requires vision, personal commitment and enthusiasm. The fact that the student evaluations are, in general, very positive is an indicator of the contribution made*" (Ison, Fossum & Wals, 2003). The agroecology education has obtained institutional recognition by receiving the university's Study Quality Award in 2003, the Nordic NOVA Education Prize in 2007, two of the members were awarded the prize as the best educators at their department in 2010, and they received the university's Education Award in 2011.

The proposed Centre has a large international network, consisting of scholars from

universities in 23 European countries, six universities in the USA, four universities in Africa, and three universities in Asia. Our international activities include active dissemination of action-based learning. The Agroecology group has recently established an action-based agroecology masters' course at the University of Calcutta, India, with funding from Norwegian Centre for International Cooperation in Education (SIU). Through cooperation with the teacher education group at NMBU, Sokoine University of Agriculture in Tanzania has developed a master's course in action research. We also draw upon a large and established network of professionals within Norway, including farmers, government specialists, teachers, and experts from other institutions who are stakeholders in the case work of our students.

The educational vision and activities of the Centre are in close agreement with NMBU's ambitions and goals for educational quality and purpose. Main priorities of the institution, as embodied in the university's learning philosophy, are to improve the quality of teaching, pedagogical development and student-centred learning and to educate candidates who will make active contributions to a sustainable development. The organisation of the Centre will be in line with the "Guidelines for Centre for Excellence in Education at NMBU, May 2016".

#### 2. Process factors

All partners have long experience in action learning. Based on a process of faculty–student collaboration (Lieblein et al. 1999), in 2000 the master's programme Agroecology was launched. This programme has since its inception been driven by an action research philosophy. This activity has so far resulted in 43 journal articles/chapters in refereed international journals and books, 43 conference proceedings, and multiple oral presentations and workshop facilitations in 19 countries on three continents. Accordingly, our educational activities are strongly permeated by R&D. This makes our group prominent in the area of higher agroecology education worldwide.

The timeline below (Fig. 2) shows stages in the development of our thinking. These transitions have been significant for our pedagogy and the choice of teaching and learning methods. On several occasions, transitions have been initiated as a result of inputs from students and resulting student–teacher dialogue.

Our main approach to teaching and learning methods is to have real-life cases as the starting point for the learning process. In the process, students collaborate with stakeholders involved in the case. In a whole-semester (30 ECTS) agroecology course, dialogue, visionary thinking and systemic approaches are introduced in workshops, and practiced throughout the course. Reflection is at the core of the educational activities and is practiced in weekly seminars and in students' writing of individual reflection documents. Key elements of the reflection document are experiences from the

course activities, relevant theory, well personal development as a professional.

Students' learning is assessed through a mix of evaluation tools in the Agroecology programme. In the first-semester course, the assessment is an A–F grading by internal and external examiners of two group documents for case work stakeholders (2\*20%), a reflection document (20%), an oral exam (20%), and student contributions to the project group work and plenary class activities (20%). Masters' thesis and its oral defence are jointly graded A–F. Since 2014, self-assessment of competences is used in the Agroecology course. In addition, we ask for feedback from case work stakeholders.



Figure 2. Timeline for development of the action learning model, including core publications

Student engagement and ownership of learning is essential in our programme. Engagement is supported through involvement in learning activities out in the field, where they have a large degree of responsibility and autonomy in running the action learning process. Most of the classroom time is used to involve students in interactive workshops where they practice how to develop the core competences necessary for supporting sustainable development activities. Lectures are used sparingly.

Through multiple interactive sessions we aim to create an atmosphere where students can give feedback and express their opinions about the educational activities and their own learning (Lieblein et al. 2004). The courses we offer are also subject to web-based evaluations, as all courses at NMBU. In addition, we have introduced a much more detailed written evaluation (quantitative and qualitative) in the Agroecology course. Since 2015, this evaluation is done every second week, handed in on a Friday, and discussed in the teacher group the following Monday.

#### **3.Outcome factors**

For students in the Agroecology master's programme, the grade average is B. The students in the master's programme on the average complete the programme within 2.4 years, and the retention rate is 88%. We have a highly motivated mix of international and Nordic students with diverse backgrounds, enhanced by basing admission on a motivation letter. The fact that students from 49 countries have so far participated in the programme adds to its international flair.

Our students consistently rate our courses and their own efforts as good and above average (5 out of 6) in the standardised NMBU course evaluation.

Feedback from stakeholders involved in students' case work also document the achievement of learning goals. Reflection documents written by the agroecology students provide important insight into their individual learning process by describing the students' own development of core competences and the attainment of important learning goals.

The content and design of our programmes are set up to enable the students to learn how to learn and to become autonomous learners in complex and dynamic situations after their formal graduation. There is also much emphasis on key elements of scientific work that are generic across disciplines. They learn how to approach a variety of situations, to know their own learning and their strengths and weaknesses, to work in groups, and to go in depth on disciplinary specialties when needed in the wider context. When addressing sustainability issues, we believe this learning is highly relevant both for further education and work life in a dynamic context that calls for transdisciplinarity, creativity and life-long learning capabilities.

Students who have completed the Agroecology master's programme have reported being employed as advisor in NGOs (23 %), in post-graduate study (21%), as advisor in private sector (17%), as advisor in GOs (15%), in teaching (11%), as farmers (7%) and in other occupations (6%).

#### The Centre Plan – Vision, strategies and plans

The activities in the Centre will revolve around seven interrelated projects to move towards our vision:

Students and teachers learn together to creatively deal with complex and dynamic sustainability challenges related to landscape, food and society. They collaborate with an evolving array of stakeholders from different professions in society and different NMBU departments. All members of the learning community develop competences for facilitating sustainable development in a changing world.

CEALS attracts many students from all parts of the world. Students experience a solid academic programme with an ecological anchoring, holistic character and strong emphasis on

action competences and education of the whole human being, and develop a personal platform for future responsible development and constructive action.

CEALS is recognised as an international hub of excellence for action learning for sustainable development, through holistic and transdisciplinary activities focused on ecology, food and environment in the intersect between nature and society.

CEALS establishes a shared identity among students and teachers of being change agents for sustainable development. Core competences of the candidates are the abilities to observe, reflect, dialogue, participate and vision. These competences prepare candidates with a high degree of capacity to constructively contribute to transition to more sustainable societies.

#### Innovation

# Strategy A: To enhance teaching and learning by integrating academic disciplines in an action learning context

In **project 1** we aim to *enhance relationships between interdisciplinary and disciplinary domains* for both the teachers and students.

In the Agroecology master's programme, the students make discipline-oriented course choices after the first, full-semester interdisciplinary agroecology course. How can a disciplinary approach enrich, and not undermine, the overall action learning approach? We have insufficient knowledge about how students transition from the first interdisciplinary semester to the subsequent single-discipline courses. Further, we need a deeper understanding of how they use this transition and experience to enhance their capacities to become agroecologists. We will facilitate processes where students can bring in their experience and reflections from these transitions, and explore how other teachers experience having agroecology students coming from the interdisciplinary course into their classes. We will also implement workshops to further explore linkages between transdisciplinary and disciplinary domains.

In **project 2** we will *explore facilitation of action learning and articulate both teacher and institutional prerequisites for success.* 

Although results from higher-education pedagogical research for decades have shown the importance of moving from a passive, theory-based education to a more student-driven and experiential one, the majority of university courses are still dominated by lectures without student involvement. Few colleagues at NMBU apply action learning in their teaching. The Centre will, therefore, involve teachers from different disciplines in workshops that explore and exchange experiences from action learning in these disciplines, with the aim of improving teaching and learning. The Centre will further involve students in action R&D projects with the same aim.

# Strategy B: To intensify students' learning based on integrating multiple sources of knowledge and experience to develop their competences for observation, participation, dialogue, reflection and visioning.

# **Project 3** will focus on *building a global network for action learning for sustainable development in higher education.*

Sustainability issues are global in nature, transcending national and regional boundaries, and they challenge the academic community to respond in a more comprehensive and coordinated way to improve education. We will strengthen and expand our global network with the aim of implementing educational activities in a global learning community for action-based learning for sustainable development. As one of the keystones in our dissemination strategy (see below), we will organise visits between programmes, arrange workshops and develop online resources to learn from each other and develop our strategies and curricula to reflect new developments. We will build on existing collaboration and contacts in Finland, Sweden, Denmark, France, Ethiopia, Uganda, Tanzania, India, Nepal, Nicaragua, U.S., Canada, and elsewhere.

**Project 4** includes further *development of our understanding of students' learning process in complex environments* 

Moving from a traditional theory-based to an action-oriented mode of learning represents a groundbreaking shift for many students, one that goes beyond the cognitive domain. There is an incomplete understanding of students' learning as they go through this process. We need to learn how we as teachers in the best way can support their journey through these phases. We will explore students' learning about how to embed theoretical reflections in their own experiences and enhance feedback to students through one-to-one dialogue. We will improve peer-to-peer feedback, improve the reflection process, explore net-based feedback, and explore formative feedback regimes. **Project 5** deals with *how to integrate real-life case experiences with classroom activities*.

Integrating theoretical knowledge with experiences "out there" is vital for successful action learning and for building competences that can enable students to bridge the gap between knowledge and sustainable action. To our knowledge, this area of education has received limited attention. We have learned by experience that we are not providing sufficient facilitation for the students to make sense of experiences through the use of their knowledge base (literature, theories), nor in terms of how they can best use relevant theories when confronted with a complex everyday situation. In this project, we will explore tools and methods for assisting students in using literature and theory to understand their experiences. We will also introduce annual and systematic student evaluations of tools and methods used, through student-led workshops.

# Strategy C: To prepare and support students in their transition from academia into transdisciplinary professions in society.

In **project 6** we will *strengthen our network with external institutions and explore options for student internships and thesis research projects in these institutions*. Given the key challenge to bridge the knowledge–action gap, there is an urgent need to explore additional possibilities for students to practice as professionals as a part of their studies. The Centre will support this by setting up internships both in Norway and abroad, where students as part of new course modules can both experience different work-life situations and have the possibility to reflect on these experiences as part of an academic programme. We envisage a new course module called "Action learning internship", where the students work with an institution, or a community, link these to relevant theory and make a final presentation to the class for feedback.

**In project 7** we will explore how landscape character and contextualised outdoor action learning in combination can foster actors for sustainability.

The project aims at integrating relevant education and research experiences of the NMBU partners to broaden and elaborate knowledge and skills on action learning at university level. We will combine landscape analysis and analysis of specific competences needed to carry out professional outdoor activities, as farming. The Centre will develop such knowledge and skills in cooperation with students and staff among international partners, e.g., at Sokoine University of Agriculture in Tanzania. CEALS aims to explore and integrate this perspective into our learning model.

#### Evaluation and impact framework

To contribute to and stimulate institutional development over time, the Centre will facilitate transition to action learning in relevant courses at NMBU and collaborating institutions. We will apply process theory and experiences from our action learning courses at NMBU and from projects in Tanzania and India. The apparent success at universities in these two countries suggests that this is an effective approach to similar development at NMBU and other institutions in Norway and abroad. In agreement with NMBU's strategy for education quality, the Centre will collaborate with NMBU's rector and education administration to establish institutional support for a training programme for educators willing to try out experiential and action-based learning.

Value for money will be gauged by monitoring completion rate, applicant numbers, student evaluations and feedback from educators involved in courses before and after transition from theory-based to action-based learning. The number of teachers at NMBU and collaborating universities that adopt a different learning strategy as a result of the Centre will also be evaluated against the money spent on the Centre. Feedback from extra-university stakeholders on the value of the students' project work and on the quality of graduates employed will constitute an indicator of value for money to the civic society.

The Centre will secure its organisational and financial position after the cessation of external funding by proving the effectiveness of its approach to learning and societal relevance of the graduates' knowledge and competences. Further, it will be worked systematically on institutional anchoring of the Centre's existence and on manifesting its power as a competence, service and training centre.

#### Dissemination

We believe that disseminating oral, written and audio-visual information through various channels (lectures, webpages, pictures, movies, learning resource repositories, social media, newsletters, conference talks and papers, journal articles and book chapters) about concepts and theory of interdisciplinary action learning and guidelines for its implementation-as worked out in the projects described above-can create awareness, understanding and even action. However, in our experience, profound awareness, deep understanding and a firm basis for action can only be obtained by participatory processes requiring the same key competences as in the education for sustainable development itself (Fig. 1). Hence, our dissemination strategy will depend on a target group and purpose. Dissemination strategies through traditional and more modern channels, as listed above, will be used to convince university leaders, administrators and potentially interested educators about the necessity, effectiveness and feasibility of a transition to our suggested approach. Participatory training programmes with substantial student involvement will be needed for educators to understand more deeply and successfully switch from a predominantly disciplinary, theory-based education to a more experience-based approach with action as the major point of departure and the student and her/his key competences in focus. Such programmes will be implemented internally at NMBU and in our existing and expanding global network (see project 3). The latter strategy will hopefully lead to a "self-propagation" without the direct involvement of CEALS.

A detailed dissemination plan with concrete deliverables for the projects at each year of the fiveyear Centre plan will be worked out. A post-project dissemination plan will also be developed.

#### **Organisation of the Centre**

The Centre will have a director (80%) and two part-time (40%) co-directors, reflecting the three units that merge to form the Centre. The three directors will distribute the responsibilities of the three strategies among themselves. In addition, three PhD scholars and one administrative person will work full time at the Centre. The Centre will have a steering group and an international advisory committee that will meet twice every year.



#### INFORMATION ABOUT THE HOST INSTITUTION

#### **Host institution**

Norwegian University of Life Sciences

#### **PO Box address**

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#### **ABOUT THE CENTRE**

Name of Centre

Centre of Excellence in Statistics Education and Metacognition CESEM

Is the Centre already established at the time of the application (yes/no)?

🗆 Yes 🖾 No

Please name any consortium partners for the Centre Biostatistics group, IKBM, Norwegian University of Life Sciences (NMBU), Ås National Centre for Science Recruitment (NSR), Trondheim Section of learning and teacher education (SLL), IMT, NMBU, Ås The Science Park (Vitenparken) at Campus Ås, Ås



#### ABSTRACT

**Describe briefly the aims as well as the current and planned activities of the Centre (150 words)** The Centre of Excellence in Statistics Education and Metacognition (CESEM) aims at identifying and implement adaptive teaching styles leading to improved learning outcomes in statistics and other STEMsubjects by identifying beneficial learning styles for different cognitive types. This is to be achieved through 1) psychological cognitive screening of students, 2) "live" neurological activity and attention screening, 3) carefully designed statistical experiments exploring teaching styles/technologies coupled with qualitative assessments, 4) multivariate statistical analysis and validation of hypothesized beneficial learning styles, 5) active implementation and dissemination for improved teaching quality and learning. This is a continuation of on-going teaching and research collaboration between the Norwegian University of Life Sciences (NMBU) and the National Centre for Science Recruitment (NSR). Current research has shown that traditional auditorium lecture styles dis-favor certain cognitive styles, and adapting teaching to cognitive types is believed to improve learning outcome and reduce drop-out rates in STEM-subjects in higher education.



#### **APPLICATION DOCUMENT**

The application must be written in English and follow the requirements set in this template. It must not contain more than 10 pages in 12-point types, with lines spaced 1.5 and margins of 2 cm. Within this format, the applicant must provide:

#### a) Documentation of educational quality in existing provision

The applicant must comment and critically reflect on themes and questions set out in the criteria, and compare their existing provision with similar provision within the same subject/discipline area, both nationally and internationally. Through this, the applicant must document that the academic community qualifies as a Centre for Excellence in Education.

#### b) A centre plan

The applicant must comment and critically reflect on themes and questions set out in the criteria. The Centre Plan must outline the vision of the Centre, its strategy and plans. It must present the plans for the dissemination of knowledge and practices to its own institution(s) and to other educational communities as well as an evaluation and impact framework.

#### Appendices

The following appendices must be included (and no other):

- 1. A list of references
- 2. A budget for the Centre for the first five-year period, including motivation for costs (see guidelines at <u>www.nokut.no/SFU/utlysninger</u>)
- 3. An action plan for the Centre, including milestones (no more than three pages)
- 4. CVs of the proposed Centre Leader and two to five key members of the Centre team (each CV must not exceed two pages)

All appendices must be in English.

#### **Practical information**

The rector of the host institution must sign the application.

The deadline for submitting applications is set in the announcement of the call.

All applications will be published on the NOKUT website, alongside the expert panel's feedback.



#### **APPLICATION DOCUMENT**

#### 1. Introduction

The focus of the Centre of Excellence in Statistical Education and Metacognition (CESEM) will be to develop novel and adaptive teaching strategies for applied statistics education for universities and colleges. The work of the proposed Centre will be a continuation of an ongoing collaboration between The Norwegian University of Life Sciences (NMBU) and The National Centre for Science Recruitment (NSR). The research on and implementation of cognitively adapted teaching styles is based on the competence and experience in psychology and neuroscience held by Dr. Helge Brovold at NSR, the statistical and educational competence of the Biostatistics group at NMBU and the mathematics education competence of the Section of Learning and Teachers education (SLL) at NMBU. We have already through inquires, statistical analyses and literature studies acquired a sound knowledge base on how cognitive types (a broad personality type classification) relate to attributes like interests, values, emotions, work and learning preferences, and how these affect learning outcome [1,2]. Statistical research on metacognition and learning with direct implementation into applied statistics education will be the cornerstone of the proposed Centre. In the continuation of the current project, and as part of CESEM, we will further exploit novel measurement technologies in neuroscience in collaboration with the Section for Cognitive Systems at the Technical University of Denmark (DTU). This will provide the opportunity to study the interaction between learning outcome, brain activity and cognitive types in an unprecedented manner. The work of the Centre will lead to improvements in teaching and learning statistics throughout Norway, and will take Norway into a leading international position in the field of applied statistics education. The Centre consortium will add momentum to the strategies to stimulate and recruit more bio-statistical competence, as basis for growth in the bio-economy sector and the need for a "green shift".

#### 2. Documentation of educational quality

a. Inputs

#### Competence and knowledgebase

NMBU, (former Norwegian Agricultural University) is one of the oldest educational institutions in Norway with a long tradition in teaching and research. The university has been the host institution for a series of research Centres, including two Centres of excellence: the Aquaculture Protein Centre (APC) and the Centre for Environmental Radioactivity (CERAD) and a Centre for research-based innovation (SFI): Foods of Norway (SFI). In addition to hosting high quality research Centres like the above,



NMBU also aims at providing excellent education through supporting the creation of the proposed Centre. NMBU will give substantial financial support to the Centre, as specified in the attached budget. NMBU has also created a Learning Centre with the role of assisting the academic staff in order to provide excellent education and teaching, and this Learning Centre will be a key collaborator also for CESEM.

With regard to the proposed Centre the tasks described in the Centre plan rely heavily on statistical competence. As a prominent provider of applied statistical research within animal breeding, plant science, food production, chemometrics and bioinformatics (in particular experimental design [e.g. 3] and multivariate statistics [e.g. 4-10]) the Biostatistics group is highly competent of performing the experimental planning and the analysis and validation of the results that are planned to be among the deliverables of the Centre. Further, the Biostatistics group has been one of the largest providers of statistical education nationwide for students in applied natural sciences. Presently about 500 students, from a wide variety of applied science fields, follow the introductory level statistics each year! Further, about 100 students follow two intermediate courses in Regression Analysis (STAT200) and Design of Experiments and Analysis of Variance (STAT210) each year, respectively.

The biostatistics group has for this work, and for the teaching in statistics in general, been awarded numerous departmental teaching awards based on student course evaluations. In addition, in 2009 three group members, Trygve Almøy, Ellen Sandberg and Guri Feten, together with two members of the chemistry group, were awarded the bi-annual education award at NMBU for the excellent teaching given at undergraduate level in the two courses STAT100 and KJM100 leading to improved grades and reduced failing rates [11]. Two of the central members of the proposed centre have further been awarded as "Best lecturer of the semester at NMBU"; in 2005 (Trygve Almøy) and 2013 (Solve Sæbø) for the teaching of STAT100. These were awarded by the Student Council of NMBU on the basis of student votes and the evaluation of a specially appointed committee of students.

CESEM will possess extensive competence within psychology, neuro-psychology, and neuroscience through Dr. Helge Brovold at NSR. Brovold is a psychologist with more than 35 years of experience in personality screening and work consultancy. He also holds a PhD in psychology within the subject area of "science cognition".

Section for Learning and Teacher education (SLL) at IMT, NMBU will also be an important partner in the proposed Centre through the competence in Mathematics Education held by associate professor Margrethe Naalsund. Naalsund is well known with Mixed Methods-designs [12] for combining qualitative and quantitative analysis in order to obtain both in-depth as well as broad knowledge about



the phenomena under study. SLL has focus on questions related to learning assessment, in which metacognition as basis for learning is central [13]. This competence will be an important asset for the fulfillment of WP3 of the Centre plan regarding study design and result assessment. Further, SLL will be central in the dissemination of results and student engagement as described under WP4 of the Centre plan.

CESEM also has the bold ambition of becoming a national and international hub within the fast growing research area of educational neuroscience. We sincerely believe this is a realistic goal with the above described competences in statistics, (neuro-)psychology and pedagogics and with the planned collaboration with Section for Cognitive Systems at DTU Compute, Denmark, led by Professor Lars Kai Hansen. Section for Cognitive Systems has special competence in the development and use of portable brain scanners that facilitate "daily-life" screening of neuronal activity [14, 15]. With their novel solutions it is feasible to perform "live" screening of students in varying learning contexts.

Together the involved parties of this SFU-consortium cover the subject areas of the Centre and the research will be a continuation and expansion of ongoing collaborative work between NMBU and NSR. The Centre will have a unique profile, which already has drawn attention both nationally and internationally through invitations to give talks on conferences and workshops (MNT, MatRIC, MEC (England), CEITEC BUT (Chech Rep)).

#### b. Process factors

#### FoU in teaching and learning

NMBU has a "learning philosophy" [16] with a pronounced aim of providing excellent education, which emphasizes student-active learning and engaged lecturers. The Biostatistics group has during the last decade put great effort into improving the learning outcomes in basic statistics. In order to meet the varying learning styles, we have since 2013 provided live streaming from lectures, interactive webapplets for illustrating statistical concepts [e.g. 17], electronic smartboard presentations, chat-groups in social media, and increased number of exercise groups (including a "Snuble-gruppe" dedicated to students in extra need of slow repetition of key topics). The live stream videos were in 2014 edited into 150 short and subject specific YouTube-videos [18] with currently more than 57,000 views as part of the first Massive Open Online Course [19] in statistics in Norway in the fall of 2014. These videos are also available to the students following the basic statistics course at NMBU.

With the aim of improving the teaching quality further, a pilot study was conducted in 2014 in which Dr. Helge Brovold at NSR was engaged to screen the cognitive types of 288 student volunteers. The



pilot study at NMBU led to the publication of a paper on the association between cognitive styles and exam performance [2]. In addition, Brovold gave group-wise lectures teaching the students about their cognitive styles and learning. Student feedback tells us that these students have become more aware of the metacognitional aspects of their own learning, and through later interviews a subset of these have provided valuable input to the project and into the process leading to this centre application.

A new screening of cognitive styles is also planned in the fall of 2016 in order to study the effect on both student evaluations and exam performances of changing to "flipped classroom" teaching style in STAT100. The qualitative evaluation of this and further studies within the proposed Centre will be joint work between the Biostatistics group, NSR and SLL.

#### Learning evaluation and follow up, student engagement

All courses at NMBU are evaluated by the students at the end of the course. The evaluation is not compulsory, but the answer rate is about 20-30%. The student feedback is extremely valuable in the process of improving courses, to take actions if rating is low and to credit excellent teaching. Further, the students at NMBU have members in all boards at the university, including the education boards at all departments, and these members also provide valuable feedback regarding the quality of the study programs and courses.

In addition to these general feedback channels and in order to engage more students in learning (and teaching), CESEM aims at increasing student engagement in learning. The Biostatistics group has a long tradition for hiring student teaching assistants. These students are important links between the regular students and the teacher(s) with regard to follow-up and feedback, and within the frame of the proposed Centre the assistant teachers will receive instructions and be kept up-to-date with regard to the metacognitive aspects of learning/teaching. Through SLL also the teacher students will be involved in the Centre activity thereby contribute to dissemination of both awareness, contents and actions from the Centre to fellow students, and further on to schools and pupils after finished teacher education.

#### c. Result factors

#### Student achievements

NMBU, the host institution, was recently ranked in fourth place in Norway among 15 higher education institutions in a broad ranking made by the U-Multirank on the basis of several education and research variables [20], where NMBU scored high on both Bachelor and Master graduation rates. NMBU also scores high in the overall score of "Studiebarometeret" (NOKUT) where the students are particularly



pleased with relevance of the studies and future employment prospects. NMBU-students score about average with regard to completing studies on time, but the drop-out rates are low. Another recent survey [21] conducted by Sentio (<u>http://www.sentio.no</u>) showed that NMBU is top ranked with regard to student involvement and inclusion. Staggering 86% of the NMBU students responded that they felt included as part of a scientific environment (total rate was 68%).

#### The need for statistical competence in research and the society in general

We now experience an explosion in the demand for competence in statistics and data analysis in applied research as well as in the society in general. Recently the American Statistical Association wrote that "The Bureau of Labor Statistics (BLS) projects that employment of statisticians will grow 34% from 2014 to 2024", and further "The field ranks 9th on the Department of Labor's list of 20 fastest-growing occupations" [22]. The "Big data" industry is all around us and data are collected everywhere, from consumer habit surveys, advertisement and media recommendation systems and social media and internet search algorithms. However, with much data comes large responsibilities, and it is very important that the data analysts are highly competent in order to avoid bias and misuse of statistics. Also in applied research, like biology, medicine and social sciences, advanced statistical methods has become an increasingly important tool and the demand of statistically sound analyses is increasingly often required in publications.

#### 3. The Centre Plan

#### Why is the Centre important?

Norwegian University of Life Sciences (NMBU) has a long tradition for acknowledging the importance of providing high quality statistical competence to students within a wide range of educational programs. Further, we now experience a steady increase in the proportion of the population that is enrolling for higher education. In Norway the proportion of the age group 30-34 who had completed higher education increased from 39.5% in 2004 to 52.1% in 2014 [23] and similar numbers exist for most European countries. Due to this, the student masses inevitably show a larger degree of heterogeneity, not only in educational background, but also in what we here refer to as "cognitive learning styles". Differences among students with regard to cognitive style call for an adaptive education in statistics, because "one size don't fit them all", as shown in the recent study conducted at NMBU [2]. Due to this heterogeneity, lecturers strive to reach out to the masses, and many students find statistics as a "hard to get" subject.



At the same time we experience an increasing demand for data analysts and statisticians. It is therefore extremely important that the data analysts are highly competent in order to avoid unintentional (or intentional) misuse of statistics. Sadly, this may not be the case. An important paper by Ioannidis in 2005 [24] claims that most published research findings are false (!) due to unintended introduction of bias in the analyses and lack of proper validation. This problem of poor validation and lack of reproducibility of published results has fortunately begun to attract attention in the science community (e.g. articles in Nature/News by Baker [25,26] and Allison [27]). One can only envision the amount of wasted research funding this adds up to!

Further, research calls for a new type of competence, not only in statistics, but in the STEM (Science, Technology, Engineering, Mathematics) subjects in general. Society is facing unprecedented challenges related to environmental problems, energy demand, food production, health care, development and demographics. New research efforts that challenge old paradigms are needed to solve many of these challenges, and we must therefore nurture the creative, the altruistic, the empathetic and the out-of-boxthinking research talents who certainly exist among the heterogeneous masses of students now enrolling at our universities.

A big problem is that traditional university pedagogics does not appeal very much to these students, and may in fact scare them off! The research of CESEM will be based on the assumption of a beneficial learning style. Some debate and even refute the so-called meshing hypothesis which claims that learning outcome improves if students are taught in their *preferred learning styles*, and a review by Pashler et al. [28] states that there is no, or even contradictory, evidence to this hypothesis. However, they also write that the number of properly designed studies for testing the hypothesis is small. The contradictory results do, however, indicate that some cognitive types really may benefit from an adapted teaching style, but this may necessarily not coincide with the learning style preferred by the student. From a neuropsychological perspective one may then instead define hypotheses about beneficial learning styles to be tested. This obvious distinction between preferred and beneficial learning style appears to be completely overlooked in previous studies.

Academia should adapt to this new reality of increased student heterogeneity in the way the students are educated. Of course, this does not only apply to the field of statistics, but since statistics is such an important tool in almost every applied research field, the success of the proposed Centre may have broad impact on the quality of research delivered in applied research in general.

#### Vision

In order to face these educational challenges described above the CESEM will work under the following vision:

"The vision of the Centre is to pave the way into a new area of teaching applied statistics and data analysis, which is adapted to the cognitive styles of the students. The Centre aims at becoming a provider of metacognitive knowledge on learning, which is relevant for higher education, both in statistics and in related subject areas like the STEM-subjects"

Hence, the vision of the Centre concerns primarily the applied statistics education, but the planned deliverables of the Centre will have high transferability to teaching within other subjects, especially within the STEM subjects. CESEM will work towards fulfillment of this vision on several levels, organized as four *Work packages (WP's)* as defined below. Milestones for each WP are defined in the attached *Action plan*.

#### Innovation and deliverables

#### a. Work packages and strategies

The main innovative tasks of the Centre are described here.

#### WP 1. Cognitive styles and optimal learning hypotheses

The main deliverable from this task is a comprehensive framework of hypotheses describing the most probable connections between cognitive styles and beneficial learning style. The framework will be based on recent research within (cognitive) neuroscience and neuropsychology coupled with established theories from personality psychology. An extensive collection of the available literature has been summarized by Brovold [1], and new discoveries from neuroscience studies are literally pouring in on a weekly basis. This is a quickly expanding field, which requires continuous literature studies and review. **WP 2.** *Neurological activity, attention and learning* 

It is well known, even intuitively so, that learning is correlated with attention level. Hence, measuring attention level may be used as a proxy for learning. The main deliverables from this task will be assessments of the connections between cognitive types, attention and learning by means of EEG-scans (Electro-encephalography) of neuronal activity under different learning conditions. In order to fulfill this task, the Centre will collaborate closely with the Section for Cognitive Systems at DTU Compute, Denmark, led by Professor Lars Kai Hansen. The success of this task depends on proper statistical handling of noisy measurements and properly designed experiments. The experiments will be conducted in "live" learning situations and coupled with qualitative assessments of learning outcome. As part of



both data collection and dissemination of both awareness of and content, there will also be a permanent facility at Vitenparken (Science Centre) at NMBU where both students, pupils, teachers and regular visitors may test their attention and learning in simple and carefully designed teaching experiments. In addition, they may complete the short Education Test [29] administered by NSR providing information about cognitive styles (this test has currently been completed by ~25,000 pupils throughout Norway and will constitute an important knowledgebase for this task). The Centre plans to appoint an additional pedagogic assistant (50%) to administer this facility, and 1-2 research fellows will be working on the computational and data analytical challenges from this task.

#### **WP 3.** *Design, evaluation and validation*

Properly designed experiments are of utmost importance in order to evaluate and test the hypotheses generated in WP1 and WP2. As pin-pointed by Pashler et al. [28] this is the typical weak spot of too many educational studies. The Biostatistics group and SLL possess the competence to design proper studies combining qualitative (self-assessments, in-depth interviews, and focus-group interviews, videoobservations), and quantitative measurements (learning scores, exam performances, neurological EEGdata), and to evaluate these using triangulation methods [30] and multi-matrix "Big-Data"-approaches [4-6, 8, 31]. In this task we will collaborate closely with other groups and Centres that can provide valuable insight and teaching technology (Department of Engineering Cybernetics, NTNU via Prof II H. Martens; MatRIC, UiA; MEC, Loughborough, UK) and venues for experimental teaching (CEITEC BUT, Brno, Chech Rep) with whom we already have a running collaboration on a pilot cognitive study (NF-CZ07-ICP-4-324-2016, supported by Norway Grants). The Centre will appoint a research fellow located at SLL as part of this task.

#### WP 4. Dissemination and student involvement

The dissemination plan of CESEM is divided into three parts:

Dissemination for Awareness

Members of CESEM will continue to rise awareness of the Centre and the importance of cognitively adaptive education through media contributions like newspaper chronicles (e.g [32]), blogs (e.g. [33]) and, if possible, TV/radio (e.g. [34]). CESEM will further mark its presence through a dedicated Centre website, social-media profiles, and participation on the planned NSR-site "realfag.no".

#### Dissemination for Understanding and Action

The Centre will reach out to educators, teachers and scientists through standard scientific activity such as journal publications, and presentations at national and international conferences, seminars and workshops. However, in order to achieve a more active and "efferent" dissemination, the Centre will



appoint a person who will work part time as a disseminator (50% position). The disseminator will, through networking with local, national and international contacts at universities/colleges, communicate the activities and results from the Centre and work towards the implementation of adapted teaching styles in applied statistics and other STEM-courses.

The acquired knowledge will also be communicated to science teacher students at NMBU via the central role of SLL. SLL is responsible for the teacher education at NMBU, and will supervise master students within the core subjects of the Centre. SLL will emphasize the activities and research of CESEM, point to how the new understanding may be relevant for teaching pupils in general and how they themselves may benefit from this understanding in their own teaching. Further dissemination to teachers and pupils is intended through the nation-wide network of NSR, and through the involvement of student mentors in the NSR-projects "Ent3r" [35] and "Rollemodell" [36]. The deliverables from CESEM will also be communicated to teachers and the public through Vitenparken at NMBU as part of WP3. Finally, CESEM will create mentor and teacher assistants groups with special awareness of the Centre.

The Centre actions will have a direct impact on the teaching of courses in statistics at NMBU, and new understanding will be implemented wherever suitable in terms of altered or adapted teaching styles and adaptive teacher assistant instruction. The knowledge acquired by CESEM will be highly relevant for teaching in all STEM-subjects and learning in general and is likely to have impact also outside the direct effects within the Centre. The deliverables from CESEM will also be a valuable asset to the fast growing adaptive teaching technology (e.g. [37, 38]) which insofar has been relying on direct and automatic student performance feedback in their adaptation of teaching. The "a priori" knowledge of beneficial learning style is expected to add an extra layer of adaptability to this technology, and it is within the longer vision of the Centre to implement this layer in existing or new adaptive technology through collaboration with developers of adaptive teaching technologies.

#### Impact and evaluation

In order to evaluate the impact of the Centre and the "value for money", CESEM will in addition to peer reviewed papers and citation indices, evaluate to what extent 1) the knowledge base, teaching principles and teaching technology is implemented, not only at NMBU, but also in higher education in general, nationally and internationally, 2) the principles, knowledge and technology is implemented at Viten-parken and international Science Centres, 3) the principles, knowledge and technology is communicated to schools and is implemented in science subjects teaching, 4) the heterogeneity in cognitive styles



among students completing a science master at NMBU is increased, 5) the knowledge and principles lead to commercial collaborators with developers within adaptive teaching technology.

#### Funding and exit-strategies

As documented above the research within the area of statistical metacognition for improved and adapted teaching is an on-going activity involving NMBU and NSR. At the time being this important research is receiving minimal external funding and relies heavily on investments made by NMBU and NSR through the core members of the proposed Centre. With additional funding released through SFU-status, this research will be heavily intensified through increased collaboration, through extra human resources and technological investments. SFU status for CESEM will increase the speed of research in an area in which it would be important for NMBU and Norway to take part and define a standard. NMBU will, upon its success, work towards a continuation of the project after the end of the SFU period.

#### Organization

The activities of CESEM will be continuously evaluated and guided by the Centre Management Board (CMB), which will have the financial and strategic responsibility for the Centre. CMB will control the progress of the Centre and secure the economical basis throughout the project period. CMB will have members from the parties of the consortium. The board will be chaired by the head of the department at which the Centre is located, and the Centre leader will be referent for board. In addition there will be appointed a Scientific Advisory Board (SAB) to give guidance to CMB with regard to progress and strategies, and to evaluate the Centre deliverables. The SAB will meet once a year and receive quarterly reports from the Centre leader.

#### Management

The Centre leader will be a fulltime professor at the Biostatistics group who will also be responsible for WP2 of the Centre plan. A full time researcher at NSR will allocate 80% workload to the Centre and will be responsible for WP1 and to support the other tasks. Two associate professor at the Biostatistics group will allocate together 50% workload to the Centre and to be responsible for WP3. In addition a Centre administrative leader (100% position) will be appointed.



#### **COMMENTS**

The proposed Centre, as it is described here, is intentionally more research heavy than the previously SFU's, but we sincerely believe that education should go hand-in-hand with research and that thorough research and proper validation of results on beneficial learning styles is extremely important on the road towards excellent education in applied statistics as well as other subjects.



# INFORMATION ABOUT THE HOST INSTITUTION

#### Host institution

Norwegian University of Science and Technology (NTNU)

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## **ABOUT THE CENTRE**

Name of Centre

SCOPE – Center for Excellence in Medical Education

Is the Centre already established at the time of the application (yes/no)?  $\Box$  Yes  $\boxtimes$  No

Please name any consortium partners for the Centre

Faculty of Medicine, NTNU (host faculty) and Faculty of Health and Social science, NTNU (these two will merge into The Faculty for Medicine and Health Science from 1/1-17). NTNU Educational Development Unit



# ABSTRACT

The vision of SCOPE is to foster lifelong learning for improved public health and patient care. Our aim is to develop educational models to strengthen students' awareness of how practices can be reshaped by research and give students confidence and capacities needed to challenge established practices. In short, we will enable the students to initiate change. Our strategy is to facilitate student involvement and learning in how to ensure that clinical practice is continually updated, based on new knowledge. The Centre will focus especially on skills in receiving and giving supervision and assessment methods mirroring real life situations. The result will be practitioners that are even better at regenerating their skills, who are highly motivated and able to update their knowledge to cope with widely varying work situations. Our work will be relevant for the health sector in general, other health education providers and for higher education in other fields.



# **APPLICATION DOCUMENT**

The application must be written in English and follow the requirements set in this template. It must not contain more than 10 pages in Times New Roman, 12-point types, with lines spaced 1.5 and margins of 2 cm. Within this format, the applicant must provide:

#### a) Documentation of educational quality in existing provision

The applicant must comment and critically reflect on themes and questions set out in the criteria, and compare their existing provision with similar provision within the same subject/discipline area, both nationally and internationally. Through this, the applicant must document that the academic community qualifies as a Centre for Excellence in Education.

#### b) A centre plan

The applicant must comment and critically reflect on themes and questions set out in the criteria. The Centre Plan must outline the vision of the Centre, its strategy and plans. It must present the plans for the dissemination of knowledge and practices to its own institution(s) and to other educational communities as well as an evaluation and impact framework.

#### **Appendices**

The following appendices must be included (and no other):

- 1. A list of references
- 2. A budget for the Centre for the first five-year period, including motivation for costs (see guidelines at <u>www.nokut.no/SFU/utlysninger</u>)
- 3. An action plan for the Centre, including milestones (no more than three pages)
- 4. CVs of the proposed Centre Leader and two to five key members of the Centre team (each CV must not exceed two pages)

All appendices must be in English.

#### **Practical information**

The rector of the host institution must sign the application.

The deadline for submitting applications is set in the announcement of the call.

All applications will be published on the NOKUT website, alongside the expert panel's feedback.

# **APPLICATION DOCUMENT**

#### **Vision: Fostering lifelong learning**

This application concerns a central aspect of all professionally oriented programmes in higher education: how to foster lifelong learning. Having had a focus on transformative learning for more than two decades, we are in a position to stimulate teaching excellence and take educational activities in this area to a new level. We will first argue for the need to focus on fostering lifelong learning in higher education, present our vision and then specify why this is important in medicine and what we want to achieve.

The future is unknown and this creates constraints and possibilities for what we do. In their future workplaces, students from professionally oriented programmes will need to acquire an unforeseeable range of new knowledge and skills. Thus, we must prepare students to cope with the unknown and build their capacity to learn in situations beyond the safe boundaries of traditional teaching formats. Traditional teaching formats tend to drive compliance, not initiative. They can foster learners' dependency on teachers and the teaching situation, and also risks making the students reluctant to look beyond the current orthodoxy, rather than becoming confident in finding new solutions. This is, however, a backward looking perspective, where students are exposed to past achievements, rather than what is needed or unknown.

The vision of SCOPE is to achieve excellence in practice, research and innovation in medical education, in order to foster lifelong learning for improved public health and patient care.

The medical field changes on a daily basis. New research replaces old knowledge, with a consequent need for constant professional updating. Societal changes, such as the ageing population, increases in chronic conditions and migration require adaption to new working situations. As will be described below, we have long experience in transformative learning with a Problem Based Learning (PBL) curriculum, and our medical students are, therefore, already well versed in the skills needed for lifelong learning. However, we still see a need to take this further. We want to extend lifelong learning by developing and deploying innovative educational activities. **The expected result from this will be medical practitioners that are even better at learning and regenerating their skills, who are highly motivated and able to update their knowledge to cope with widely varying work situations. We must therefore strengthen our activities for building students' capacity, and refine our educational practices accordingly.** 

Our teaching today has one major limitation. Students are extensively exposed to established best practice, but do not learn how to drive the evolution of practice on the basis of new knowledge. Our aim is therefore to develop our educational model to strengthen the students' awareness of how
established practices can be reshaped by research and to give them the confidence and capacity to challenge these practices.

### In short, we will enable the students to initiate change.

# DOCUMENTATION OF EDUCATIONAL QUALITY IN EXISTING PROVISION Input factors

The Faculty of Medicine (DMF) at NTNU was established in 1975 and has offered a full 6-year medical doctor programme since 1993. DMF has 720 medical students, 800 students in other programmes and 400 PhD candidates (the ongoing merger, with three university colleges offering a range of health care courses, will add 2000+ students). The medical doctor (MD) programme is one of the most sought after study programmes in Norway and NTNU has the highest grade point average for admission of all Norwegian MD programs. Our campus is integrated into St. Olav's Hospital and primary health care services, providing learning spaces for students, research facilities and staff offices within the clinical spaces. Thus, research, clinical and academic functions are intertwined, exposing students to the work field on a daily basis. The learning environment also includes a self-developed electronic schedule linking e.g. learning outcomes and learning materials from our own repository to each scheduled activity. The students have access to the same extensive range of international journals, e-books, databases etc. as the staff.

DMF has 1200 employees with 315 in permanent scientific positions, comprising 156 full time equivalent staff (66% are professors). The Faculty has a long tradition of excellence in research, including the 2014 Nobel Prize in Physiology/Medicine. DMF currently hosts two Centres of Excellence in Research (SFF) and one Centre of Excellence in Innovation (SFI) in addition to six other major research centres. In 2015, 1012 scientific papers were published and an average of 70 PhDs are awarded annually. The Faculty has a long history of engagement in medical education research, on which the Centre will build.

The majority of the teachers at DMF have combined positions as academics and clinicians, ensuring close connection with the field of practice. Formal pedagogical training is a requirement for permanent employment. A self-developed course in facilitating PBL groups has been run for more than 20 years, training 30 staff members and 40 students annually, as well as external participants. We offer a number of courses for staff to enhance their pedagogical competence, such as Team Based Learning (TBL), how to write cases for Multiple Choice Questions (MCQ), etc. We are currently building a standardised patient pool for clinical examinations and have developed a programme for training volunteers, including children, to enact patient situations. DMF hosted the large AMEE (Association for Medical Education in Europe) conference in 2007 and we present several papers at this conference every year. Through cooperation with all Nordic MD programs

and 27 other international MD programs, 40% of our students go on exchange in the fourth year, which is taught in English to accommodate international students. We collaborate with Dhulikhel Hospital in Nepal on a summer school where 15 students have clinical rotation.

Due to our study model and the large number of staff in combined positions, 400 teachers are involved in delivering the MD programme (excluding practice placements etc.). Maintaining the comprehensive quality of the programme is a continuing challenge, and the success of our study model is greatly dependent on managerial competence. After a programme evaluation in 2014, we increased the Programme leader position from 25% to 100%, and appointed leaders for each study year in 50% positions. The Faculty has also allocated more resources to the development of assessment and PBL quality, and the Centre will build on and extend this work.

The vision and plans for the proposed Centre have grown out of a joint initiative from management, students and the academic community, mainly based on an analysis of the current situation following the programme evaluation in 2014. Educational quality is part of the Faculty's long-term strategic plan. In 2015, more than 1m NOK was allocated to educational development projects, and 2 PhD positions in medical education research were funded from the Faculty's budget. The Centre will be placed within our Teaching and Learning Centre, PLUS, which was established in 2015 to facilitate pedagogical development and educational quality across all the Faculty's study programmes (including the new 6 new health professional programs after the NTNU merge). **Process factors** 

The MD programme employs a complex integrated curriculum model with spiral learning, and subject and discipline integration. The programme has from the start been oriented towards transformative learning, actively engaging students in identifying problems and finding answers. To achieve this, PBL in small groups constitutes the backbone of the pedagogical model. In a PBL-session, students choose their own learning objectives, organise the work and identify relevant research literature in order to solve the problem. Instead of a fixed syllabus, there is a set of comprehensive learning outcomes and all learning activities must be linked to these. All academic staff are researchers as well as teachers, and the majority are also clinicians. Teachers base their teaching on the desired learning outcomes, published research and prevailing clinical methods, and suggest reading material. Consequently, students are exposed to research through lectures and reading, and thus have to decide for themselves what to take from the literature. Importantly, we have an integrated research programme, which admits 10% of the students annually. This adds one year to the MD programme, during which time the students complete half of a PhD.

Traditional lectures are designed to provide overviews of new and complex topics. We are, however, working to reduce the number of lectures, and student-centred methods, such as team

based learning and flipped classrooms, are gradually being integrated. Single-topic lectures are also gradually being replaced by seminars in which two or more lecturers from different specialities collaborate.

Many MD programmes will not allow students early patient contact. At NTNU, however, early patient contact has been a key feature from the beginning and is highly appreciated by the students. Our students meet patients from day one in our Doctor-Patient Course and they learn to communicate, examine and prescribe treatment for real patients with an increasing degree of independence throughout the programme. We are among the best when it comes to giving our students practice based training, but we want to be even better. We also employ simulation exercises and training on mannequins, to allow the students to practise skills in a safe environment. Simulation exercises are also used to bring students from different health professions together to practice collaboration in realistic clinical settings.

Student assessment reflects our study model of subject integration; i.e. summative assessments integrate basic science with clinical cases. We have changed to the method of MCQ with single best answer, as research has shown this to be a reliable way of testing medical knowledge when done correctly (100 MCQs with 40 on knowledge and 60 on reasoning in each exam counting for 60% of the grade). A 'short cases' component allows for more testing of reasoning skills. For clinical skills, we have recently conducted a pilot replacing practical exams with Objective Structured Clinical Examination (OSCE), which is more reliable and tests a broader set of clinical skills. Additionally, communication skills, inter-professional group work, public health and clinical long cases are also subject to summative assessment, along with a research paper equivalent to a master's thesis.

In terms of formative assessment, PBL provides students with continual feedback on group dynamics and acquisition of methodology skills. A central aspect of PBL methodology is self- and peer assessment of teamwork skills, which is included and reported on, by fellow students and supervisors, in every PBL session. Similarly, the doctor-patient course provides feedback and supervision on communication and clinical skills, in addition to a mid-term evaluation. The doctorpatient course and other activities also involve self- and peer assessment, e.g. using taped student consultations with real and simulated patients. During clinical rotation and practice placement, the students receive feedback and supervision on clinical skills acquisition.

Although scoring very high on student satisfaction, our programme, in common with the other MD programmes in Norway, has been criticised for the amount and quality of feedback to the students, particularly feedback on clinical skills acquisition. We have taken steps to address this, and are implementing improvements in the practice placement periods, in collaboration with local

hospitals. Supervision and feedback are among the issues the Centre will address.

Student involvement is central. Reference groups, which are part of NTNUs quality system, are the main vehicle for student feedback. The reference group reports are a significant part of the annual quality report to the programme board, which is responsible for overall programme quality. The students also systematically evaluate each PBL case, the practice placements and assessment quality. They have permanent places on the Faculty Board, the Programme Board, and on the Dean's and the Programme leader's advisory boards, and there are student representatives on a range of other committees, including all committees working on curriculum development.

#### **Outcome factors**

Our study programme, as with other medical education programmes in Norway, has a very low dropout rate. Approximately 95 % of our students graduate and about 90% finish within the estimated time. Nearly all students go on to work as doctors or continue with a PhD.

Our students and alumni report that our programme has a very high relevance for the practice field. This is in line with feedback from employers who have high regard for students from NTNU, especially because of their experience in identifying their own learning needs, specifying learning objectives and researching relevant literature in order to find solutions to medical problems. They also say that that our students communicate efficiently and empathically with patients and their relatives, as well as with colleagues. We have won educational awards and been candidate to NOKUT's "utdanningskvalitetspris". Our medical students are more likely to go into general practice (GP) than students from any other Norwegian university. We think this is partly because we prepare doctors to undertake clinical practice immediately upon graduation, and to engage in continuing professional learning, as GPs work more independently and with more responsibility for the totality of patients' treatment than other doctors.

### **CENTRE PLAN**

#### Strategies and plans for educational development and innovation

The magnitude of the task we have set ourselves, and the nature of our plan (see figure below), is established by 1) the challenge of keeping up to date on new research findings and 2) the variety of practices within the specialities and jobs that students can choose after graduation. Every year, more than one million new research papers are published in medicine and the number is increasing rapidly. Health care must constantly adapt to new knowledge, and students thus need to learn to identify the most relevant new knowledge in their area of specialisation, ranging from laboratory work, via clinical work to public health, amongst others. Thus, students must be exposed to different research traditions. Our strategies and plans must also tackle 3) the challenge of empowering students to facilitate the changes required to implement new evidence-based standards in practice. This includes initiating change, not only in their own practice, but also in the practice of the organisations where they will be working. This is a huge task in a field with a very strong tradition of master – apprentice learning. And it is relevant for higher education in general.

The key step to realising these ambitions is for us to make large-scale changes across the whole study programme. We will integrate the Centre into our teaching and learning centre, PLUS, and organise the work into work packages (the boxes in the figure below). Integration into PLUS, which works with all the study programmes at the faculty (including nursing, physiotherapy etc. after the merger), will ensure that the Centre, and its activities after the end of the funding period, are part of the Faculty's ongoing efforts to continuously improve educational quality from day one, rather than being a 'bolt-on' project.



The overall work package (WP) structure is presented below, while the milestones and more details are presented in Appendix 3. As the Centre is a large undertaking we will ensure the necessary attention by establishing a steering committee. The Centre management will be physically co-

located with employees at PLUS and management of the study programme. We will have **two advisory councils; national AC** with the other medical education programmes, focusing on cooperation and dissemination, and **international AC** with national representation, focusing on



strategy and research. We will also have **two reference groups;** staff and students from the faculty only, meeting more frequently, and having closer involvement in daily work, together with an extended group including representatives from the practice field and other health professions. We will have a management group overseeing the day to day work. For each WP we will have separate working groups with representatives from the students, staff and other stakeholders. NTNUs Educational Development Unit will be a close collaborator to further strengthen the pedagogical competency in our work.

The strategy of the Centre is to enable students to initiate change, through facilitating student involvement and learning in how to ensure that clinical practice is continually updated, based on **new knowledge**. This requires skill in receiving and giving **supervision** and the use of formative and summative **assessment**, mirroring real life situations.

There are some prerequisites for making it all happen. One aspect is the **Management** of the Centre and **Coordination** between the different WPs and projects e.g. to ensure synergies. Another central aspect is buy-in from both students and staff. This can only be achieved by involving them in a comprehensive process of **Faculty development**. Due to the scale of our intended changes to the study programme and the large number of teachers, this is a huge task needing systematic long-term work and student and staff involvement.

The limited time available to students for direct patient contact poses a challenge. In order to give students more time on task, we will use **Learning technologies**, such as virtual reality and simulation, as tools to better prepare students for practice. Better-prepared and involved students are more open to learning, and thus more time can be spent on showing them how practice has evolved due to new knowledge.

However, this is not enough to fully prepare the students for good clinical **Practice**. We will therefore establish student-led clinics where the students themselves are in charge and where they are challenged to use current and emerging research to direct their clinical actions. Student-led clinics also provide a very important arena for student involvement.

To run these clinics effectively, students need to be confident that they can identify and apply the best available knowledge resources. To achieve this, they need to be exposed systematically to critical reasoning and how **Research** is used in practice. We will provide them with opportunities for rotation in research groups and expose them to how staff members use research, and research methods, in their daily work and in different areas of medical practice.

The core of our work is improving students' skills in using new knowledge and applying it in practice, but this does not in itself enable students to change the practices or cultures they will encounter after graduation. We believe that the best way for students to prepare for the challenge of changing established practice and promoting collaborative practice is through improved skills in receiving and giving **Supervision**. Thus, we will use supervision as a tool to strengthen the students' confidence and ability to be good team members, role models and to take the lead in driving change through personal example. It is also a tool for student involvement.

Assessment is an important driver for behaviour. To succeed, we need sustainable

assessment methods that have lasting impact on the students' skills for lifelong learning. Sustainable assessment methods developed in the Centre will have the same focus as our overall strategy: enabling students to be involved and to initiate change, through awareness of the need to continually update practice on the basis of research.

The success of the Centre may be measured by the extent to which others have been able to use the knowledge and methods we will develop. This is within the tradition of the Faculty: new knowledge is only valuable when it is shared and used by others. Thus, our focus for **dissemination** is on involving others who can benefit from the work of the Centre.

Importantly, we are conscious that study programmes at the Faculty must mirror the process of changing practice. We must empower the students to shape their own learning by giving them real influence and the ability to challenge what is done. As such, **our education will be a living lab in preparing the students to be involved and to initiate change**.

Education for the health professions faces more or less the same challenges across the western world. In 2010, The Lancet Commission issued "*Transforming Education to Strengthen Health Systems in an Interdependent World*". The report calls for reforms in health professional education guided by two outcomes: *Transformative learning* and *Interdependence with the practice field*. By placing these issues at the heart of the Centre, we will be able to make a significant contribution to health professional education, nationally as well as internationally. We will also be able to take on some of the significant challenges that face society, and thus healthcare, in the future.

Thus, **our contribution will address how large-scale changes, focused on lifelong learning, can be developed and implemented so that they permeate the whole study programme.** I.e. we are not implementing separate, innovative new subjects, but **are shifting the culture**. All professional education should focus on preparing students for change through fostering lifelong learning. The work of the Centre will thus also have significance for higher professional education outside the field of medicine and health.

The students are involved and active partners in the analysis and evaluation of the curriculum and take part in all developmental work. Two of the five members of the core group for writing this application are students, and **student involvement** will be continued in the Centre, where students will be employed in paid work (see budget). They will have office space in the Centre and PLUS and will be integral members.

The additionality of receiving the SFU Centre Award comes from the extra resources and prestige it will bring. This will be used to expand projects and involve more of the staff and other education programmes, especially those for the health professions. We will be able to introduce

more extensive changes to our curriculum and introduce new learning activities more rapidly. With more resources, we will be able to buy time for engaging staff in developmental work and, not least, conduct more research on educational activities and their impact and be able to disseminate to a larger community, nationally as well as internationally.

### **Evaluation and impact framework**

With all Centre activities, we will develop sustainable solutions to facilitate long lasting changes. Normalisation Process Theory (NPT) will be used as an evaluation and impact framework and also to estimate value for money. NPT is a framework for understanding the processes by which complex interventions are naturally integrated and sustained in daily work, or not. It has been tested, refined and applied in studies conducted across diverse settings.

There are four core constructs in NPT, defined as essential conditions and processes for new working practices to become a natural part of daily work: **Coherence, Cognitive participation**, **Collective action**, and **Reflexive monitoring**. The relationship between the constructs is not linear, they influence each other, and implementation work is necessary within all four constructs. The table gives an overview of the questions to be investigated to assess the interventions, building on:

NPT components	Questions to be investigated	
Coherence	Does the intervention have a clear purpose?	
(Makes sense)	Who will benefit from the intervention?	
	Are the staff and students likely to value these benefits?	
	Will the staff and students understand the intervention?	
Cognitive participation	Will the intervention fit the overall goals and activity?	
(Engagement and	Are the staff and students likely to think it is a good idea?	
commitment)	Are the staff and students prepared to invest time and work in this?	
Collective action	How will the intervention affect staff and students?	
(Facilitation for use)	Is it compatible with existing practices?	
	Will the staff and students need extensive training before they can use it?	
Reflexive monitoring	Are the staff and students likely to appreciate the intervention after a while?	
(Appraisal of value)	Can the intervention be improved on the basis of experience and feedback?	

In order to ensure that its activities can be sustained after funding ends, the Centre will be integrated with our established teaching and learning centre, PLUS. The knowledge gained will be used within an established structure whose task is to work with institutional educational development over time.

Our legacy, some years after completion, will be in the form of innovative models for transformative learning and interdependence, which will foster lifelong learning and enable students to initiate change in their practice after graduation. This will be evidenced by publications, as well as by changed curricula in health care education programmes.

#### Dissemination

Our dissemination strategy is built around our target groups. Our primary target groups will be 1) students and staff at the Faculty of Medicine (primarily medicine, followed by the other study programmes) and 2) other MD programmes in Norway. Both groups will be involved directly in the work, through joint projects and representation, as we consider this the best method of dissemination. Locally, the NTNU merger, which brings all the health education programmes together in one faculty, and our position within the Faculty's teaching and learning centre, PLUS, will give us increased opportunities to directly involve other health education programmes in our projects. The medical faculties in Norway already have close collaboration, both at management and student level, as well as on educational projects. We will build on this collaboration to spread knowledge from the Centre, and to support related changes they may wish to implement.

Several of the planned activities of the Centre will be carried out in the field of practice. They will also have relevance for the health sector in general, and particularly those institutions providing students with practice placements. These institutions will form a stakeholder group for many of our activities. Furthermore, realising the full effect of our efforts within the Faculty to foster lifelong learning will depend on the students encountering supportive environments after graduation. Therefore, building on our close cooperation with St. Olav's Hospital, other hospitals and primary care, we will target these settings, include them in our work, and create improved environments for continuing learning.

Medical schools outside Norway will be targeted through research publications in journals for medical and health education and a range of activities at international meetings. Our international advisory board and our existing international partners will be used for network dissemination.

Our work will be relevant for other health education providers and for higher education in other fields. These groups, and the general public, will be reached through our website, newsletters and social media. We will also arrange (and take part in) conferences and workshops, which will be open to external participants.



# COMMENTS

[Body text (150 words)]

### **Appendix 1: References**

The list includes references used in the application and references to research papers conducted by our academic staff on our own medical model published in peer review journals (i.e. not conference proceedings from e.g. the AMEE conferences where we have several presentations each year)

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# ABOUT THE CENTRE

Name of Centre

TRANSark



Is the Centre already established at the time of the application (yes/no)?

🗷 Yes 🗆 No

Please name any consortium partners for the Centre

- Faculty of Architecture and Fine Art (AB)
- Unit of Educational Development (UNIPED), at the Faculty of Social Sciences and Technology Management (SVT)
- Department of Product Design (IPD), at the Faculty of Engineering Science and Technology (IVT)
- Faculty of Medicine (DMF)

# ABSTRACT

#### From 'best practice' to 'next practice'

TRANSark- Transforming Higher Education is the shared vision of a transdisciplinary group of educational programs at NTNU, with the ambition of contributing to the emerging paradigm shift in higher education. The challenges of our time call for new goals in higher education, including:

- Transforming higher education into an agent for change in addressing societal challenges
- Developing and promoting the use of transformative pedagogies
- Creating a faculty of 'dual professionals' with combined disciplinary and pedagogic expertise
- Empowering students to learn actively
- Embracing and navigating complexity

TRANSark will be in the vanguard of developing and testing next-generation, 'high impact' pedagogies, initially for architecture, product design and medicine. It will move professional education from discipline-specific teaching to advanced generic learning methods, whilst simultaneously transferring cutting-edge disciplinary knowledge and values to general pedagogy.



# **APPLICATION DOCUMENT**

The application must be written in English and follow the requirements set in this template. It must not contain more than 10 pages in Times New Roman, 12-point types, with lines spaced 1.5 and margins of 2 cm. Within this format, the applicant must provide:

### a) Documentation of educational quality in existing provision

The applicant must comment and critically reflect on themes and questions set out in the criteria, and compare their existing provision with similar provision within the same subject/discipline area, both nationally and internationally. Through this, the applicant must document that the academic community qualifies as a Centre for Excellence in Education.

### b) A Centre plan

The applicant must comment and critically reflect on themes and questions set out in the criteria. The Centre Plan must outline the vision of the Centre, its strategy and plans. It must present the plans for the dissemination of knowledge and practices to its own institution(s) and to other educational communities as well as an evaluation and impact framework.

# Appendices

The following appendices must be included (and no other):

- 1. A list of references
- 2. A budget for the Centre for the first five-year period, including motivation for costs (see guidelines at <u>www.nokut.no/SFU/utlysninger</u>)
- 3. An action plan for the Centre, including milestones (no more than three pages)
- 4. CVs of the proposed Centre Leader and two to five key members of the Centre team (each CV must not exceed two pages)

All appendices must be in English.

## **Practical information**

The rector of the host institution must sign the application.

The deadline for submitting applications is set in the announcement of the call.

All applications will be published on the NOKUT website, alongside the expert panel's feedback.

# **APPLICATION DOCUMENT**

### TRANSark – Transforming Higher Education

TRANSark is the shared vision of a transdisciplinary group of educational programs in architecture, design and medicine at NTNU, developing and testing next-generation, 'high impact' pedagogies. The ambition is to take practice in higher education to a new level, by engaging a wide network of mutual and complimentary initiatives towards an emerging shift in higher education. TRANSark will explore, challenge and develop the relationship between discipline-specific pedagogies and general pedagogies, with the purpose of re-thinking both.

## **1 PROLOGUE**

TRANSark was established in 2014 spurred by the SFU application in 2013, as a response to calls for a 'big rethink' within architectural practice and education (Buchanan 2012). We experienced traces of this new paradigm by a "new wave" of radical student activities (TYIN tegnestue) emerging from the tradition of architectural education at NTNU. TRANSark has started developing new pedagogical frameworks to support this trend. These involves both student-driven and tutor-led developments, rooted in the pedagogical theory of Transformative Learning (Mezirow & Taylor 2009) and Threshold Concepts (Meyer & Land 2003). A more solid pedagogical basis for building competences within architectural education is based on the concept of 'dual professionals', combining disciplinary and pedagogical expertise (Beaty 1998, Peel 2005). TRANSark will strengthen the research-based development of this platform, tested by pilots and implemented in educational programs. TRANSark has also recognized shared pedagogical development trends, grounded in 'problem-based learning', 'design thinking' and 'live pedagogies' at other NTNU faculties, leading to this transdisciplinary joint effort to create a more general pedagogy, relevant for a wider audience.

## **2 MOTIVATION**

We live in times of major transition. Climate change and frequent economic or environmental crises affect all areas of the globe, whilst new technologies, social media and cultural mobility are radically altering our world-view. Consequently, facts soon become outdated and no longer provide the right answers (Barnett 2000). Change in pedagogical practice is slow when compared to these developments. Projects underway at NTNU (see section 4) already show what such a 'rethink' might look like. Such projects exemplify the need for a radical shift, from content-based education to active learning, which prepares students for navigating societal change, complexity and an unknown future (Rasmussen 2004, Sennet 2008).

## **3 EDUCATIONAL VISION**

Transforming Higher Education: From "Best practice" to "Next practice"

Responding to the challenges of our time, a new set of criteria for quality in education needs to be defined. Being "best" refers to existing paradigms, whilst "next" is something beyond the horizon. **TRANSark will be in the vanguard of developing and testing new pedagogies within the field of higher education, in order to reach the next level of pedagogical practice.** 

The main points of orientation within this emerging field will be:

**Education as an agent for societal change:** The TRANSark vision sees education as not just a path to a professional career, but a combination of personal growth, the development of disciplinary expertise and active participation in society. To be a contemporary professional, in any discipline, entails responsibility towards society (Owen et al 2013). Students need not only to learn the knowledge and skills, but also develop the resourcefulness and ethical competence necessary to implement societal change.

**Student–active learning:** TRANSark's vision is a major change in higher education from a teaching-oriented to a learning-oriented perspective (Biggs 2007). This will change the roles of teachers and students, transforming learning into an active process of discovering, gathering and developing knowledge, skills and values, within disciplines. TRANSark will be a laboratory, a repository and a mediator of experience and research in this process. It will facilitate student activities, curricular and extra-curricular, for learning and the development of professional identity.

**The challenge of transformative education:** Transformative education focuses on deep learning, where ontological and epistemological shifts open new horizons of knowing and understanding. TRANSark will identify and amplify these processes within a transformative pedagogy, providing opportunities to "integrate, synthesize and apply knowledge, skills and values that are essential to deep meaningful learning experiences" (Kuh 2008).

**The dual professional:** From a "Next practice" perspective, the roles and responsibilities of teachers evolve through a deeper understanding of the learning process. TRANSark will develop a culture of 'dual professionals', faculty who combine disciplinary and pedagogical expertise and thus contribute to the status of teaching.

**Complexity:** Most aspects of modern society are complex and rapidly changing. Within the fields of medicine, architecture and product design, the practicing professional has to handle complexity on many levels, on a daily basis (Barnett 2000, Rasmussen 2004, Bleakly 2014). This represents a unique competence, which should be developed in an educational environment.

## 4 QUALITY IN ESTABLISHED EDUCATIONAL ACTIVITIES

The study programs in Architecture (AB), Product Design (IPD) and Medicine (DMF), as well as TRANSark, are continuously developing the study programs according to NTNUs quality system,

and share high levels of quality. The qualities can be categorized as shown in the diagram. Some qualities are quantifiable or can be identified as tangible system design qualities. Others are purely qualitative, such as educational culture and individual

individual factors

 Cuture
 Quality Systems

 Individual
 Numbers

experiences. These cannot be measured, but explained through dialogue and comparison.

Within AB: The five-year Master program in Architecture at NTNU has for years, built a culture of educational quality, shared by a diverse community of dedicated individuals. The SINTEF/NTNU awards for outstanding teaching (Steffen Wellinger 2010 and 2015), and the Norwegian Quality Enhancement Award for NTNU Live Studio 2015 are products of this culture. The main elements include a close individual relationship between teachers and students (external evaluation report 2015), weekly one-to-one facilitation of design projects, peer assisted learning, problem solving in a shared learning environment, and teams of teachers and students who work and develop courses in close collaboration. The educational framework motivates students and stimulates personal growth, ethical responsibility, and professional competence. This is evident in the many extra-curricular projects, such as Live Studio projects, StudioBeta, Tidsskriftet A, Rallar Arkitekter, Arkitekt Hjelpen, and in the popular curricular courses involving societal interventions. In such instances, students work closely with clients and communities to plan, design and build full-scale structures, e.g. <u>Rindal Star Cube.</u>

**System** quality can be seen in the on-going revision of the five-year master program, based on an evaluation and development process with wide participation from both students and faculty (external evaluation report 2015), due for implementation by 2018. Additionally, the Faculty carries out student surveys, most recently in <u>2016</u>. Other aspects include the extensive use of external practicing architects as tutors and examiners throughout the program, maintaining important bridges between academia and the profession. A crucial driver of system quality is the high ambition and clear policy of the NTNU leadership on all levels, for innovative learning and educational quality, backed with strategic and financial support.

Finally, qualities documented in **numbers**: In 2014 the average percentage for completion of planned studies at Norwegian universities was 81,9%, whilst for NTNU, it was 84,6% overall and for the Faculty of Architecture and Fine Art it was 94,5%. For many years, the Faculty has attracted top quality applicants - in 2015 the average admission score was 58,4 (DBH-Database for Higher Education). In an <u>NTNU student survey</u> about the learning environment, architecture

students reported the highest score of 93 %. The study program also scores well internationally, ranked among the top 100 by <u>QS World University Rankings</u>.

Within UNIPED: The department provides pedagogical training to all new faculty, evaluation and development of programs, and advice to the central administration. Its research areas are assessment, course design, threshold concepts, and the educational use of ICT. UNIPED received the 2005 NOKUT educational award for its teaching assistant training program (LAOS). Within IPD: The Department of Product Design (IPD) manages The Industrial Design Engineering Program, and 60% of courses are within IPD. IPD is a small department where all staff members are co-located with students and workshops in the IPD building. This creates an open and accessible **culture**. Almost all courses are taught in a studio format, which involves making, guided reflection, and end-user involvement. From the second year, students relate to real industry briefs. Vertical integration is encouraged, from Ph.D. projects to master thesis and from master thesis to lower level courses. The studio format creates a strong sense of ownership and engagement in students. Students also write academic articles, about 20% of which are coauthored by faculty and published at conferences or in level 1/2 journals. All academic staff are involved in teaching. Trends in industrial design point to a need for rethinking education (Baggerud 2011). Over the last five years, the study program system has been fundamentally overhauled, with two specializations and many new courses being created. This involved an international review group, student, alumni, employee and industry feedback, and a comparative study with Chalmers Industrial design program. The program receives 830 applicants for 35 places, requiring 58 points for admission. Students report working 42.6 hours a week. Many students are also active in on- and off-campus organizations. In the NOKUT 'studiebarometer', students awarded the program 4.6 points. Transfers to the master in entrepreneurship distort completion numbers, but all IPD graduates have jobs within a year, with 60% employed within a month, according to IPD biannual alumni surveys.

**Within DMF:** The medical doctor program is a six-year program characterized by problem-based learning, patient contact from year one, discipline integration and spiral learning. In 2014 the program underwent a full <u>internal evaluation</u>. Consequently, the leadership of the program was strengthened, with new positions, a new teaching and learning Centre, and enhanced spiral learning, discipline integration and student active learning modalities. A collaboration between the Medical Simulation Centre and TRANSark members has already resulted in two forthcoming international presentations (Hokstad et al 2016a, Hokstad et al 2016b). The Faculty of Medicine published 1022 scientific studies in 2015 and Moser & Moser at the Centre for Neural Computation were awarded the Nobel Prize in Physiology/Medicine in 2014.

**TRANSark Achievements:** TRANSark is financially supported by NTNU, as one of seven innovative learning projects (2013-16), and is included in the 'Top Teach' program (2015-16) through the TRANSark MiT Lab (see WP1) 2015/2016. Additionally, TRANSark is given priority as one of five strategic areas at the faculty (AB) and has been granted research funding for innovative education 2015-16, as well as one dedicated Ph.D. and new academic positions in relation to innovative learning methods. The Centre has extended its transdisciplinary network of international collaborators. Furthermore, it has developed and tested educational pilots to challenge the traditional curriculum, such as plug-ins for master-courses; a new master-course (Making is Thinking) with a strong R&D base; a coaching and reflection model as a pilot for Blackboard LMS testing; a peer evaluation pilot; and participation through 'gamification'. Findings and experiences from activities have been disseminated in publications such as Meyer, Land and Flanagan's Threshold Concepts in Practice (2016). TRANSark is also referred to in Ray Land's Study on Teaching Excellence Framework for Higher Education Academy (Land & Gordon 2015). The Centre has also had considerable impact on the process of evaluation and reformulation of the study programs, Master in Architecture and Master in Sustainable Architecture (Evaluation Report 2015). Additionally, in 2016 TRANSark was included in the research project NEST, 'New Schools of Thought', undertaken by the University of Liechtenstein and presented at the Venice biennale 2016. For more information about our achievements, please visit the project page on Cristin.

## **5 INPUT FACTORS and CONTRIBUTORS**

Originating from a collaboration between the Faculty of Architecture and Fine Art (AB) and the Unit of Educational Development (UNIPED), TRANSark has included the Faculty of Medicine (DMF) and the Department of Product Design (IPD) in specific work packages (see WP descriptions). This constitutes an ideal complementary partnership in TRANSark, with common pedagogical experiences, a shared focus on student active learning, and an increased interest in complexity.

The Centre direction (CVs attached) and work package leaders are:

Centre leader, Associate Professor Gro Rødne (AB): Leader of WP1, Architect Professor Leif Martin Hokstad (UNIPED): Assistant Centre Leader and leader of WP4 Associate Professor Bjørn Otto Braaten (AB): Leader of WP3. Architect Associate Professor Steffen Wellinger (AB): Leader of WP2. Architect. Associate Professor Trond Are Øritsland (IPD): Assistant Leader of WP2 Professor Ivar Sjåk Nordrum (DMF): Assistant Leader of WP2 Other faculty members planning to be involved in the Centre include: **From AB**: University Lectors Andreas Gjertsen and Yashar Hanstad, of TYIN Tegnestue, Pasi Alto and Professor Sami Rintala, have, for several years, organized full-scale building workshops and a master-course (Design in Context), in Norway and abroad. Associate Professor Eivind Kasa is central to theory development in WP1, together with Ph.D. Johanna Gullberg. Luca Finocchiaro is program lead for Master in Sustainable Architecture and responsible for the Climate HUB Lab. Furthermore, Andrew Freear of Rural Studio at Auburn University, USA, has recently joined the faculty as a Visiting Professor in order to be involved in TRANSark activities. **From IPD**: Associate Professor Ole Petter Wullum (IPD, Design Thinking) and Associate

Professor Andre Liem (IPD, Vertical Learning)

**In addition**, the Centre will draw upon the resources of other relevant academic environments at NTNU with particular relevance to TRANSark, such as Professor Aksel Tjora (Department of Sociology and Political Science) and his students at the 'Sosiologisk Poliklinikk', with whom we have several bilateral collaborations.

# 6 ORGANISATIONAL PLAN



**TRANSark** : A joint research and development Centre between the Faculty of Architecture and Fine Art (AB), Unit of Educational Development (UNIPED), Department of Product Design (IPD), and the Faculty of Medicine (DMF) and with links to educational programs in Scandinavia and Europe. The Centre is hosted by AB, under the direction of Associate Professor Gro Rødne, with Professor Leif Martin Hokstad (UNIPED) as deputy leader.

A steering committee will monitor the overall progress of the Centre, with representatives from the NTNU Principal's Board, Deans of the Faculties AB, SVT, DMF, Institute leader of IPD and a student representative.

An international scientific committee will give critique and advice on the scientific progress and

consists of: **Professor Ray Land**, director of the Centre for Academic Practice in the School of Education at Durham University, and former higher education consultant for the OECD and European Commission (particularly known for research on 'Threshold Concepts' and 'Troublesome Knowledge'); **Professor Mats Benner**, who holds a Ph.D. in Sociology (Lund University) and is currently professor in science policy studies at Lund University School of Economics and Management, and associate dean (research) at the School; **Anu Yanar**, an architect with a Ph.D. in educational development; and **Dr. Harriet Harriss**, from the Royal College of Art in London. Harriet's teaching, research and writing are focused on pioneering new pedagogic models for design education, particularly those that respond to specific community challenges.

**Reference Group 1** consists of external professional organizations with which we have already established bilateral co-operation. **Reference Group 2** is the Student Think Tank, consisting of the teaching assistants, led by TRANSark's student representative. **Reference Group 3** is the Program Council, with representatives from all the master programs currently involved in TRANSark.

# 7 WORK PACKAGE OVERVIEW

The relations between the work packages is as shown in the diagram below. WP 4 (Emerging Pedagogical Practices) will use WP1, WP2 and WP3 as targets for research.



**WP 1 Making is Thinking:** WP1 will carry out a much-needed investigation into the development of skills connecting body and mind (Deane 2013). The target assignments range from full-scale building, to 'hands-on' experiences. Central to WP1 is 'lateral thinking' (de Bono 1970), which challenges students to overcome learning thresholds by breaking free from 'design fixations' (Bilalic et.a. 2008). Furthermore, WP1 will investigate the transformative aspects of direct 'learning by making', developing tacit knowledge, and reinforce understanding through reflection exercises (Shön 1983). WP1 has a strong R&D base through Johanna Guldberg's Ph.D. work, based on Action Research (Greenwood & Levin 2006). WP1 has initiated the Making is Thinking Laboratory (MiT Lab), which is now being strengthen by Design Thinking at IPD. The

MiT Lab is being developed in collaboration with students, as an accessible learning lab for all, to encourage lateral thinking. It will be a learning tool for all the TRANSark WPs, enabling their pedagogies to be tested 'live', equipped with digital and analogue tools that encourage experimentation. This is an environment where failure is acknowledged as a necessary condition for the creative process. The methods of WP1 involve being temporarily liberated from critical or inhibiting perspectives. These can be made generic so as to be relevant outside our Faculties, since lateral and creative thinking is relevant for all higher education. As such, it will be paramount to expand the knowledge base in cooperation with other disciplines, for example, psychology and neuroscience.

**WP 2 Live Learning:** The Live Learning work package (WP2) is grounded in the recognition that professions are fundamentally practice based, social endeavors. NTNU Live Studio is one of the main targets of the Live Learning work package. Live Studio projects take architecture students out of the university environment and into real-world situations that enable them to gain insights, skills and understandings that cannot be academically 'taught' (Harris 2014). The problems students confront in live projects are embedded in real-world constraints, and require physical and social solutions. Linking the experience from Live Studio with theory an practice from IPD with user-centred design and problem-based approach from DMF will develop new generic approaches with transfer value.. Furthermore, students not only learn more efficiently by engaging all their senses, but also acquire a wider understanding of the significance of their profession. Experience shows that students acquire the capacity to improvise, to communicate effectively, and to demonstrate social responsibility. WP2 will investigate the relationship between student ownership, risk, project quality and learning outcomes. Rooted in "communities of practice" approach Lave & Wenger (1991), the Live Learning WP will develop open source (online) modules to facilitate peer coaching and learning reflections.

**WP 3 Complexity and Depth:** Complexity, in this context, deals with the interrelationship and integration of different categories of seeing and understanding. Being a professional in the 21st century requires the ability to see the detail and the whole picture, the facts and the ethics of the task, simultaneously (Rasmussen 2004, Sennet 2008, Davies 2008). WP3 will compare similarities and differences in multi-perspectival understanding amongst students of architecture, industrial design and medicine. These perspectives each have an inner aspect, a developmental line from gross to subtle, from superficial to deeper levels. To gradually discover the different levels of a perspective is a process of growth. Knowledge is always a matter of levels of understanding. In WP3 research will be carried out in relation to the depth/developmental perspective. We will investigate unconscious aspects of the creative process among architecture and design students, to

find links between transformative learning/growth process and the manifest design projects. A preliminary investigation into this field already shows promising results. A complementary investigation will be conducted with medical students, looking at links between personal involvement, learning, growth and complexity. Thus WP3 will focus on the relationship between the inner and outer aspects of becoming a professional, and the learning journey itself.

WP 4: Emerging Pedagogical Practices: This work package will provide a theoretical framework for the development of knowledge in the other work packages. The WP will draw upon the threshold concept framework and transformative learning to develop high impact practices that allow complexity, risk and uncertainty to be important aspects of the learning trajectory, as well as fostering ownership and social responsibility (Mezirow & Taylor 2009, Meyer & Land 2003, Shulman 2005, Harriss 2014, Froud & Harriss 2015, Evans et.al. 2016, Land 2016). The 'Threshold Concepts' framework explores the deep aspects of disciplines, often associated with tacit knowledge (Polyani 1966, Marton & Säljö 1976, Entwistle 2009). Challenges in students' learning trajectories are connected not only to disciplinary issues, but also to developing the ability to move between disciplines (Trowler et al 2013). The main tasks for WP 4 are to explore, challenge and develop general pedagogical theories and frameworks on the basis of the discipline specific pedagogical development of the partners combined with existing theoretical framework.

### **8 DISSEMINATION**

TRANSark's dissemination strategy has three levels, each with specific target groups (Hamsworth & Turpin 2000). The first level is dissemination for **awareness**. TRANSark will spread information about our profile, our projects, and how to contact us. Numerous channels will be used, including Facebook, the websites of <u>TRANSark</u>, the faculties and NTNU, as well as personal contact with interested individuals and institutions, and 'ambassadors' inside and outside NTNU. Dissemination will be inclusive and be aimed at everyone interested in new perspectives on higher education; students, teachers, administrators and leaders. The second level is dissemination for **understanding**. TRANSark will offer experience and theoretical knowledge concerning 'high impact' pedagogical strategies for those in education who seek support for developing their own programs, or have the same vision (Evans et.al. 2016). In addition to international conference presentations, articles, internal seminars and 'think tanks' for students and faculty, CROSSROADS will serve as the main platform for sharing and co-developing deeper understanding, through experimental praxis. CROSSROADS will allow for joint-hosting with national and international conferences. The third level, dissemination for **action**, is aimed at institutions and individuals in positions of influence. TRANSark's ambition is to take practice in

higher education to a new level by implementing changes in the participating educational programs at NTNU, and through collaboration with our network of complementary pedagogical development projects. The CROSSROADS platform is crucial as a venue for people from the network to share knowledge and ideas. Students, high profile guests, faculty, leaders from different levels, educational policy makers and researchers will meet, informally, in an open forum (see Appendix 3: Action Plan).

# 9 IMPACT

TRANSark has already put transformative pedagogical practice on the agenda at the Faculty of Architecture and Fine Art at NTNU. It has been a major factor in developing the five-year Master Program in Architecture (2015-2016). Since 2014, TRANSark has built up its relationship with other study programs and is looking to establish common course development systems. TRANSark is now aligning with other disciplines, starting with medicine and design, and aims to develop comprehensive and inclusive research, corresponding to our educational vision. Furthermore, it has established an international network of academic institutions that are investigating other emerging pedagogies (see section 6 and Appendix 3: Action Plan). These are important steps towards positioning TRANSark as a transdisciplinary pedagogical development centre.

**Future developments** within TRANSark will ensure that the emerging paradigm within higher education is recognized as a vital aspect in the development of relevant educational programs, simultaneously strengthening theories of transformative learning in professional education. The Centre will measure its success in the following ways: 1) expansion of the TRANSark network; 2) degree of adoption of its methods at other institutions and; 3) the reported benefits to students and staff in these institutions, and NTNU.

The **legacy** of TRANSark will be present in the culture for student involvement in educational developments, and through a more contemporary understanding of the learning process amongst students and faculty. This will be visible in professional study programs that accommodate emerging pedagogical practices and build on experience-based knowledge, pedagogical theory and research.

The ultimate goal of TRANSark is to promote research-based "next practice" pedagogies, with the perspective on education as a truly transformative journey. TRANSark's adoption and testing of these pedagogies will represent a significant contribution in developing next practices in higher education.



# COMMENTS

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#### References

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# **ABOUT THE CENTRE**

Name of Centre Centre for integrated Earth System education (iEarth)

Is the Centre already established at the time of the application (yes/no)?  $\Box$  Yes  $\boxtimes$  No



#### Please name any consortium partners for the Centre

The application for a Centre for Excellence in Education hosted at the Department of Earth Science, UiB, Centre for Integrated Earth System Education (iEarth), is a joint effort on the part of four central national institutions engaged in Earth science education in Norway: the Department of Earth Science at the University of Bergen, the Department of Geosciences at the University of Oslo, the Department of Geology at the University of Tromsø – the Arctic University of Norway and the Department of Arctic Geology at the University Centre in Svalbard. To ensure pedagogic excellence and innovation, we are collaborating with the Higher Education Research Unit at the University of Bergen and the Centre of Excellence in Higher Education BioCEED in the Department of Biology at the University of Bergen, Bergen Technology Transfer (BTO), the Centre for the Science of Learning & Technology (SLATE), University of Bergen and the Institute for Teaching Excellence and Faculty Development at UMass Amherst, US.



# **ABSTRACT (150 WORDS)**

Earth science education is a cornerstone of Norwegian Society, underpinning Norway's major energy and resource based industries, but is also key to societal resilience and environmental safety. Yet the Earth sciences are in change, posed by changing climate, shifting energy landscape and resource utilization acutely highlight the inter-dependence between human society and our planet. In iEarth, we build a national consortium with broad international networks, to transform the Earth Science education in Norway. We will connect excellence in research to excellence in student-active learning by: 1) creating a national competence education within critical fields of societal relevance (geohazards, resources, energy, environment, climate), 3) establishing a coherent system of evaluation to foster teaching excellence and identify best practices to disseminate worldwide.



#### Centre for integrated Earth System Science Education (iEarth)

#### 1. Motivation

Earth science education is a cornerstone of Norwegian Society, underpinning Norway's major energy and resource based industries, but is also key to societal resilience and environmental safety. The challenges posed by a changing climate, modern societies' need for more natural resources and the shifting energy landscape acutely highlight the inter-dependence between human society and our planet. This is perhaps particularly evident in Norway, where the strong economic reliance on the oil and gas industry, with its dependence on Earth science expertise, and the concurrent ambition to become a global environmental leader have sparked the need for renewed thinking about the role of modern Earth scientists in society. Yet the Earth sciences are in the midst of a major revolution. Input from knowledgeable, critical and engaged geoscientists is essential in shaping this debate and meeting the challenges of the twenty-first century. In addition, they provide key societal knowledge regarding the complex functioning of the Earth System, including its myriad processes and their interconnected feedbacks; the requirements for continued prosperity and competent decision making on subjects ranging from urban planning, risk-mitigation and adaption to devising sustainable environmental, resource and energy strategies. In iEarth, we take action to educate a new generation of internationally competitive future earth scientists and practitioners who consider Earth as an integrated system, harnessing this inter-disciplinary perspective to solve the complex inter-disciplinary (environmental) problems of the twenty-first century. The societal changes require a more holistic knowledge of the complex functioning of the Earth System for use in decision making ranging from urban planning, infrastructure, risk mitigation and adaptation to devising sustainable environmental policies and developing resource and energy strategies for the future. In the future, candidates with an Earth science background will need to be trained for a wider range of occupations than has traditionally been the case in Norway, where the oil and gas sector has been a highly dominant recipient of graduates. These changes constitute the motivation for establishing iEarth as a national resource directing this transformation in Earth science education. The consortium is uniquely positioned to blaze this trail, joining forces through a committed network of four major national Earth Science departments. The consortium benefits from existing Centres of Excellence in research<sup>1</sup> and strong links with partners in industry, government and education when identifying the best practices with top-level international partners. The Establishment of iEarth as a NOKUT Centre for Excellence in Education will provide us with the means of establishing an unprecedented national competence centre for Earth science learning. This will thus support changing Earth

<sup>&</sup>lt;sup>1</sup> Bjerknes Centre for Climate Research (BCCR), Centre for Arctic Gas Hydrate, Environment and Climate (CAGE), Centre for Integrated Petroleum Research (CIPIR), Centre for Earth Evolution and Dynamics (CEED) and Centre for Geobiology (GCB)



science knowledge needs in society, with relevance for the oil and gas sector, as well as other sectors, advancing the quality of current teaching through a coordinated team effort. In order to reorient education to the changing societal landscape, we need, however, to move away from current practices where the curricula tend to be compartmentalized and kept within relatively narrow sub disciplines. The transformation will involve a redesign of the curricula to ensure a more holistic, integrated Earth System perspective as well as a redesign of the teaching methodologies. Establishment of Geobiology at UiB as a new discipline is an example of cross disciplinary development of the curricula. Together, we will thus reorient Earth science education in Norway towards an inter-disciplinary Earth System approach, creating a student-active research-based learning environment that is supportive of innovation and delivering graduates with a broad understanding of key issues in the Earth sciences, as well as future societal and industrial needs (Boulton 2009). iEarth will support innovation among students in the classroom, in the laboratory and in the field by stimulating the students to take a series of steps that begin with imagination and may result in the creation of societal values and activities, whether this occurs through innovation in academic thinking, bridging science and society or the actions of individual entrepreneurs. We specifically aim to accomplish this by 1) creating a national competence centre for Earth science education in Norway, 2) developing a generic approach to cross-disciplinary earth science education within critical competence fields of societal relevance (geohazards, resources, energy, environment and climate) and 3) setting up a coherent system of evaluation to foster teaching excellence and identify best practices. Lifting the status and quality of teaching among staff members requires a cultural change. This change will be fostered by incentives such as teaching grants and the establishment of distinguished professorships in teaching.

VISION: *iEarth will promote an engaging, innovative learning environment to educate the next generation of Earth scientists, who must be skilled enough to tackle the twenty-first century's societal challenges, through research-based student-active learning and reality based practicals at a national level with strong international collaboration.* 

In the next section, we will set a baseline describing the current situation and establish a set of benchmarks, envisioning what Earth science education at UiB and Norway should look like 5 years from now. The key to this approach is that both students and teachers should be able to measure progress and identify best practices.

2. Why us - quality and challenges in established Earth science education

#### 2.1 Input factors

iEarth's input factors were selected based on the assumption that research excellence is a precursor for excellence in teaching. This is exemplified in the consortium in the form of research and innovation activities; participation in five Centres of Excellence; numerous ERC grants, including the only ERC



synergy grant in the Nordic countries, and participating in Centres for Environment-Friendly Energy Research and in Centres for Research-based Innovation. Participation in large research programs has increased the capacity, professionality and knowledge at the management in the consortium securing that the organisation is ready for supporting iEarth. The consortium consists of all major Earth science communities in Norway with high levels of pedagogic competence in Earth science research and education<sup>2</sup>. In addition, there is a tight collaboration with experts at the international level, specifically with adjunct professors hired from universities worldwide. The consortium allows shared access to state-of-theart research infrastructure and promotes excellent teaching abilities. The consortium allows access to unique field sites and stations from Finse, in southern Norway, to Arctic Spitsbergen, offering excellent opportunities for field work during graduate and undergraduate research and for field excursions. Access to world-class state-of-the-art research vessels and instrumentation is available for those executing marine research: high-technology instrumentation for mapping the sea floor, coring marine sediments and seismic acquisition on a crustal scale. Practical work in the field or on cruises is a cornerstone of Earth science education, and it helps to develop a scholarly and scientific attitude, making students independent and prepared to link observation, description and interpretation during academic critical thinking and problem solving.

The Department of Earth Science (GEO) at UiB will be the hub of iEarth and coordinate the consortium. Though only established in 1946, the University of Bergen currently ranks among the top 100 European universities (Elsevier 2016 ranking: no. 92), fostering a strong international student presence (12%). GEO outperforms this university-wide average and is rated as one of the top 50 European Earth science institutions (QS 2015). GEO's staff come from more than 34 nations (counting all employees), ensuring internationalisation at home and wide-ranging international research networks. All teaching staff are required to take 20 credits in basic pedagogics for higher education, which has resulted in an enthusiastic and devoted staff that is keen on applying new methods and ideas in teaching. Among the staff, we have the desire, qualifications and ability to change the curriculum and lead the transformation in Earth science education in Norway. So far, we have mapped the curriculum and made it transparent at the 100 level, preparing for a "flipped classroom" methodology; we have developed an innovative program for undergraduate research; we have conducted frequent international webinars as part of our curriculum<sup>3</sup>; we use GeoClass as a digital platform in petroleum geophysics; we have innovative student-active learning in several of our courses; we have a systematic approach to student exchange, with almost 40 students every year traveling to a variety of places, mostly in Europe but also at other continents; we have advanced

<sup>&</sup>lt;sup>2</sup> NOKUT student evaluation 2015

<sup>&</sup>lt;sup>3</sup> https://www.geo.umass.edu/climate/webinar.html



laboratory facilities (three of them national facilities) that we use for academic training; we developed the first MOOC at UiB<sup>4</sup> on climate change; we train our students in outreach and dissemination through Scisnack<sup>5</sup>, Grind<sup>6</sup> and Turspor<sup>7</sup>; we have a mentoring program in which each staff member has the responsibility to follow up on nine undergraduate students from the time they start until they graduate with their bachelor's degrees; there are regular all-staff meetings discussing the teaching program, and these have created great engagement; our staff is engaged in outreach and dissemination activities in the national and international media; we are responsible for arranging pre-courses for candidates' participating in GEO-Olympics and our staff is active the national Research School Resclim, which has been taken over by CHESS<sup>8</sup> and financed for anther ten years. Our focus on teaching and teaching methods has resulted in the "Ugleprisen" the UiB award for our strong involvement in developing the national, interdisciplinary field-course SVALEX at Svalbard. Furthermore, the recent NOKUT evaluation shows that the GEO Master's students are the most satisfied of any students of the Science Faculty of the University and significantly more satisfied overall than other evaluated Earth science programmes in Norway (Studiebarometeret 2015).

#### 2.2 Process factors

The iEarth consortium has a strong tradition that R&D should permeate into the development of teaching and student learning. Earth science students are exposed to an exceptionally broad range of teaching and assessment methods because we prioritize on-site fieldwork, cruises, excursions and expeditions as part of education to enhance content knowledge and provide hands-on experience with research methods in arctic, marine and terrestrial geology. As an added bonus, these extraordinary learning environments support the development of transferable skills and lifelong learning. Some of the study programmes already involve students in research-based activities modelled after undergraduate student experiences (CRU). This will be implemented in all bachelor's programmes in iEarth. At present, our curriculum is international and based on state-of-the-art research, including the extensive use of research papers in teaching at all levels, yet appear too compartmentalized to provide the width of knowledge demanded by societal needs. Furthermore, our curriculum is focused on developing independence of thought and introducing students to the culture and methods of research in order to promote student learning. This is achieved through, for example, discussions, critical reading, writing, peer-review evaluation and feedback and small research projects in which students are supported throughout the research process. These projects aim to help students identify research questions, develop aims and objectives, identify study sites, learn new techniques,

<sup>&</sup>lt;sup>4</sup> https://www.futurelearn.com/courses/causes-of-climate-change

<sup>&</sup>lt;sup>5</sup> http://www.scisnack.com

<sup>6</sup> http:/grind.no

<sup>&</sup>lt;sup>7</sup> http://turspor.b.uib.no/

<sup>&</sup>lt;sup>8</sup> http://www.uib.no/en/rs/chess


obtain equipment, collect data in the lab or field, analyse and evaluate these data and write scientific reports and/or 'papers' that contain hypotheses and testing/falsifying. In most courses, various teaching and assessment methods are used in combination to foster and evaluate various skills and kinds of knowledge. In petroleum geology, for ten years, we have used the "GeoClass" digital resource as an interactive digital tool that includes animations, short movies and questionnaires. We aim to implement this in our curriculum with the help of DigUiB, which is a central resource at UiB. DigUiB was responsible, together with staff members from GEO, for developing the first climate MOOC in Norway, an interdisciplinary online course integrating the teaching of climate dynamics and paleoclimate. It was attended by 6,000 registered users worldwide. The experiences from this production are already integrated into the course planning for next year via producing short video introductions that will be used in flipped classroom experiments at the 100 level in our curriculum. Central to the development of our course portfolio are assessments of student learning. UiB's SLATE research centre has one focus on assessment and feedback and will aid in researchinformed development of new assessment forms. We monitor our introductory classes annually, and we evaluate the remaining courses in the 100-, 200- and 300-level curriculum on a three-year rotational basis. Field course reports are evaluated accordingly and compared to the long-term average. To measure learning outcomes, we alternate our student learning evaluations between written field reports, traditional exams, digital exams and oral examinations. The monitoring program is executed on the student web, and normally, more the 70% of the students take part in the program. The results of the evaluations are summarized by the programme council and used to take action where we see a need for improvement.

Our first asset used in promoting student engagement and ownership of learning is our mentor programme, in which the staff has personal communication with students in small groups. We have developed a set of questions that each mentor group should discuss and a progress plan for feedback and monitoring. This is further followed up in the introductory class taken at the start of the Master's programme, which focuses on the philosophy of science and clarifying academic opportunities regarding their Master's projects. However, we acknowledge that the process of academic critical thinking must be implemented at an earlier stage than now in the curriculum in order to ensure that the students have the ability and experience needed to identify research questions and set up hypotheses for testing/falsifying. In iEarth, we will develop the mentor programme further using the pedagogic expertise of the Department of Pedagogics at UiB.

#### 2.3 Outcome factors

Based on the evaluation of our student programmes and the completion rates, the present Earth science curriculum is a proof of success. Surveys find that graduates are satisfied with the content, relevance and quality of their education, which they believe gives them key valuable transferrable skills, such as analytical, communication, and cooperative skills (NORKUT, 2015). Our students are active and



represented in decision-making bodies at the department, processing education, recruitment and social activities. Our "Mjølnir" student club is active in arranging social gatherings and the annual "Day of Geology", with a range of outreach activities for the public. Both Master's and PhD students are engaged as teaching assistants throughout the curriculum in classrooms, labs and the field, ensuring interaction and communication between senior and junior Earth scientists. We envisage that our educational provision is relevant for the continued development of our educational programmes. Despite this strong standing and many excellent results, we realise that the scope and practices of Earth science teaching is in need of a major transformation, particularly due to societal demands for new forms of Earth science expertise and the transition to a more sustainable and low-emission society.

#### 3. Centre plan – strategy, plan for innovation and dissemination in iEarth

iEarth will have three interdependent work packages with one leader from UiB and a co-leader from the consortium. Our approach is to gather the resources available in the consortium and together transform our earth system education into a transparent curriculum with flexibility to develop cross-disciplinary new units with the establishment of Geobiology at UiB as an example. We will develop the governance of iEarth through shared leadership, shared resources and annual meetings within the consortium.

# WP1: Learning how to learn (Lead by Atle Rotevatn) *Keywords:* critical thinking, core values, key skills, Course-based Research Experience (CRE), student-active learning

**Objectives:** In this WP we aim to develop present day discipline oriented earth science education, making the curriculum transparent at national level and increase the teacher's ability to offer good learning environments. Mastering the scientific method is vital to the education of a new generation of geoscientists. To ensure the implementation of critical thinking and methodology in science, we aim at a more visible placement of these subjects in the curriculum. We, as scientists, are in the best position to immerse students in the research methodologies that are currently the best practices. Four areas have been identified as being central to how geoscientists think and learn (Kastens, Manduca et al. 2009), and their development will be systematically addressed in the new iEarth programmes: 1) Viewing and understanding Earth as a *complex* system characterized by feedbacks between processes and among component parts; 2) temporal thinking with a long view of time, expecting low-frequency, high-impact events; 3) the extensive use of spatial thinking with a wide array of specialized spatial representations and 4) fieldwork as a central formative experience that provides a sense of scale and develops one's ability to reason spatially and temporally, creating a "professional vision". The process of becoming a competent geoscientist (enculturation) can be understood and described as a *learning trajectory* from an initial peripheral position to becoming a full member of the community of geoscientists (Lave and Wenger 1991). When designing educational programmes, we must thus engage students in the many activities that geoscientists take part in, initially



under the supervision of competent members of the community and gradually with more autonomy and responsibilities. Participation in authentic research is a key activity that will be a cornerstone of the new iEarth programmes from the first semester. Course-based undergraduate research experience (CRE/CBE/CURE) will be a new and important learning activity that has documented positive effects (Linn, Palmer et al. 2015). These includes exciting and challenging students through a class-, lab-, projectand field-based process of discovery, allowing them to raise and answer questions. This iterative process of intellectual development is largely unscripted, shaping geoscientists that are flexible, independent and critical – all valuable transferrable qualities. The successful implementation of the outlined CRE approach requires a reorientation from traditional teacher-centred education towards student-active learning, which uses a broader range of teaching and learning (e.g., computer supported collaborative learning) tools. Promising examples include the flipped classroom technique, which changes class time from a one-way knowledge transfer from teacher to student into an interactive discovery-based workshop (Barr and Tagg 1995, NSF 2015), or mobile learning approaches (e.g., to bridge fieldwork and the classroom). To this end, iEarth will prioritise the development of digital platforms, using existing expertise at DigUiB and SLATE in disseminating video lectures, online quizzes and webinars. Students at a university level are expected to have intrinsic motivation to study their chosen subject. Intrinsic motivation is associated with engagement and high-quality learning (Ryan and Deci 2000). Autonomy support is found to be important in maintaining intrinsic motivation, and iEarth will have a curriculum with enough freedom to allow students to investigate areas of special interest and initiate their own scientific projects. Finally, we acknowledge that the outlined transformation of earth science education requires significant institutional change. Having the financial resources in iEarth to give staff members time and technical support available, will help in speeding up the process of transforming our education program.

**Key steps:** WP 1.1 Implementation of Course-based Undergraduate Research Experience (CRE) teaching: a) integrate lab, field, BSc thesis and class to foster discovery-based education. To secure ownership and engagement, we will perform a GAP analysis as part of the training program in collaboration with the students; b) integrate numerical problem solving as an approach early in the curriculum, ensuring that students have the skills needed to design numerical experiments at the end of their bachelor's degree programs; c) reorient towards student-active learning, preparing for flipped classroom approaches by broadening and updating the range of teaching and learning tools (e.g., digital platforms); d) instruments for strengthen links between research and teaching preparing MSc students for PhD studies. This will be done by increasing the involvement of early-stage researchers in teaching (teaching fellows), including the engagement of PhD and post docs as mentors for those writing BSc theses; e) raise educational standards



by transferring excellent research, taking the advantage of the high standard of current Earth science research at UiB and among its partners

WP 1.2 Instil key values in flexible, independent and critical future geoscientists raised in a strong academic organisation: a) Increase ethical awareness through an increased focus on ethics from the beginning of Earth science education. Focus on plagiarism and reference culture throughout training; b) strengthen introduction courses in history of science and academic traditions at Master's level.

WP 1.3 Enhance knowledge about societal and industrial needs and stimulate innovative and entrepreneurial thinking among students: a) Facilitate the Bachelor's thesis being completed in collaboration with relevant companies and public sector organisations (see also WP2); b) make use of real case studies in the student curriculum; c) extensive use of guest lectures in the courses from partners.

WP 1.4 Install an iEarth teaching chair to streamline educational transformation, who will be responsible for the following: a) Coordinate institutional change, ensure a transparent curriculum among the institutions in Norway and prepare for exchange with international partners; b) create an open discussion forum for staff; c) implement and build webinar facilities at all partner institutions, allowing attendance of courses at the partner universities.

WP 1.5 Establish a learning fellowship stipend, providing the faculty staff a semester without any teaching commitment to redesign their courses, with the obligation that they must interact with other specialists within their field, interact with students and receive feedback on their course portfolios.

WP2: Shaping the future – meeting tomorrow's societal challenges (Lead by Bjarte Hannisdal) *Keywords: interdisciplinary, Earth System Science (ESS), Geohazards, Resources, Environment, Energy and Climate* **Objectives:** Modern geoscientists assume a holistic view of the Earth, requiring knowledge of the wide range of interacting geological, biological (including anthropogenic), physical and chemical processes that govern our planet. Instead of framing them as separate entities, as has traditionally characterized teaching, the Earth System Science (ESS) approach studies the interaction between the components of the Earth System, which represents a departure from the reductionist view that has dominated science since the Enlightenment (Kauffman 2006). This inter-disciplinary approach is crucial to understanding and meeting the complex challenges and opportunities that confront mankind during the twenty-first century. Geoscientists understand that the stability and habitability of Earth, a prerequisite for human flourishing, is underpinned by feedbacks among its components – a concept that is crucial for effective decision-making. iEarth will foster this understanding by promoting the applied Earth System Science (ESS) approach as the unifying concept of Earth science education in Norway. We will do so by developing a new curriculum that revolves around the interactions of the Earth's main sub-systems, or "spheres". Tailoring the ESS approach



to the needs of Norwegian society in the twenty-first century, we will focus on five pillars: geohazards, resources, energy, environment and climate. For this purpose, we will forge cross-sectoral partnerships outside academia with corporate and government stakeholders, co-creating career opportunities through internship programmes.

**Key steps:** WP2. 1 Development of transparent integrated Earth System Science (ESS) curricula at UiB, UiT, UiO and UNIS, creating increased understanding among the students concerning the interactions between Earth's components: a) Establish mandatory ESS BSc "Earth Systems Science" course, focusing on the spheres; b) offer integrated MSc degree programmes; c) establish cross-disciplinary collaboration platform led by the iEarth teaching chair, with the goal of integrating the ESS curriculum between groups and among partners.

WP2.2 Tailor education to societal challenges and opportunities of the twenty-first century with five selected focus areas: geohazards, resources, energy, environment and climate. The development of these cross-disciplinary disciplines will be performed by a) Forging cross-sectoral partnerships beyond academia (industry and state); b) co-creating internship programmes; c) establishing stronger alumni networks that are involved in the development of new cross-disciplinary disciplines; d) using BTO and the FORNY program at the Research Council, Inven2 and Norinnova to engage students and apply for start-up seed money; e) establishing courses in innovation and entrepreneurship related to geosciences (Accel)<sup>9</sup>.

# WP3: Best practice – fostering teaching excellence (Lead by Helga (Kikki) Flesche Kleiven) - *Keywords; pedagogic growth, best practice, evaluation, dissemination and communication*

**Objectives:** To successfully bridge the gap between the present baseline and our envisioned benchmark within 5 years' time, we will identify, foster and exchange best practices from baseline to excellence; measure progress; arrange teachers' retreats; and ensure dissemination between partners and to society. One focus is to lift the pedagogical competence of the individual teachers from baseline to benchmark. Our benchmark is to lift 30% of the individual teachers to *Excellent Teaching Practitioner*<sup>10</sup> status within five years. Central to this process is the scholarly investigation of how local teaching and learning activities are related to students' learning processes and outcomes<sup>11</sup> (Huber and Morreale 2002). This will provide research-based knowledge of teaching and learning in the iEarth programmes. Also, mutual mentoring programmes for teachers will be implemented, improving pedagogic competences. Instrumental to the success of this objective is our (UiB's) collaboration with the Institute for Teaching Excellence and Faculty Development (TEFD) at UMass Amherst, with decades-long award-winning experience in this subject in

<sup>&</sup>lt;sup>9</sup> https://bergento.no/what-can-we-do-for-you/seminars/accel/

<sup>&</sup>lt;sup>10</sup> UiB central, as well as the faculty of mathematics and natural sciences, is in the process of establishing a reward system for excellence in teaching modeled on the Pedagogical Academy system of Lund University in Sweden. Similar initiatives are presently being discussed at several universities in Norway.

<sup>&</sup>lt;sup>11</sup> These types of investigations are internationally known as the Scholarship of Teaching and Learning (SoTL).



addition to SLATE at UiB. Teaching is not only an individual responsibility but also a team effort. To measure progress, we will develop and implement standardized evaluation methods (quantitative) and criteria. For this purpose, we will rely on digital close-ended polytomous surveys that can be compared between courses. To optimally gear the questions towards improving learning outcomes and gain research-based knowledge about what provides the best learning outcomes, we will fund two PhD projects in pedagogical sciences on devoted to pedagogical information science focusing on Technology Enhanced Learning (TEL). Finally, to streamline a cyclic evaluation process and ensure that clear cases of best practices are implemented across the curriculum, we intend to appoint a "head of assessment", which will alternate among the consortium partners. Our benchmark is to develop a more responsive system in which feedback is gathered systematically and used to inform decisions regarding improvement; one research focus in SLATE is on learning analytics, and in particular analytics on the curriculum level is relevant for iEarth.

**Key steps:** WP3.1 Identify, foster and exchange best practices through establishing a communication platform (virtual competence centre) that will be used to a) spread excellence through workshops (ripple effect); b) improve pedagogic competences through mentoring programmes; c) implement new reward systems; d) fund course-development fellowships; e) implement performance-based salary increments and f) secure the dissemination of results among partners and to the community in general.

WP3.2 Measure progress from baseline to benchmark through the development of evaluation tools using standardized methods and quantitative criteria: a) Design inter-comparable close-ended polytomous surveys; b) fund two pedagogic PhD projects to help ask the right questions in collaboration with SLATE and Department of pedagogics; c) enhance the focus on evaluation in higher education; d) complement traditional exams with alternative evaluation forms; e) emphasise student-led projects, presentations and problem; f) install a head of assessment to streamline the evaluation process (see also WP1); g) implement the identified cases of best practice department-wide and h) move from static to compulsory evaluation.

WP3.3 Evaluate internship program and innovation courses/programmes: a) Create a common framework for internships; b) prepare guidelines for student and mentors; c) continuous evaluation and improvement of curriculum and d) evaluate and further develop Student Accel innovation programmes (Brown and Kant 2009).

WP3.4 Create a *teachers retreat* each semester, serving as a communication platform in which experiencebased knowledge, as well as R&D knowledge from SoTL projects in geoscience, is shared and discussed within the team of iEarth teachers. The format and quality of the teachers retreat will mirror those of a research conference in order to signal the equal importance of teaching and research. We will collaborate with bioCEED on the format of these retreats.



Centres for Excellence in Education

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## **ABOUT THE CENTRE**

Name of Centre

Making a Difference with Education (MADE): Centre for excellent education in Global Health

Is the Centre already established at the time of the application (yes/no)?  $\Box$  Yes  $\boxtimes$  No

Please name any consortium partners for the Centre

1.School of Global Health, University of Copenhagen

2. Centre for the Science of Learning and Technology (SLATE), University of Bergen

3.DigUiB, University of Bergen

4. Faculty of Psychology (Department of Health Promotion and Development (HEMIL) and Department of Education), University of Bergen

#### ABSTRACT

Describe briefly the aims as well as the current and planned activities of the Centre (150 words)

Global health challenges are complex, changing, and affect large populations. Our vision is to provide excellent and innovative education in Global Health, thereby improving health for the world's poorer populations. Since 1990, the University of Bergen (UiB) has initiated Global Health education in collaboration with institutions in low income countries. While this education has, by all accounts, had a positive impact, we believe that it needs to be fundamentally re-thought, given the challenges we will meet in global health in the future.

We will: 1) Include topics reflecting current global challenges 2) Increase student involvement 3) Educate educators in new pedagogical skills 4) Increase our use of technology-based innovative teaching methods. With our collaborators, we are planning research projects to evaluate the impact of our innovations. Results will be disseminated throughout the network of Centre for International Health (UiB), locally, nationally and internationally and involve alumni and current students.

# Profile, vision and strategic anchoring

<u>The vision</u>: By transforming and enhancing teaching in Global Health, the proposed Centre for Excellent Education in Global Health will improve health for the poor populations in the world. The vision includes disseminating improvements in education to other faculties and universities in Bergen, Norway and worldwide.

Strategies: Education and research related to improving health and living conditions in low- and middleincome countries (LMIC) has been a strategic focus for the University of Bergen (UiB) since 1988. This was the background for establishing the Centre for International Health (CIH), which is the leading partner in this application. This focus was re-affirmed in UiB's strategy 2016-2022 (1,2). In 2016, UiB's University Board has decided that CIH will play a central role in the organisation of a new interdisciplinary network, "Global Challenges" (3). Beyond UiB, a national Norwegian report on health challenges (4) and health planning 2015-2018 (5) highlights Norway's important leadership role in global health; a role that is the responsibility of all institutions involved in health issues. A Lancet Commission Report (2013) underlined that investment in education is a critical aspect of investment in global health (7). In 2015, world leaders adopted the UN's Sustainable Development Goals (SDG). Together all nations will contribute to sustainable improvement of health in people living in regions where poverty, hunger and poor health are prevalent (6). Two SDG are particularly relevant for this application: SDG 3: Good health and well-being; SDG 4: Quality Education.

# a) Educational quality in existing provision

The Centre for International Health (CIH) collaborates with higher educational institutions in low- and middle income countries, other academic units at the Faculty of Medicine and Dentistry (MOF), as well as at other faculties at UiB (8). CIH also co-operates with the Department of Health Promotion and Development (HEMIL) at the Faculty of Psychology (FP) for parts of its courses. CIH staff and associated researchers are highly productive. The Centre hosts a Centre of Excellence (SFF) for "Intervention Science in Maternal and Child Health (CISMAC)"(9). MOF also hosts an SFF, "Centre for Cancer Biomarkers (CCBIO)"(10), with co-operating partners in LMIC, which is particularly relevant for oral sciences students. This high-quality academic environment permeates the research-based, educational activities at CIH, which are centred on a Master in Global Health. The Master programme is multidisciplinary, incorporating Epidemiology, Culture and Health, Ethics and Priority-setting, Health Economics, Psychology, Public Health and Social Science. The activities are well-integrated with other educational activities at MOF. In addition, CIH contributes to medical student training in Global Health.

Research and education at CIH are genuinely interdisciplinary. For example, the research group "Global Health Priorities" teaches medical ethics, health economics and priority setting with focus on applied analyses of health inequity and social justice. In 2012, its leader (OF Norheim) was awarded "best educator" by the MOF medical students, recognising both the importance of the topic and the way Norheim communicated with the students.

## The history of the global health education

About 1990, UiB started a Master in International Health at the Medical Faculty, a Master in Oral Sciences at the Faculty of Dentistry (11) and a Master at the Faculty of Psychology; all focusing on health problems in LMIC. CIH adapted the first curriculum for these studies from similar studies in Europe; adjusted to fit the competencies of the professors at CIH at the time. In 2015, CIH embarked on a revision process resulting in the merging of these into one Master in Global Health. In addition a Master in Global Development Theory and Practice is provided at HEMIL (12), who is partner of this proposal. The revision shifted the focus "from teaching to learning", according to the Norwegian Qualification Framework for Lifelong Learning to (13).

CIH became a member of a European educational network TropEd from its start in 1996, and has benefitted greatly from this co-operation. TropEd focuses on improving education in the area of global health for disadvantaged populations (14, 15). Most elective courses at CIH have been evaluated and accredited with the TropEd Standard Quality Framework (14). In 2016, CIH and TropEd partners in Scotland and The Netherlands received funding for an Erasmus+ project on educational co-operation. <u>Students:</u> Master students at CIH have primarily been doctors, nurses and allied health professionals working within academic institutions, the health system, Ministries of Health, NGO's and other organizations. The majority of participants come from LMIC, but also from Norway and other Western countries, and near to 100% have completed their studies. The TropEd network brings guest students from member countries for the TropEd accredited courses. The Norwegian Quota Scheme has funded a majority of the students, but is now being phased out. Recruitment, however, remains high. In 2015 CIH had 614 applicants for the 25 Master places, and similar figures were seen at HEMIL for its Master at Faculty of Psychology. At UiB, CIH and HEMIL together today have about 90 campus based Master students.

CIH/MOF also provides compulsory education in Global Health for all medical students at UiB, focusing on key health challenges and disaster-related health issues in LMIC. For the past five years, we have also offered an elective 10-week Global Health course to medical students, to stimulate their interest and knowledge in health in LMIC. The course includes an 8-week field stay in a LMIC facility, and is very popular among the students. Parts of the teaching of medical students and CIH Master programme are integrated.

<u>Staff:</u> Scientific staffs at CIH are highly competent. They are responsible for the teaching modules for Master and medical students. All teaching is research-based, and the elective courses reflect the specific competencies of the staff. In 2012 CIH received the UiB top teaching award, "Ugleprisen", recognising the importance of Global Health as a topic as well as the LMIC field-work, as a special learning opportunity for medical students. CIH administration has extensive experience in project- and educational management.

Teaching methods:

*Classroom teaching:* While originally highly conservative and lecture-based, teaching now incorporates newer teaching methods, such as individual assignments and discussion groups. We use a computer lab for statistical analysis training; scientific laboratories at the hospital/dental clinic for analytical skill development; and research seminar participation, for promoting academic communication skills. Teaching activities at HEMIL involve a particular emphasis on Problem Based Learning (PBL). *Field work:* The Master students undertake field work for their theses. As most of them come from LMIC, they perform the field work in their home countries. This includes interviews, surveys, clinical

examinations, observations, environmental measurements and focus groups. The field work is generally undertaken in co-operation with local supervisors and scientific staff at partner institutions. The medical students also perform field work during their visit in LMIC. They visit institutions/hospitals, and gather information about a given situation, which they then present when they return to CIH.

*Massive Open Online Course (MOOC):* In 2016, CIH's first MOOC – "Occupational Health in Developing Countries" was developed and run in cooperation with students and staff in Ethiopia and Tanzania (5 900 participants). It provided a framework for reaching a greater number of students, particularly for subjects where teaching resources are minimal or where there are geographical and economic issues (16).

*Evaluation of the teaching:* All teachers at CIH are dedicated to their teaching and have some type of evaluation with the students after ended courses; such as plenary discussion with the students. TropEd students evaluate the courses in the setting of TropEd when returning to their mother institution, and CIH courses always have high rankings.

International, multidisciplinary education

Four partner institutions are part of this application. They are institutions where CIH/MOF is involved in educational capacity-building. Representatives from these countries will participate in our planned Advisory Board. Ethiopia: There have been 30 years of collaboration with Addis Ababa University. Almost all of the many Master students have returned home and now serve in important leadership positions at health institutions, and ministry offices, or at health colleges or universities. CIH participates in four different Master programmes at Ethiopian universities. Tanzania: Since 1990 we have educated about 80 clinical specialists and PhDs in cooperation with Haukeland University Hospital and Muhimbili University of Health and Allied Sciences (MUHAS), Tanzania. We have been instrumental in establishing two Master programmes at MUHAS, resulting in the establishment of a new official profession (cadre) in the Ministry of Health system. Zambia: Fifteen years of partnership with the University of Zambia has resulted in outstanding educational developments and research activities with policy impacts (17). It has enabled the Department of Public Health to become a School of Public Health. The Democratic Republic of Congo (DRC) has major hunger and malnutrition problems but a limited pool of scientists and researchers in these areas. However, they are now being prioritised by the University of Kinshasa, which is promoting higher education and research in this field. In 2014, CIH established a Master degree in Nutritional Epidemiology here, in co-operation with the School of Public Health and PRONANUT (National Nutrition Programme, DRC).

## **Challenges - to make education excellent**

<u>Need for curriculum revision:</u> Global health problems are becoming increasingly complex, with unresolved issues in LMIC in severe poverty, hunger, infectious diseases, non-communicable diseases and health systems (6,7). In addition, we see increasing health problems due to large-scale migrations related to crises from war and climate change. The complexity of the problems requires innovative, multidisciplinary approaches to explore, transform and change existing education in Global Health. The complex needs were for instance clearly demonstrated in the latest Ebola outbreak (18). Successful innovation will require close co-operation with staff and students in LMIC.

<u>Need for increased student involvement:</u> Global issues involve awareness of cultural issues. Students from LMIC may not be used to being responsible for their own learning and teachers may not be well educated in student involvement methods. We need to address these issues to improve the quality of learning (13, 19-20). In addition, funding for students in global health has recently changed. As capacity-building with LMIC increases, we will be able to engage in more joint education initiatives with them as partner institutions enabling us to continue educating students from low-income countries.

<u>Need for new technology:</u> Global joint education initiatives will have greater requirements for innovative technologies (20). New technologies may also be used in on-campus teaching to increase flexibility (21). First, the educators must be educated in new technologies. Despite the widely-publicized growth of learning technologies, eLearning remains under-utilized in European higher education institutions in the area of global health education. A survey of TropEd alumni (22) found that virtual student mobility can enrich learning experiences, while also decreasing some of the challenges of physical mobility (travel expenses, logistics). Through eLearning we can cost-efficiently reach many more students than would be otherwise possible, thus contributing to the needs of geographically- and economically-disadvantaged learners.

<u>Need for better evaluation:</u> It is also important to assess our learning initiatives, especially in LMIC settings, and factors like costs and productivity must be included in the evaluation of higher education (23). Improving and systematising our learning assessment will make it possible to better monitor our teaching activities as well as to carry out more long-term evaluations (24,25).

# MADE – Making a Difference in Education

Candidates who complete the CIH Master Programme gain advanced knowledge of important global health and poverty related problems, as well as insight into interventions that promote health, prevent and control disease. As most students return home after graduating, the programme has a long-term impact on both health education and practice in LMIC. It makes a difference.

As global health challenges increase, the critical need for more Global Health graduates becomes pressing. This underlines the potential global impact of our programme. In addition, we intend to share our SFU experiences beyond the MADE consortium. We will exchange best practice input not only within CIH/MOF and HEMIL, but with other educational units at UiB, other institutions in Norway, Europe and other countries working with education in LMIC. CIH has a huge network and leads global health education activity in Northern Europe. This will enable MADE to impact a large number of institutions, scientists and scientific environments within global health.

# b) Centre plan

MADE will reform Global Health Education through a number of different but interlinked activities involving both Global Health Challenges and Research. These three are intrinsically linked (Fig. 1). The complementary competencies of the partners in the MADE consortium make it possible. Bi-directional north-south relationships are imperative to achieve excellence in these areas (Fig.2). Activity will be





organised in six work packages (WPs). The main focus of MADE will be on the Master programmes in Global Health/Development, and the integration with similar Master programmes in partner institutions.

#### The MADE consortium

At UiB, **CIH/MOF and FP** (Dept. of Health Promotion and Development; Dept. of Education) represent multi-disciplinary competency in global health challenges in

addition to well-established learning environments based on long-term partnerships with LMIC institutions. These units will be central for starting new education and implementing research related to this centre plan, with input from other partners. **The School of Global Health, University of Copenhagen** represents strong competence in integrating E-learning and ICT elements into campus courses. The school is developing online and blended learning courses in different formats. Centre for the Science of Learning

and Technology, **SLATE**, is capable of undertaking various analytic approaches for assessing learning initiatives. **DigUiB** has specialists in developing digital support solutions for education and communication. Together these partners will be able to develop new methods of teaching in the global health area. CIH has memorandums of understanding with the mentioned partners in **Ethiopia**, **Tanzania**, **Zambia** and **DRC** and they will be included in bilateral co-operation in MADE, by participation in workshops, scientific board and by implementing new educational methods within their own institutions.



Figure 2. Bilateral co-operation on higher quality and innovation in education, involving students and teachers.

## WP1: Comprehensive courses with thematic tracks

The existing course portfolio will be expanded, using elective courses, and changed to make it more comprehensive and to introduce the possibility of having four structured study tracks (Tab.1). Activities: i) An alumni study among former Master students at MOF and FP; performed by one scientific staff and

1	Mandatory core courses			
2	Global Medical Challenges	Odontology	Cultural dimensions of Global Health	Global Health Priorities
3 4	Field work and master thesis			

Table 1. Overview of the four semesters and four possiblestudy tracks of proposed Master in Global Health.

one administrative staff, in co-operation with a current student. Only very few alumni studies exist in the global health area (22) and even fewer in low income settings (26). Most of our former students come from developing countries. They will be contacted by mail or phone using a structured interview. The interview will be on the usefulness

of their study, related to their present work situation, and on their evaluation of the content of the study. This activity will inform about evolving demands from Global Health Challenges and be an engine for our conceptual framework (Fig. 1) Some of the participants will be selected to participate in a workshop in Bergen, as described in ii); and be able to give more detailed input.

ii) Workshops with staff and students from the four chosen African institutions and all staff at CIH / FP will be held regularly, to discuss the type of courses and needed content of courses in Master studies. Staff from different departments at MOF and FP involved in global health teaching will be invited to the workshops as well. The first workshop will also include selected international students from the alumni study. The workshops will be combined with activities in other work packages.

## WP2: Student involvement

Development of a more student-centred learning environment is necessary, as student activity enhances learning (27), and there is a need for optimal education in settings with small resources, as in LMIC. We will increase the use of student-active learning methods in global health education. We will, for instance, use Problem-Based Learning (PBL)(28) and case studies (29). The learning that results from the process promotes understanding of how problems can be resolved. HEMIL staff have applied PBL for more than 15 years (30), and will share this method to other educators. Case competitions is a related learning method, where interdisciplinary groups of students over 24 hours address a particular challenge defined primarily by a non-university partner e.g. an international humanitarian NGO, a UN organization or a privately owned hospital. The students will be trained in delivering solutions to real life challenges. This method has been used at the University of Copenhagen, and experiences will be shared with other consortium educators. Other methods can be answering questions in class using clickers, completing worksheet exercises, interactive quizzes, all of which are methods that impact learning (31). We will use this new knowledge to transform our existing educational approaches and to redesign our curriculums and methods for field-work follow-up. We also plan to evaluate the effect of transformed teaching methods.

Parts of the seminars described in WP1 will be used for this purpose; more active student learning methods.

Two students will be employed part-time (20%) throughout the whole centre period, and will actively participate in planning and evaluation. The students will be responsible for developing evaluation methods to be used both during courses and at the end of courses. Use of students as mentors and developers of small learning elements for peers and student presentations will also be included in the plans. Making students responsible and actively engaged in their educational community is based on a central pedagogical principle whereby a dialogue approach is seen as a co-operative activity involving respect. It is about recreating an open, "authority-free" space through "herrschaftsfreien" dialogue, a non-hierarchical discourse (32). It is important to develop consciousness to open up for action that is informed and thus can make a difference in the world; a focus of particular importance in educational activities related to global health. Similar thoughts are also reflected in newer literature (33).

## **WP3: Systematic education of educators**

Teaching will be transformed from an individual activity to a collective effort. We aim, thereby, to be able to better improve and measure achievement of learning objectives. In addition, we will increase transparency and openness and thus improve the teaching quality and enhance learning by creating an environment conducive to reflection and critical evaluation of one's own and ones' colleagues' teaching/facilitation of learning. All course leaders at CIH/HEMIL as well as those from partner universities will systematically evaluate and develop their own courses and teaching together with colleagues, and document changes in student evaluations and performance over time.

i) We will have quarterly seminars at UiB with all CIH/FP teachers; ii) We will have seminars with staff and students from partner countries twice a year, combined with the local UiB seminars. The educators will be taught new teaching methods by partners from FP and University of Copenhagen.

Every year, teachers will present a report to a panel of peers, where they reflect on what changes they have made to improve courses, teaching styles, student activities, learning materials, assessment methods based on the feedback from students, colleagues and active assistance from our proposed educational writer and video producer/web designer.

## WP4: Innovative modes of education

The use of technology-enhanced learning activities such as online- and blended learning (combine campus and on-line activity) can enable learning to be flexibly organized (34-35). In addition, online learning can

reach a larger number of students and increase co-operation with educators in LMIC. MADE will incorporate open educational resources or adapt open resources to become elements of existing curriculums, by integrating visual presentations, databases, key lectures, animated teaching aids, adaptive learning tutorials etc. Massive Open Online Courses (MOOCs) have been used for some time (36-38), and as this type of teaching may reach large numbers of students, also in countries with low levels of infrastructure and few educational institutions, the method is of interest. Few, if any, evaluations have been conducted concerning the use of MOOCs in LMIC settings (39), and we will contribute to alleviate this lack of knowledge. If these educational activities have effects, it can cause major changes in LMIC. We will: a) Design and develop new methods for learning activities and learning modules within existing curriculums. We will apply a range of eLearning methods to deliver the material and engage students in activities, and test out possibilities of, for instance 3D teaching; b) Investigate how eLearning can be certified and accredited in all universities involved (LMIC); c) Evaluate the effects and experiences of the new CIH MOOC; d) Develop and evaluate the effect of four nano-MOOCs over the five-year period. MADE will employ a video producer/web designer (100%) and use the competence from partners in Copenhagen, DIGUiB and SLATE for this WP.

# WP5: Dissemination of educational principles and experience

Disseminating the new education and educational practice knowledge and experience will be a key objective for MADE. We will organise annual seminars in Bergen with all LMIC partners and invite all interested educators at UiB to share and discuss educational practice.

Four educational PhD projects are suggested:

a) MOOCs an nano-MOOCs in developing countries; b) Flipped classroom teaching in multicultural settings; c) Learning from case-studies in global health settings; d) Active learning in global health. These PhD-candidates will be supervised by Professors Gray/Daniel from FP, as well as by Professor Konradsen from Copenhagen and Professor Wasson from SLATE. In addition, we will disseminate educational experiences by publishing at least one scientific article annually.

The project will use social media actively as part of their communication strategy, engaging both students and staff in collaborating groups. Further networking opportunities include the "Norwegian Forum for Global Health Research", where CIH plays a leading role, and The European Network TropEd and European centre for expertise, networking and resources in the internationalisation of higher education (EAIE), where CIH is on the board. Results from MADE will be disseminated at annual seminars in these networks, reaching most educators in global health education in Norway and Europe; as well as other countries world-wide. MADE will employ an educational writer (100%).

## WP6: MADE management

MADE will be based on a consortium agreement. It will be managed by a **leader group** headed by the **Centre Leader** (UiB, Robberstad, 50%), and including the Head of CIH (Moen, 20%), one CIH professor (20% Hinderaker) and one administrator (100%); responsible for day-to-day activities, fostering contact with WP leaders by regular meetings, and monitoring progress and reporting. Each **WP** will be led by an academic staff member (50%) to develop and manage the specific educational activities. MADE will be governed by a **Steering Group** of 7 representatives (2 students, 1 CIH, 1 FP, 2 other partners and chaired by MOF dean). The steering group will monitor the finances and the progress of MADE, and ensure that our activities are tailored and managed to meet objectives. The steering group will convene at least twice annually. An **Advisory Committee** with members from all partners; staff and student representatives, as well as international educational experts, will meet annually to advice MADE on matters regarding educational strategies and dissemination. The AC will be chaired by UiB Vice Rector for Internationalization.

# Summary

**Innovation:** New modes of blended learning using online technology will be developed and evaluated in the area of Global Health. Student involvement in global health education will be increased and evaluated, and focus also on aligning student achievement with learning aims and outcomes (Fig.1). Both topics are unexplored territory in LMIC settings.

**Evaluation and impact framework:** MADE will plan all activities on an annual basis. These will be an organisation involving day-to-day leadership, regular meetings with WP-leaders and associated staff from other units, quarterly meetings with staff and students, seminars and meetings twice a year with African partners and the Advisory Board and two annual meetings of the Steering Group. The Steering Group will evaluate the activities and outcomes and control budgets. The plan is to develop a new framework for global health education that will be sustainable when the project period is over.

**Impact and dissemination:** MADE will ensure the best practice developed in the SFU is disseminated to all units working with LMIC at MOF, FP and UiB, as well as nationally and internationally through CIH's large, existing networks. There will be four PhD projects. The work will improve education in Global Health and will, in turn, make a difference for the health of the poorer populations in the world.

# COMMENTS

[Body text (150 words)]



# **INFORMATION ABOUT THE HOST INSTITUTION**

Host institution University of Oslo		
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Postal code 0316	City Oslo	Place [text]
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# **CONTACT PERSON**

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# ABOUT THE CENTRE

Name of Centre

alt C - Advanced Learning Technology Centre

Is the Centre already established at the time of the application (yes/no)?  $\hfill Yes \ensuremath{\boxtimes} No$ 

Please name any consortium partners for the Centre

Faculty of medicine, UiO - Centre of Educational Measurement at the Faculty of Education, UiO - Academic



Development Group at the Faculty of Education, UiO – Prof Bernhard Veldkamp, University of Twente, The Netherlands – Dr Simon Kitto, University of Ottawa, Canada

# ABSTRACT

Describe briefly the aims as well as the current and planned activities of the Centre (150 words)

In a world of globalisation, environmental and demographic challenges, and rapid technological development, lifelong learning is a necessity. Optimal learning requires relevant information, self-regulated learners who plan and regulate their own learning, and efficient and effective methods of instruction. Lifelong learning starts at home, continues as formal education and gradually becomes personalised and unlimited by time and space. In this context, computer assisted instruction (CAI) is an invaluable tool; however, most CAIs have a one-size-fits-all design. This SFU will turn CAI in health sciences into personalised intelligent tutoring systems (ITSs) that measure learning needs, methods, progress and a) provide efficient learning through adaptive testing and personalised feedback, b) teach learners to become self-regulated, and c) provide knowledge tailored to the learners' individual needs. This will be accomplished through research-based development of ITSs in collaboration with students and teachers. An open access ITS for teaching these methods will finally be developed.



# **APPLICATION DOCUMENT**

The application must be written in English and follow the requirements set in this template. It must not contain more than 10 pages in Times New Roman, 12-point types, with lines spaced 1.5 and margins of 2 cm. Within this format, the applicant must provide:

#### a) Documentation of educational quality in existing provision

The applicant must comment and critically reflect on themes and questions set out in the criteria, and compare their existing provision with similar provision within the same subject/discipline area, both nationally and internationally. Through this, the applicant must document that the academic community qualifies as a Centre for Excellence in Education.

#### b) A centre plan

The applicant must comment and critically reflect on themes and questions set out in the criteria. The Centre Plan must outline the vision of the Centre, its strategy and plans. It must present the plans for the dissemination of knowledge and practices to its own institution(s) and to other educational communities as well as an evaluation and impact framework.

## **Appendices**

The following appendices must be included (and no other):

- 1. A list of references
- 2. A budget for the Centre for the first five-year period, including motivation for costs (see guidelines at <u>www.nokut.no/SFU/utlysninger</u>)
- 3. An action plan for the Centre, including milestones (no more than three pages)
- 4. CVs of the proposed Centre Leader and two to five key members of the Centre team (each CV must not exceed two pages)

All appendices must be in English.

## **Practical information**

The rector of the host institution must sign the application.

The deadline for submitting applications is set in the announcement of the call.

All applications will be published on the NOKUT website, alongside the expert panel's feedback.

# **APPLICATION DOCUMENT**

# Introduction

The Centre's main goal is to develop methods for lifelong learning in health professionals through adaptive evidence- and computer-based teaching, personalised feedback and self-regulated learning. We understand lifelong learning as the ever-present professional challenge (and commitment) to update one's own competences and, if necessary, adjust the acquisition of skills and knowledge. Consequently, successful lifelong learners are proficient, self-regulating learners. The Centre will develop and embed methods to foster self-regulated learning into the computer-based learning environments. In addition, the need for learning does not cease to exist on entering the professional field: Learning is neither bound to a specific time nor to location. Therefore, the Centre will focus its research and development on technology-aided learning environments that offer evidence-based adaptive teaching in informal as well as in formal contexts; that is, in higher education as well as in professional practice, in "off-campus" and "on-campus" learning. Technology based learning environments have the potential to bridge the gap between "school" and "profession" by addressing individual learners' needs. The use of state-of-the-art technology is a necessary prerequisite for moving from a one-size-fits-all instructional approach to a truly personalised, immersive way of continuing education throughout a professional career.

Lifelong learning health professionals play a key role in building a sustainable and efficient healthcare system. Updating knowledge becomes a pivotal activity as the volume of scientific evidence in healthcare is growing rapidly: The *Medline* database lists approximately 22 million publications in the biomedical sciences, while 2,000-4,000 references are added each day. In order to significantly improve the healthcare system, this knowledge has to be translated into everyday clinical practice. Such translation of knowledge, as all learning, will be most effective when tailored to the learner's individual needs. Formative computerised adaptive tests (CATs) are especially well suited for the purpose of identifying knowledge gaps and at the same time providing appropriate personalised feedback in order to update knowledge and refine skills.

In summary, the SFU will take recent developments in personalised instruction, computerised adaptive assessment, and intelligent tutoring systems to the next level and, at the same time, facilitate the use and application of scientific evidence within both educational and clinical practice.

# Consortium

*The Faculty of medicine (FOM), University of Oslo (UiO)* is the host institution. FOM has 1,200 medical students and 900 students spread across nine master programmes; e.g., nutrition,

interdisciplinary health, nursing science, nurse practitioner in geriatrics, health economy and management, and international community health. Around 1,400 students are currently enrolled in our PhD-programme. In 2016, FOM launched Norway's first postdoctoral programme.

FOM's teaching and research cover a wide area, from basic biomedicine to health management and leadership. Our policy is to offer the best possible research-based education. In a recent international evaluation of biomedical research in Norway, organised by the Research Council of Norway, the leading research areas and groups at FOM were evaluated as world-class.

Oslo University Hospital (OUS) is an important collaborator in research and education. OUS is Norway's largest hospital with more than 20,000 employees and 1 million patient encounters annually. The collaboration with Oslo City Council is equally important, especially, since FOM is revising its medical education aiming to prepare future doctors for community-based services including age care and geriatrics.

FOM has established an R&D Centre for Health Sciences Education in response to the growing need for educational R&D benefitting medical programmes nationally and internationally. For more information, see the <u>web site</u>.

*The Faculty of Educational Sciences, University of Oslo* is one of the largest institutions dedicated to educational research in Europe and the largest one in Norway. The faculty comprises three departments and two centres (CEMO and ProTed) and an Academic Development Group (ADG). CEMO and ADG are partners of this SFU.

*Centre of Educational Measurement, University of Oslo (CEMO)* is an international research unit which conducts basic research in educational measurement and applied research in higher education. CEMO develops national competence by disseminating knowledge about educational measurement to stakeholders and teaching Master and PhD students. Two years ago, FOM and CEMO started a close collaboration on the use of psychometric methods in computer assisted learning and digital exams.

*The Academic Development Group, University of Oslo (ADG)* performs research in higher education, provides training courses in university pedagogy for all new academic staff at UiO, and counselling and consultation on quality of education. For three decades, the collaboration between FOM and ADG has proved successful and was of special importance when problem-based learning (PBL) was introduced in medical education, twenty years ago. ADG's research on life-long learning is particularly important for the SFU.

*International collaboration:* Two internationally renowned scientists have accepted 10% research positions at the SFU. In psychometrics and formative assessments: Professor Bernard

Veldkamp, Head of Department of Research Methodology, Measurement and Data Analysis, Faculty of Behavioural Managerial and Social Sciences, University of Twente, The Netherlands. In interprofessional education: Associate Professor Simon Kitto, Department of Innovation in Medical Education, Director of CPD research, Faculty of Medicine, University of Ottawa, Assistant Professor, Department of Surgery, Faculty of Medicine, University of Toronto, Canada.

# **Organisation: Steering and Leadership**

*The steering group* will consist of the deans or vice deans from the Faculty of Educational Sciences (chair) and FOM, the leader of CEMO, and the leaders of the two student organisations at FOM. The steering group will decide on R&D and allocate resources to the Centre.

*The operational leader group* will consist of the Centre leader Professor Kristin Heggen (FOM) and Professor Per Grøttum (FOM).

*The scientific advisory board* (SAB) will consist of: 1) Professor Roger Azevedo, Human Factors and Ergonomics, Department of Psychology; Leader of Chancellor's Faculty Excellence Programme cluster in Digital Transformation of Education, North Carolina State University, USA, 2) Professor Sari Lindblom-Ylänne, Director, Centre for Research and Development of Higher Education, Institute of Behavioural Sciences; Vice-Dean, Faculty of Behavioural Sciences; Director of PsyCo (Psychology, Learning and Communication) doctoral programme, University of Helsinki, Finland, 3) Professor Carolin Strobl, Head of research unit, Department of Psychology, Psychological Methods, Evaluation and Statistics, University of Zürich, Switzerland.

The function of the SAB will be providing feedback on the R&D programme, and offering an international perspective on the educational innovations and strategies for dissemination.

# Documentation of educational quality in existing provision

## **Input factors**

In the last five years, FOM has made education a strategic priority. Educational leadership has been strengthened and for the first time FOM has two deans of education and one educational leader/professor at each of the three institutes. The <u>Centre for Health Sciences Education</u> has been established. A considerable increase in financial assistance has been made available for the development of e-learning and digital exams; (In 2016 professor Per Grøttum won <u>The Olav Thon</u> <u>award</u> for innovation in computer assisted instruction). On behalf of the four Norwegian medical schools, FOM took the lead in the development of an open access <u>national e-learning portfolio</u>, (which has proved to be of special importance for less developed countries).

The Quality Assurance System is an important element in the efforts aimed at fulfilling the

ambitions and objectives set for education at FOM. Faculty procedures descriptions are based on the UiO's System Description, and are an integral part of the work of education, quality improvement and quality assurance at all levels.

*Staff:* The best research groups at the faculty have been graded "very good" and "excellent" by international expert panels in evaluations, and FOM has been granted four Centres of Excellence, of which three are still running.

*Applicants:* In 2016, the Professional programme of Medicine has the highest relative number of first priority applicants of the four medical faculties in Norway (8.8 in Oslo; NTNU came second with 5.9). Six of FOM's nine MA-programmes have high/very high numbers of applicants.

*Learning arenas off-campus:* The faculty has a well-developed network and cooperation with several stakeholders: the tertiary university hospitals, local hospitals, medical centres with general practitioners, health centres, nursing homes, etc.

#### **Process factors**

FOM's teaching takes place in an outstanding research environment. Learning spaces are deliberately created to bring teachers and students together to foster critical reflection and societal engagement. Likewise, FOM is continuously revising the programmes, catering to the requirements and expectations of the patients and the society as a whole. One outstanding example is the ongoing competency-based revision of the medical curriculum with an increased emphasis on community-based healthcare, public health, clinical skills, global health issues, and varied student-activating learning methods. The revised curriculum focusses on coherence among expected learning outcomes, teaching methods and assessment. The Centre for Health Sciences Education will monitor and evaluate the revised curriculum. The Centre will also assist in improving performance in the MA-programmes. FOM's collaboration with ADG will, as before, be of great importance for improvements of educational quality.

*National test:* FOM heads the work of developing and implementing a <u>national test</u> for all medical students in Norway.

*Students' practical experience with research:* FOM facilitates student research through "Forskerlinjen", which is a one-year programme specially designed for medical students who are interested in research or contemplate a research career. About 1/3 of these students enroll in a PhD programme. Most students participate in the teacher's/supervisor's research projects, in all MA-programmes of FOM.

#### **Result factors**

The Ministry of Education and Research (NOKUT) granted FOM the most prestigious national

award for educational quality three times, and on all three occasions FOM won the first prize; in 2001, for its innovative revision of medical education with problem-based learning (PBL); in 2010, for integration of students in the Master of International Community Health programme into the teachers' research projects; and in 2011, for innovative research inspired pedagogy in the MPhil in Health Sciences programme.

The most valid comparisons (bench marking) between our programmes and similar international programmes are: 1) Over a decade ago, medical students at FOM were offered a six month (one semester) training and clinical practice at a top international medical school. Comparisons between quality and structure of the curriculums and mutual site visits were made, followed by a three-year pilot with overwhelmingly positive results. The <u>international semester</u> was made permanent in 2005. 2) FOM benefits from a similar comparison between universities in an interdisciplinary <u>MA-programme</u>, offered jointly by four leading European universities (Rotterdam, Innsbruck, Bologna, and Oslo). The accreditation process was particularly thorough and confirmed that FOM is in the European forefront in this discipline. This programme integrates students in research projects and offers internship in international organisations (e.g., World Health Organisation). 3) This spring, the Nurse Practitioner (NP) Degree Programme in Geriatrics has qualified for a student and teacher exchange programme with the prestigious John Hopkins University.

# **Centre plan**

FOM generally shares the Lancet commission's stance that good "professional education programmes mobilise all learning channels to their full potential: didactic faculty lectures, small student learning groups, team-based education, early patient or population exposure, different worksite training bases, longitudinal relationship with patients and communities, and the use of IT" [1]. SFU's aim is to develop and implement information and communication technologies (ICTs) that support and strengthen this vision of education in an evidence-based way.

## Strategy

SFUs activities are characterised by a dual strategy: the provision of a generic ICT framework – a possibly globally operational toolkit - is of equal importance as the overarching objective of fostering prerequisites for lifelong learning on a local level. This strategy ensures that all developments are built with the aim of *scalability*; while developed at FOM with its unique educational environment, they will be adaptable to any other learning scenario. The use of the developed materials, services, and their underlying technology will be open to students, teachers, and staff from other institutions. Hence, SFU facilitates the "creative adaptation of global resources to address local priorities" [1]. Furthermore, supporting the utility and effectiveness of the

developed solutions by empirical evidence will be an integral part of SFU's endeavour.

# Innovation

ICT will function as the foundation for achieving SFU's specific objectives. These objectives are: utilizing the power of personalised feedback (WP1), facilitating and fostering self-regulation (WP2), adapting instruction to students learning needs (WP3), supporting teachers in ongoing supervision (WP4), teaching interdisciplinary practice (WP4), and facilitating evidence based clinical decision making (WP5). With respect to a potential continuation after the first five years, SFU will use the accumulated insights to bring adaptive instruction to the group level and to provide contextualised, intelligent support systems for knowledge translation (WP6+7). In order to achieve these goals, students will participate in development and research activities (cf. "Student Involvement"). These objectives strengthen each other, and their implementation in the educational environment will enrich the latter significantly.

# Impact and Evaluation

SFU's approach is to include all stakeholders in the efforts to achieve its mission. Students will benefit from their participation in the Centre's research and development activities but also from the developed learning environments. SFU will function as a catalyst of best educational practices within FOM and in a broader context (nationally and internationally). The long-term success of the Centre's activities will be evaluated on different scales such as actual usage rates, adaption to other subjects and institutions, but also with respect to outcomes of the research, the number and impact of publications, and the potential for applying for further funding for related endeavours. Structurally, SFU will work in close collaboration with the relevant departments at FOM, notably, the Centre for Health Science Education. ADG and CEMO will incorporate the methodological knowledge gained from the SFU into their permanent educational activities. All these efforts will ensure sustainability and availability of the developed resources far beyond the five-year period of financial support.

# Work packages

# WP 1 Adaptive assessment for learning



The main purpose of this WP is to develop a computerised adaptive formative test (CAFT) which can be used to guide personalised feedback, teaching and learning. In a computerised adaptive test (CAT), the respondent is presented with items that best fit their ability level [2]. This not only results in reduced test length, increased accuracy, but also has the advantage of selecting items whose difficulty are optimally compatible with the respondent's ability level (see figure). For feedback to reach its full formative potential, it should be tailored to the learner's current ability level, and become increasingly elaborate in an interactive and iterative manner [3–5].

Such a CAFT will be accomplished through a) a Bayesian item bank and CAT that will measure learners' ability/content knowledge, b) elaborate feedback that is tailored to the learner's current ability level, and becomes increasingly elaborate in an interactive and iterative manner, c) new item selection methods that optimise learning gain as well as psychometric models that take the effects of the guided learning process into account, d) a Bayesian CAFT focussed on mastery and learning using results from steps a-c. e) a blue-print for developing a Bayesian CAFT.

# WP 2 Taking real-time adaptation to the next level: Developing a medical Intelligent Tutoring System promoting self-regulated learning

The purpose of this WP is to develop an intelligent tutoring system (ITS) that will a) measure the extent and characteristics of self-regulated learning (SRL) that the student shows when working with digital learning resources in a medical study programme, and b) based on these measurements provide personalised guidance on how to become a more self-regulated learner.

The first task will be to define hypothetically good and applicable models of factors governing SLR development and models of the SLR process itself. Abundant literature is available [6–10]. Secondly, methods to record and measure model variables will be developed; e.g., clustering techniques and sequence analysis [11]. Subsequently, heuristics must be developed to translate the measurements into interventions; e.g., prompting, metacognitive scaffolding, feedback. The work will be an iterative process of theoretical development, technical implementation, evaluation in pilot studies with on-campus health science students. Finally, the results will be disseminated by constructing an open access ITS to teach about the developed methods.

# WP 3 The proof of the pudding: Evaluation of an Intelligent Tutoring System combining adaptive testing and SLR-fostering in medical education

The purpose of this WP is to a) merge the results of WP1 and WP2 with existing e-learning systems in medicine into intelligent tutoring systems (ITS), and b) evaluate their effect on knowledge building, retention and SLR development in case-control studies with medical students.

This will be accomplished by selecting at least two comprehensive well-functioning e-learning packages from the large collection that FOM has built, modify the contents to make use of the methods developed for adaptive testing in WP1 and for fostering SLR in WP2, re-implement the

systems with analytic capabilities and adaptive interventions, and perform full scale case-control studies in classes of medical students. Pre- and post-tests will be used to measure effects on learning and SLR, and long-time retention will be assessed. The relevance and usefulness of the ITS, which also determines experimental compliance, will be secured by employing and involving students and teachers both in the ITS design, (e.g., formulation of goals, feedbacks and interventions, layout), and in the integration of the ITS in the running education.

#### WP 4 Reaching out: MOOCs in Clinical examination of geriatric patients and Clinical teaching

The purpose if this WP is to implement the results of WP1 and WP2; i.e., adaptive testing and training of self-regulated learning, into existing Massive open online courses (MOOC). The interventions will then be modified to work specifically in interdisciplinary learning and off-campus learning. As preparatory efforts, development of the following two MOOCs will start in 2016 as activities independent of the SFU:

*Clinical examination of geriatric patients.* The MOOC provides interdisciplinary training of clinical examination for students in medicine and the master nurse practitioner programme before they go on clinical rotations in nursing homes and primary healthcare .

*Clinical teaching during rotation.* The MOOC targets teachers in clinical placement and focusses on pedagogical training, feedback to students, and handling of students with academic or personal difficulties. The arenas will be general practice, local hospitals, nursing homes and psychiatry for medical students, and nursing homes for master students in the nurse practitioner programme and the clinical nutrition programme.

## WP 5 From bench to bed: Knowledge translation (KT)

The purpose of this WP is to develop an e-learning programme that teaches students and professionals how to combine scientific evidence, clinical expertise and patient preferences. Based on testing of the programme, the KT tool will be modified to work specifically in interdisciplinary and off-campus learning.

This WP requires in-depth insights about the nature, sources and limits of knowledge as well as the policies regarding evidence based medicine (EBM). Currently, insights about clinical judgment are largely neglected in EBM, while it plays an important role when basing clinical decisions on research evidence.

Clarifications of the theoretical underpinnings related to KT are already published [12, 13], and will be continued and accompanied with insights about e-learning as a training tool, when it comes to communication of interpretive clinical skills.

The first piloting of a theoretical dynamic model is tested on medical students with promising

results. In 2019 the development of e-learning will be intensified with student involvement. The next step is individual testing on students in academic as well as clinical contexts. Lastly: testing on interdisciplinary groups, necessary modifications and open access publication.

## WP 6 Lost in translation? Adaptive KT

This WP is scheduled for the second five-year period, and for this reason we now only present the problem and not details on how it may be approached. It will later be split into more WPs.

In the first five- year period, emphasis was placed on optimal learning of a given material, a typical situation in formal education. In life-long learning, the learning needs (goals) will eventually be highly variable and situated, i.e., dependent on the situation the learner is in. For optimal learning to take place, one must know the problem or knowledge requirements that the situation poses, the best available knowledge on the problem, and the current knowledge of the learner. The aim of the instruction is now to identify and fill the knowledge gap. The knowledge requirements of the situation may not be evident or well-articulated by the learner, but may at least in part have to be derived from other sources; e.g., knowledge about the typical patient population in a nursing home. At the research front, the best available knowledge must sometimes be extracted from an overwhelming amount of diverging research literature, which uses terms and concepts with which the learner may be unfamiliar. The "differentiating" process thus poses challenges both with measurements and knowledge translation. Solving these problems will be the goal of this WP.

## WP 7 Together we are dynamite: collaborative learning

This WP is scheduled for the second five-year period, and for this reason we now only present the problem and not details on how it may be approached. It will later be split into more WPs.

In the first five-year period, emphasis was placed on individual learning processes. This WP will explore *collaborative* learning with ITSs. Learning goals in a collaborative setting maybe quite variable. In a nursing home with a small staff on rotation, the least knowledgeable person may represent the biggest risk and problem. The primary aim of the instruction will then be using collaborative effort to lift the knowledge bottom. In a multidisciplinary environment like a hospital, the goal may be to achieve the best possible integrated performance of a large team. The different professionals may have the same goal with respect to SRL, but very profession-specific knowledge goals. Both situations introduce a new instructional intervention: the work team. The challenge will be to understand and use the possibilities for interplay between the ITSs and the work team individually and as a whole, and for using the ITS to trigger activities within the team and thus achieve secondary effects. The study and use of these mechanisms will be the subject of WP7.

#### Student involvement

The Faculty of Medicine has a long history of involving students at all levels of the educational environment: skills lab instructors, mentors for fellow students, reviewers of exam questions, presenters of educational studies at conferences, members of committees on educational issues. As an example, FOM is now introducing skills training in diagnostic ultrasound and has recruited and will train a dozen students to become instructors. The students are simultaneously invited to write student papers on ultrasound education. Another example is the pre-exam quality assurance process, where senior students appointed by the student organisations read and comment on all exam questions. Of particular interest to the SFU is the 15-year long practice of involving students both in the development and assessment of e-learning resources. The typical e-learning project team consists of teachers, hired students, and experts in IT and pedagogy. In these projects students usually play a very active and innovative role in the selection and production of material, pedagogical approach and user interface design. Many extend the practical work to conduct student projects on, e.g., the evaluation of learning outcome or compliance of the e-learning resource. A few enter into year-long engagements with FOM as specialist developers, e.g., with programming, animation or as subject experts. FOM annually spends € 150,000 on grants to e-learning projects, much of which goes to student salaries.

Against this background, it is only natural to continue actively involving students in building the best possible educational environment. Students will participate in the SFU in three specific roles, essentially applicable to all WPs: As *experts* on their own educational environment, when they participate in development and evaluation of the ITSs. As consultant/developers they will be included actively into the process of creating instructional resources. As researchers they will get the opportunity to participate in research; e.g., as part of their mandatory student projects.

#### Dissemination

Theoretical findings, methods and software will be presented at scientific conferences, published in journals, and made available to health professionals through workshops, courses and consulting services offered by ADG and CEMO. ADG is currently transforming its introductory courses in pedagogy for academic staff to an e-learning resource available throughout Norway. Methods to foster self-regulated learning will complement this resource. CEMO and FOM have applied for a grant to turn the tools we use for psychometric analysis of digital exams at FOM into an open access web-based analysis service and an on-line course about test analysis. The software and methods for adaptive learning (i.e., formative test analysis) will enhance the value of this package. The ITSs in health science will be available at no cost through the national portal <u>elæringhelse.no</u> and the MOOC.



# **COMMENTS**

[Body text (150 words)]



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# **ABOUT THE CENTRE**

 Name of Centre

 C3E - Centre for Excellence in Entrepreneurship Education

 Is the Centre already established at the time of the application (yes/no)?

 □ Yes

 □ Yes

 □ Please name any consortium partners for the Centre

 The Norwegian University of Life Sciences (NMBU)



# ABSTRACT

Gründerskolen is an *inter-university* collaboration between all the universities in Norway, coordinated by the Centre for Entrepreneurship at the University of Oslo. Gründerskolen exposes the most motivated students to *internship practice in an international entrepreneurial context*. We do so in close collaboration with the trade offices of Norwegian embassies/consulates abroad, embracing global hotspots like Silicon Valley and Singapore as exemplars. However, time has come to direct our practice-based entrepreneurial educational competence to the life science/ICT ecosystems in the Oslo region. The aim for this centre is to establish pedagogy and learning environment (meeting places and arenas) that in the best possible ways prepare and integrate students with the existing and growing initiatives in the ecosystem. It means to raise *awareness*, and develop *entrepreneurial competence* in accordance with the European/Norwegian Qualification Framework. Such a *joint educational centre effort* qualitatively and quantitatively distinguishes the proposed entrepreneurship centre from more independent centre initiatives.


## **APPLICATION DOCUMENT**

#### 1. Existing programme structure and courses

The <u>existing provisions</u> consist of three programmes in entrepreneurship: 1) Gründerskolen, 2) Master programmes in entrepreneurship, and 3) a broadly scoped elective course for BSc students.

#### 1.1 Gründerskolen – A practice based national programme in global entrepreneurship

Gründerskolen is an inter-university collaboration between all the universities in Norway, coordinated by the Centre for Entrepreneurship (SFE) at the University of Oslo (UiO). The programme is open to all students from all disciplines. The aim of the programme is to enhance the employability of students by providing them with real-life entrepreneurial learning and cross-cultural understanding from the world's most vibrant innovation hotspots. The main part of the programme abroad is a 12-week internship, where the students work full time in start-up companies and follow *tailored* entrepreneurship programmes at a local university. Before the internship, the students complete a full introductory course in entrepreneurship at their home university, and a preparatory course on cross-cultural understanding.

The programme has grown considerably in terms of student numbers and national and international partners. Starting out with six students in Silicon Valley in 1999, the programme now includes 170-180 students annually with internships offered at innovation hotspots globally covering San Francisco (UC Berkeley-45), Boston (Boston University-40), Singapore (National University of Singapore-24), Houston (Rice University-22), Cape Town (University of Cape Town-22) and Oslo (University of Oslo - 20); university partner and number of 2015 students shown in brackets.

The programme (30 ETCS) is an integrated part of other high quality master programmes in Norway. It includes faculty collaboration with universities globally, and the programme is well integrated with Innovation Norway's trade offices and their industrial networks abroad. The Norwegian University of Life Sciences (NMBU) is today the largest partner in Gründerskolen and has integrated this programme as part of its dedicated master programme (120 ECTS) in entrepreneurship and innovation.

The Gründerskolen programme has already been awarded three quality prizes. In 2006, GS was named 'Best Learning Environment' at UiO. In 2007, the programme was given a prize by the Norwegian Agency for Quality Assurance in Education, which emphasized the thorough planning and execution of the stay abroad, and the programme won the 'Best Service Provider' award from the Nordic StartUp Awards in 2012. In 2015, 92.6% of responding students found the programme satisfying or highly satisfying, and 94.0% said that they would recommend the programme to other students. Some of the positive outcomes highlighted by former students include the experience of personal growth from having dealt with many challenges in a more entrepreneurial and international



context and the new network of highly competent entrepreneurial people, as stated in the following quotes:

"Can we do this programme twice? | Absolutely fantastic programme. You are doing a great job, keep it up! | Very good teaching programme! A+ | Gründerskolen has changed my life | Excellent, I am very happy I did this! | Gründerskolen is a fantastic programme and is the best way to learn entrepreneurship | Gründerskolen is my best investment ever."

**1.2 MSc Programmes in Innovation and Entrepreneurship at UiO and NMBU -** Both NMBU and UiO have master programmes in Innovation and Entrepreneurship (involving approx. 40 students) and both programmes have a ten-year track record.

**1.3 Broadly based course modules for BSc students -** NMBU and UiO also each have one <u>elective</u> course offered to all students. The BSc course components certainly need to be further strengthened – we will address this broad challenge in more detail later.

## 2. Availability of critical input factors

**2.1** Academic faculties with a broad background in entrepreneurship - The <u>Centre for</u> <u>Entrepreneurship</u> (SFE) at UiO, and the <u>School of Business and Economics</u> (SBE) at NMBU have core faculties with both academic and practitioner backgrounds from real-life entrepreneurial practice. SFE has two full time faculty positions, currently four PhD research fellows, and 15 practice-based adjunct professors who cover various industrial fields. SBE has two full time faculty positions, currently one PhD research fellow and one practice-based university lecturer. Both units have close and ongoing collaboration with the pedagogical faculty at their respective institutions. In addition, we may draw on the flexible faculty of the executive education programme at the Department of Informatics, UiO. Moreover, we also collaborate with the Centre for Technology, Innovation and Culture, UiO.

**2.2 Extensive experience in entrepreneurship education under very diverse conditions** – Gründerskolen (UiO) has for more than 15 years developed pedagogy that facilitates entrepreneurial competence building in a cross cultural context, now covering North America, Europe, Africa and Asia. NMBU has for more than 10 years developed entrepreneurial learning pedagogy that embraces students with a wide variety of disciplinary backgrounds, including veterinary science, food science, biotechnology, renewable energy, nursing and economics. In a national perspective, this track record and experience base is unique.

### 2.2 Innovation and entrepreneurship - a strong and growing focus at both UiO and NMBU

This is perhaps best illustrated by the fact that the Vice Rector of UiO has taken on the responsibility for innovation, and the emerging innovation focus at the faculty level, best exemplified with twenty-four *newly created* PhD research fellow positions at UiO targeted towards innovation. As part of this, two task



forces on innovation and entrepreneurship have been launched (one at the university level, initiated by Vice Rector Knut Fægri, and the other at the Department of Informatics, initiated by Head of Department Knut Liestøl), both task forces being led by Nils D. Christophersen; SFE is strongly represented and well aligned. We also see significant initiatives within the life sciences and ICT at both UiO and NMBU to improve collaboration across the R&D and commercial interface. The current life sciences initiative represents the largest initiative in the history of UiO. Similarly, NMBU has devised an innovation and value creation strategy that integrates research and education for joint value creation focusing on a greener economy.

### 2.3 Close vicinity to R&D institutions and industrial clusters of international calibre

The Oslo region hosts both strong research clusters and industrial clusters of international calibre and is the only region in Norway where such milieus are co-located. The Oslo Region is home to Norway's largest research cluster including the University of Oslo, Oslo University Hospital, the Norwegian University of Life Sciences, Simula Research Laboratories, SINTEF and others. Both SFE and NMBU have long term collaboration with these partners with regard to educational design. In total, these institutions host 12 out of the nation's 21 centres of excellence, 10 of them at UiO and one at NMBU. Within life sciences, natural sciences and information technology, the region hosts eight centres of excellence and six centres of research-based innovation. UiO and NMBU have about 3000 and 500 PhD students, respectively. Furthermore, the greater Oslo region also hosts industrial clusters of international quality within several knowledge-based industries such as ICT and life sciences. The Norwegian ICT industry is a global leader within several niches. Of all R&D activity conducted in the Norwegian private sector, 45% is ICT related, counting both the ICT sector itself and ICT investments in other industries. Approximately 80% of all ICT related jobs in Norway are located in the region. The life sciences sector has a significant cluster centred on the research activities at Oslo University and Oslo University Hospital. This health cluster is served by two Norwegian centres of expertise (NCE); NCE Oslo Cancer Cluster is dedicated to accelerate the development of new cancer diagnostics and NCE Oslo Medtech covers all other health related sectors. In total, these two NCEs have more than 260 members from Norway and Northern Europe representing the entire value chain. The Health ICT and eHealth categories are growing, bridging the ICT and life science clusters. What is missing in this ecosystem is a formally recognized centre of excellence in entrepreneurship education ("C3E").

### 2.4 Close vicinity to critical support services and expertise

The Centre for Entrepreneurship (SFE) has extensive experience in international relations and crosscultural understanding among students and faculty and thus represents a national node and centre for all



universities in Norway on internationalisation in entrepreneurship education (EE). UiO and NMBU have both close vicinity to critical support services and expertise such as 3-4 incubators, technology transfer offices (TTO), a large investor community, professional legal and financial services and an active community of experienced serial entrepreneurs and professionals, to mention the most important elements. Norway's largest incubator <u>StartupLab</u> is located at UiO's campus.

## 3. Availability of critical process factors

**3.1 A culture of research based education -** The consortium consists of a faculty delivering both front end research on real life entrepreneurship and how this translates to EE. Gründerskolen at SFE and NMBU's MSc programme also serve as viable test beds in developing and improving new methods and strategies within EE, and this is necessary for conducting research and to *understand* and *improve* learning in a student setting. As such, SFE attracts top academic entrepreneurship scholars from internationally renowned institutions. However, the strongest evidence for EE development can be found in the emerging EE research literature, including our own (Erikson et al., 2009; 2014; 2015; Kubberød & Pettersen, 2016; Lahn & Erikson, 2016; Blenker, Korsgaard & Neergaard, 2011). A recent external evaluation of the NMBU MSc programme confirms this assumption.

**3.2 Pedagogies and learning designs devised to promote students' learning -** The current course designs aim to promote strategic thinking in unpredictable environments through <u>situated learning and internship</u> pedagogies. These educational efforts are implemented in close cooperation and support with the best experts in innovation and entrepreneurship nationally and internationally. NMBU is today leading a nationally funded education project initiative aiming at developing mentoring support models in higher EE. This project is supported by a competitive grant from Norgesuniversitetet. At UiO, we will foot all course development in the "Interact manifest" for new programme development, and we will seek 1) "synergies between breadth and depth", make 2) "research based education", develop 3) "integrated professional competence", and always strive for 4) "excellence in learning" (Mørken, 2014).

**3.3 Multi-faceted evaluation methods to assess and monitor student learning** - The Gründerskolen programme makes use of several formative evaluation methods like longitudinal evaluation through team assignments, oral presentations/examinations, and experiential based process learning reports. Both institutions have developed methods for aligning their pedagogy to real "entrepreneurial learning" in a broad range of contexts and cultures. All of the Gründerskolen classes are highly interactive, and the students receive considerable formative feedback throughout the introductory courses at their respective universities. Interactive sessions are also held at UiO before the students leave for their internships abroad. At UiO, the faculty help the Gründerskolen students in setting their personal learning goals and



reflecting on specific entrepreneurial process dimensions while being *in* practice, and later reflecting *upon* practice. Abroad, the students are given evening classes, and they are assigned a tutor to assist them in the process of project development with feedback sessions. A summative evaluation of learning experiences is the basis for the completion of the Gründerskolen programme. Based on the 2015 survey, 94.2% of the responding students (46%) declared that Gründerskolen improved their competence to launch their own venture; and 97.1% reported personal growth. Through an active alumni network from Gründerskolen, the relevancy of our EE initiatives are continuously evaluated and challenged.

3.4 Student engagement and ownership hardwired into the learning process - The students are confronted with a new learning situation emphasising more student involvement. In particular, exposing the students to lengthy international experience offers an extra dimension and meta-perspective to their own learning. During the international practice, students meet fellow students from other programmes on a regular basis in joint sessions at the university and on social occasions outside the course. These meetings have a vast impact on building companionship between students of different cultural backgrounds and friendships that will last for life. Additionally, employing students as peer-mentors for each other and using the class as a resource pool are important involvement strategies enhancing sociocultural learning. Our efforts are backed by a growing bottom-up student cultural involvement in the university: examples are Navet (UiO), Eik and Idedrivhuset (NMBU) and Start (National).

### 4. Outcome factors

4.1 Students learn to tackle and cope with entrepreneurial insecurity and uncertainty and are exposed to how to drive entrepreneurial initiatives through to fruition - The students are exposed to real-life practices, and forced to step out of their comfort zone and develop their internal mental models through transformational learning, which in the end build entrepreneurial competence and contribute to personal growth. Former students have highlighted these positive outcomes in 652 newspaper articles (Retriever, 2016) featuring Gründerskolen since its inception. Gründerskolen has a completion rate of 99.8%, and an approval rating of 92.6%.

4.2 Such entrepreneurial skills are critical for growing existing companies and launching new firms - International and practice based experience are highly appreciated by employers and Gründerskolen delivers both these qualities and in addition motivates for future international mobility in the labour market. For the partner institutions, Gründerskolen makes their students stand out from others as first time job applicants. To sum up, the acquired entrepreneurial competence helps to create what we may label early polymaths, candidates that are multidisciplinary in orientation and nature and can handle complex cross disciplinary tasks even in their first jobs.



# THE PLAN FOR THE CENTRE

## 5. Vision

Entrepreneurship is regarded as one of the most important driving forces for change and development of the economy and society as a whole. Entrepreneurial expertise is defined by the EU as one of eight key competences and should be encouraged at all levels of education (Kunnskapsdepartementet, 2009). In the "Norwegian Qualification Framework" (NQF) *familiarity* with innovation processes (bachelor level) and the *ability to contribute to and practice innovation* (masters level) are described as targeted learning outcomes for all students at a *general competence level* (Kunnskapsdepartementet, 2014), empowering students with the necessary entrepreneurial capability needed in a rapid changing labour market.

While EE at primary and secondary levels reaches large parts of the student population, recent evaluation of EE in Norwegian higher education points to limited and fragmented results targeting these general competencies (Spilling et al., 2015). Higher education institutions <u>are found to lag far behind</u> in delivering on the specified NQF ambitions.

The motivation to establish this Centre of Excellence in Entrepreneurship Education is to meet this challenge at a regional level, followed by the national level. *The aim for the Centre is to establish pedagogy and learning environment that in the best possible ways prepares students for and integrates them with the existing and growing initiatives in the ecosystem.* Thus, in contrast to other EE programmes where students take the role as action-based commercialization agents starting their own ventures (Rasmussen and Sørheim, 2005), the Centre does not aspire to be a source of new ventures in its own right. Rather, the Centre seeks to leverage all the external resources to build robust entrepreneurial competencies for future employability, positioned prior to any form of value creation in the region and the society as a whole. Following this principle, the Centre has adopted the vision:

Transforming higher education – bridging insightful scholarship with entrepreneurial capability

## 6. Strategic Direction

Our ambitious vision will be achieved through three closely related strategies:

- 1. *Empowering students with entrepreneurial curiosity, understanding and executional capability.* Traditionally, most students are security oriented but we are now moving towards a more global and dynamic labour market. Our aim is to prepare the students for a future professional life where the ability to cope with unknowable uncertainties and to drive new initiatives through to fruition will be much more important that in the past.
- 2. Nurturing an entrepreneurial curiosity and understanding among the academic staff and their



management. The attitude of the academic staff is a key enabler in the long term. The strategy is initially targeted to focus on those who through self-selection are most inclined to be motivated by involvement in our vision.

3. Driving an entrepreneurial cultural development in the university and beyond. Students graduate for the most part never to return. Our strategy is focused towards over time developing a much broader, continuous and vibrant relationship between industry and academia, and between current and graduated students.

This strategy is fully in line with what we see at similar centres internationally. Traditionally, Stanford and MIT have been the universities to learn from, but these institutions have different ecosystems, and the Nordic (collaboration) model points to the collaboration based Stockholm School of Entrepreneurship as the next generation of entrepreneurship centres - devising diverse entrepreneurship activities to all students in an effective manner.

Below we outline our work packages for operationalising our strategy. We emphasise that Work Packages 1 and 2 are closely linked. By matching actors in the ecosystem in the Oslo region with students in a variety of forms of entrepreneurial practices, the Centre will provide both interactive and tailored learning arenas as well as creating a much more efficient value creation process hardwiring the external ecosystem into higher education.

## 7. Operational Plan

### 7.1 Leadership and coordination

We will establish a dynamic and operative management team that effectively manages and facilitates the Centre's activities and resources in the respective institutions as well as creating synergies between institutions. The management team will consist of equal partnership and involve a balanced representation from both institutions. The management team will consist of the Centre Director (Elin Kubberød) with Jens Petter Falck and Truls Erikson as co-directors. The activities are organized in two work packages, each being led by separate WP management teams comprised of student and faculty representatives from each institution, constituting a management quartet for each WP and therefore enabled for local adjustments as well as synergies between institutions on the activity level. The WP management team will each establish a resource team in the respective institutions. The advisory board for the Centre will comprise members from industry, the public sector and the innovation system, international top scholars, students, alumni, and be governed by the Vice Dean Solveig Kristensen. Leadership and management activities are briefly shown in the Action Plan (see A1-A3).

## 7.2 Work Package 1 - Pedagogical activities and development

**7.2.1 Scalable and tailored course modules and programmes** - Effective implementation of our strategy requires innovation on several levels. The learning outcome of exposing the students to our entrepreneurial practices is a two-fold <u>meta-competence</u> of entrepreneurial learning that can be defined as the students' ability to:

- *Cope with complexity*. To act entrepreneurially is a highly emotional experience. The ability to deal with the insecurity and uncertainty involved is a critical learning outcome of the entrepreneurial learning process. The pedagogical methods to achieve this are an active area of research (Kubberød & Pettersen, 2016; Lahn, Kubberød et al., 2016).
- See and develop attractive opportunities of value to others. It takes a lot of practice and experience to spot attractive opportunities. To successfully develop an opportunity (and develop entrepreneurial capability) is a craft, which can be learned through advanced methods and techniques that significantly improve the success rate.

Based upon these learning outcomes, the Centre seeks to attain breadth in dissemination of the tools as well as depth through a scaling strategy in line with the NQF, see Figure 1.





These offerings and activities are organized in the following threelevel structure:

Level 1 - Provides BSc students at UiO and NMBU with basic entrepreneurial <u>awareness</u> through integrated coursework and modules. These activities will focus on building awareness and motivation for innovation and entrepreneurship.

Level 2 - Provides BSc students with *entrepreneurial competence* through more lengthy elective courses and programmes targeting students interested in a continuous learning process of entrepreneurship.
Level 3 - Provides MSc students with *advanced entrepreneurial competence* through separate mentor programmes, and elective courses in innovation and entrepreneurship. Such mentoring programmes and courses aim to facilitate advanced practice-based knowledge. We will focus on developing repeated



learning experiences among multiple actors, between students, and between students and the ecosystem.

The internal balance between the three levels is important for the overall impact and execution. Volume exposure is secured through Level 1 activities. Level 2 offers motivated and engaged students additional competence and learning. Level 3 offerings are critical to NMBU in order to educate enough students with advanced competence in entrepreneurship to help facilitate Level 1 activities, and over time to nurture and build an entrepreneurial culture in the research community. Level 3 packages at UiO will mainly support and back the Research Council's FORNY2020 StudENT scheme (Action Plan B1-B3).

**7.2.2 Research based pedagogical development activities** - We will design and tailor the curricula through a robust development process at each level, designing content from learning outcomes (Mørken, 2014). It is essential to develop new learning based tools and pedagogies that leverage students' disciplinary knowledge and interests into entrepreneurial competence development. These will allow students to engage creatively with their own ideas and initiatives and involve learning with relevant others in a socially situated learning environment. While there is a demand for innovation in pedagogical content, it is also evident that there is less consistency in how entrepreneurial learning can adequately be approached from the teacher's perspective (Haase and Lautenschläger, 2010), and therefore we need to address this issue through innovating how entrepreneurial learning can be managed. The general established view is that the essence of entrepreneurial competence cannot be taught in a traditional sense, but we can *work with learning*. Hence, there is a need for developing *learning systems* for how to balance between supporting and securing students' learning on the one hand and pushing students to act and experiment on the other (Kubberød and Hagen, 2015). The proposed centre will focus on developing new and innovative ways to stimulate learning processes and focus on collaboration to document how learning outcomes can be secured through these efforts (see Action Plan C1-C4).

### 7.3 Work Package 2 - Ecosystem enabling activities

Developing successful activities in Work Package 1 requires access to a well-developed ecosystem to function properly. Thus, in addition to course work, a set of ecosystem enabling events, activities and services will be required in order to meet the strategic objectives. Those are:

- 1. Support and build *interest* in entrepreneurship among students through student initiated events.
- 2. Give students access to critical infrastructure and services to help student-initiated start-up companies.
- 3. Develop concepts to attract alumni and senior professionals to student initiated start-ups.
- 4. Develop matchmaking arenas for effective exchange and identification of unsolved problems that are both commercially important and academically attractive
- 5. Incentives to drive a stronger commercial orientation among the academic staff and management.



6. Identify, document and market commercial successes with links to the universities.

Such activities are today not undertaken in a systematic way. The centre will take on the role as overriding initiator and coordinator, continuously develop, orchestrate and organize such activities in close collaboration with all members of the ecosystem (see Action Plan D1-D6).

## 8. Dissemination strategy and plan

Being a CEE in innovation and entrepreneurship, with close collaboration with all partners in the ecosystem from the academic community to business community, is a core function for the Centre and as such a focal point for the CEE's management team. Thus, dissemination is hardwired into the activity plan. The entire centre project is in its own rights an entrepreneurial dissemination towards students, the academic community and relevant stakeholders in the ecosystem. As laid out in the Action Plan (E1-E3), the development of targeted activities for the different audiences is a continuous activity. Collaboration with other universities will be channelled through the Gründerskolen network, especially with regards to Work Package 1 and pedagogical development.

## 9. Framework for evaluation and influence

9.1 Framework for contributing to and stimulating institutional development over time – A core strategy for the Centre is to drive an entrepreneurial cultural development in the university and beyond. To this end, the Centre has devised Work Package 2 which targets students, faculty and the broader ecosystem players.

9.2 Framework for measuring impact - The impact of the Centre will be measured qualitatively and quantitatively in the following way as seen from the different stakeholders:

- Students Number of students taking relevant courses or participating in relevant activities and workshops. Number of entrepreneurial situated practice-learning encounters among external actors by UiO and NMBU students and possible long-term value creation effects.
- Faculty Faculty participation in events and activities. Number of PhD research fellows and postdoctoral fellows working on projects in collaboration with the business community.
- *Infrastructure* Number of co-activities together with the supporting ecosystem actors.
- *Relevant business community* Participation in relevant workshops, events and projects.
- Toolkit and new methods development Number of new simulations and exercises.

**9.3 Securing sustainability post funding** – Long term funding will be secured through the internal revenue stream generated from study point production, and through external soft funding (e.g. Regional Development Funds, Norgesuniversitetet, Research Council Funds, and collaborative EU funds).



## **INFORMATION ABOUT THE HOST INSTITUTION**

#### Host institution

Faculty of Health Sciences, UiT The Arctic University of Norway

PO Box address 6050, Langnes			
Postal code 9037	City Tromsø	Place Norway	
Telephone (+47) 776 44 000		I	
E-mail address postmottak@uit.no			

## **CONTACT PERSON**

Name Anita Iversen	
TItle Director, The Centre for Faculty Development	
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## **ABOUT THE CENTRE**

Name of Centre INTERPROF – Centre for Interprofessional Education in Health and Social Sciences

Is the Centre already established at the time of the application (yes/no)?  $\hfill Yes \hfill No$ 

Please name any consortium partners for the Centre



# ABSTRACT

**Describe briefly the aims as well as the current and planned activities of the Centre (150 words)** INTERPROF will redesign clinical education in health and social care by exploring novel models of interprofessional (IP) learning activities for students. A common introductory 10 ECTS course has been implemented for 10 study programmes, and IP simulations of emergency scenarios for four programmes as well. We will extend IP learning for our 13 health and social care programmes to authentic student-led encounters with clients in need of health care. Six partners - five municipalities and the university hospital - will host two pilot models, collaborating with the university and fellow municipalities/hospital. Typical clinical placement venues will host the IP activities (preventive care, nursing homes, home-based service, health centers, mental health service and patient pathway). A digital platform will be developed to explore possibilities for virtual IP collaboration. The clinical placement sites and students will serve as central ambassadors for the new models, and experiences and results will be widely disseminated.



## **APPLICATION DOCUMENT**

The application must be written in English and follow the requirements set in this template. It must not contain more than 10 pages in Times New Roman, 12-point types, with lines spaced 1.5 and margins of 2 cm. Within this format, the applicant must provide:

### a) Documentation of educational quality in existing provision

The applicant must comment and critically reflect on themes and questions set out in the criteria, and compare their existing provision with similar provision within the same subject/discipline area, both nationally and internationally. Through this, the applicant must document that the academic community qualifies as a Centre for Excellence in Education.

### b) A centre plan

The applicant must comment and critically reflect on themes and questions set out in the criteria. The Centre Plan must outline the vision of the Centre, its strategy and plans. It must present the plans for the dissemination of knowledge and practices to its own institution(s) and to other educational communities as well as an evaluation and impact framework.

### **Appendices**

The following appendices must be included (and no other):

- 1. A list of references
- 2. A budget for the Centre for the first five-year period, including motivation for costs (see guidelines at <u>www.nokut.no/SFU/utlysninger</u>)
- 3. An action plan for the Centre, including milestones (no more than three pages)
- 4. CVs of the proposed Centre Leader and two to five key members of the Centre team (each CV must not exceed two pages)

All appendices must be in English.

### **Practical information**

The rector of the host institution must sign the application.

The deadline for submitting applications is set in the announcement of the call.

All applications will be published on the NOKUT website, alongside the expert panel's feedback.

# INTERPROFESSIONAL TEACHING AND LEARNING

## Vision and mission:

## Educating students for interprofessional team work in health and social care

Despite policy objectives and guidelines, clients suffering from long-standing and complex conditions still experience uni-professional clinical practice. Students and health professionals are traditionally taught to interact with other professions through referrals, resulting in waiting times for the clients (days, weeks or even months) for the next encounter, and with danger of differing interpretations and explanations from different professionals and conflicting feedback to the patient (1). To meet this challenge, we will redesign clinical education by letting students from different professional programs meet the client in simultaneous encounters, experiencing and learning how they collaboratively can contribute to better care for the client. Interprofessional collaboration is a competence that does not come by itself; it has to be trained through the whole programme. Based on our experiences with pilot interprofessional (IP) learning activities (2), and supported by theories on situated learning (3), we will create and explore models of IP learning activities in various authentic clinical situations and thus contribute to a new approach in clinical education across health and social care study programmes. Our vision is to educate health and social care students who are skilled to work in interprofessional teams and who collaborate with and for the client.

The main participants in our Centre are students from the Faculty of Health Sciences (H-Fac) and the Faculty of Sports, Tourism and Social Work (IRS-Fac), in partnership with academic staff, collaborators from clinical placements (i.e. municipalities and the University Hospital of Northern Norway/UNN) and leading international educational institutions within IPE.

## Introduction:

## Responding to a global need for innovation

Against the backdrop of changing conditions for health and social care, there is a global call for strategic changes to professional study programmes in the health and social sciences. The Lancet Commission report (1) argues that there is a need for a new professionalism and a new set of skillsbased criteria to classify the competences of health professionals. Competency-based curricula and interprofessional education (IPE) have been promoted globally by policy makers as a necessity to meet the demands of future health professionals (4). IPE has been defined as curricular activities in which students from different professional programmes learn from, with and about each other (5, 6). Although IPE is being implemented on a large scale by educational institutions internationally, a number of fundamental research questions remain (5). The optimal practices for training students in collaboration and team-based care are not well defined, and the impact and effectiveness of IP learning activities lack evidence (7-9). Does IPE really equip students with IP collaborative skills and capabilities? A recent report from the Institute of Medicine of the US National Academies (9) identified several gaps in the evidence linking IPE to patient, population and system outcomes. Four areas were pinpointed as important for laying a foundation for evaluating the impact of IPE on collaborative practice: 1. Aligning the education and health and social care delivery systems. 2. Developing a conceptual framework for measuring the impact of IPE. 3. Strengthening the evidence base for IPE, and 4. Linking IPE with changes in collaborative behavior (9). Our aim is to meet this challenge together with students and health and social caregivers in the municipalities and hospitals by creating and testing models of IP real-life learning situations for students to enhance collaborative learning based on the defined needs in clinical work.

## **Documented excellence in education**

## Experience with interprofessional education

In our 2013 SFU application, we described Inter-base, Inter-sim and Inter-prax as a framework for IPE at the Faculty of Health Sciences, to be organized within a Centre for Interprofessional Education in Health and Social Sciences (INTERPROF):

1) Inter-base: A 10 ECTS introductory course for first-year health professional students

The course is now running in full scale for the fourth year for 450-500 students in 10 study programmes. The pedagogical approach is blended learning, partly through physical interprofessional tutorials and seminars and partly on-line learning through videos, on-line lectures and exams. Learning outcomes are defined in relation to communication, ethics, knowledge of the health and social care system, and reading and writing academic texts.

2) Inter-sim: Interprofessional simulations of emergency situations

Inter-sim has been established at our Centre for Skills Training and Simulation (FOSS) at Campus Tromsø, and full-scale implementation for students of medicine, nursing and radiography (200 students) is due in 2016/17. Each student will participate in four different emergency scenarios during a full one-day session. To date, 23 facilitators (clinical teachers) have been trained for the purpose, but there will be a continuous need for more facilitators and a need for Inter-sim implementation at all UiT campuses.

3) Inter-prax: Interprofessional team based learning activities in clinical settings

IP activities have been piloted in a variety of settings (home-based care, nursing homes,

hospital wards) for small groups of students in nursing, medicine, physiotherapy, pharmacy, occupational therapy, social care and psychology and will - as a part of the SFU-proposal - be further developed gradually into full-scale implementation by 2021.

## Successful strategies in education

The 2009 merger between the University of Tromsø (UiT) and the Tromsø University College brought together two different cultures within higher education: the university college tradition with a strong emphasis on pedagogy and education and less emphasis and competence in research, and the university tradition with the opposite priorities. Inspired by the merger, the new faculty (H-Fac) has adopted a strong commitment to high quality in education, as reflected in strategy for education<sup>1</sup> and largely conducted through the Centre for Faculty Development (HelPed). The Faculty has a longstanding tradition of innovation in teaching and learning to enhance educational quality, with student-active learning activities widely used as a pedagogical approach. Studiebarometeret<sup>2</sup> gave top score in 2016

<sup>1</sup> Strategy 2020, Faculty of Health Sciences

<sup>2 (</sup>http://www.studiebarometeret.no/en/)

to our BSc programmes in Physiotherapy (4.8 out of 5.0 points) and Occupational Therapy (4.6). They were the first of their kind in Norway (established 1989 and 1990) to adopt problem based learning (PBL) systematically through the whole study programme. The revised medical curriculum (ongoing in its fourth year) is using case based learning as a pedagogical approach, also involving first year dentistry and nutrition students. Whole study programmes and some individual faculty members have excelled in their work for quality in education. Of relevance to this application may be the fact that Inger Njølstad was granted the UiT prize 2015 and the national Olaf Thon Foundation prize for excellence in education (2016), both of these for the ongoing revision of the medical curriculum. Kirsti Hokland was awarded the 2016 UiT prize for excellence in education for an on-line master's course in Biomedicine (the first one in Norway). The decentralized nursing programme was awarded the Forbundet for Ledelse og Teknikk 2015 educational prize for facilitating for lifelong learning.

### **Input factors:**

### Striving for a culture of excellence

*Faculty qualifications:* Among our 530 academic staff, 353 hold a PhD degree or are qualified as professor/associate professor. In principle, all faculty members have a shared position of teaching/ research, varying from 80/20 to 50/50. H-Fac and the work we have done on IPE has been used as good examples in two recent parliamentary white papers (10, 11).

*Centre for Faculty Development (HelPed):* Established at H-Fac in 2012 as the first centre of its kind in Norway, it represents an important part of H-Fac's now well-established infrastructure for education. The Centre has five academic staff and three professors in 20% positions. HelPed offers courses, learning activities and projects for teachers and healthcare professionals to cope with new challenges in teaching and tutoring related to e.g. a changing student body, novel pedagogical methods, innovative educational frameworks, and novel venues for learning. Monthly seminars/workshops relating to educational roles and skills unite teachers from all study programmes across all six UiT campuses. Increasing numbers of participants join the seminars [2015: average number of 28 participants (range 9-63)]. Since 2013, 1300 clinical facilitators have joined our longitudinal programmes addressing student tutoring in clinical placements. In collaboration with Helse Nord, H-Fac organizes biannual conferences in education that usually bring together 100-200 teachers and health care professionals. The Action plan for pedagogical development at the Faculty (2015-2020) aims to systemize the faculty's work on educational quality and the development of a culture of teaching excellence.

*The IPE-group:* was established in 2015 with staff from all 13 study programmes (H-Fac and IRS-Fac) including student representatives, to support and inspire broad involvement in the planning and implementation of IP activities.

*Sabbaticals for education:* were established at H-Fac in 2011 in collaboration with UNN as a complement to sabbaticals for research.

## **Process factors:**

## Continuous research and development

The Research Group of Health Education (2010) is in current research studying how students' learning in clinical placements is related to the development of knowledge, motivation and professional identity. A research project on student participation in IPE has documented outcomes and inspired the further planning of IP activities at H-Fac (2). The project aims were to establish IP learning environments for health care students in municipality health care service and to study and disseminate the outcomes of those IP activities. The project, which included four different health professional BSc and MSc programmes and three rural health care services, has successfully met its objectives, as 32 students formed nine different interprofessional student "mini-teams" in rural health services during two weeks of clinical placements, collaborating with patients with long-term and complex conditions. The team assessed the patient's need of coordinated care, suggested new integrated strategies, and collaborated in practical work. Reported student learning outcomes included increased knowledge and awareness of their own professional knowledge and increased understanding of how individual professionals can contribute in a team and collaborate with other professionals. The collaboration between student teams and health services resulted in increased knowledge of how new sites for IP placement may be established (2), in line with recommendations by Thistlethwaithe (5) and Barr *et al.* (12).

The ongoing implementation of a revised medical curriculum is being evaluated by Professor II Sylvi Stenersen Hovdenak, who uses qualitative methods including focus groups and observational participation (13).

## **Outcome factors:**

### Maximizing and measuring impact

Student recruitment to our professional study programmes is generally stable and good. Student flow, credits and candidate production is generally satisfactory.

*Assessment of student learning:* All programmes assess student learning outcomes through a variety of methods: oral rehearsals, mimicking real patient encounters, written assessments and reports, clinical examinations and portfolio. About 90% of students of health professional programmes complete and pass this exam (2015). HelPed has initiated work to enhance formative evaluation of the students' learning, conducting seminars for faculty members with students as lecturers, promoting inter current programme evaluation that allows adjustment during the course, not only at the end.

*Involving students:* Students are represented in all programme committees, and the student board meets with the dean and vice-dean of education every second week. Students have formed groups, supported by the staff, to engage in various learning activities, such as emergency medicine (TAMS) and patient safety (ForBedre). In order to enhance IP activities, a student IPE board is being established at H-Fac. *Peer teaching* occurs within and across study programmes: Physiotherapy students' vs nursing and dental hygiene students, dental students' vs dental hygiene students, medical students in different courses. Medical students are trained as instructors at our Skills Training and Simulation Centre (FOSS).

*Meeting the needs from the northern region in innovative practices:* In 1990, Tromsø University College was the first in Norway to offer a decentralized (off-campus) BSc for nurses (14), followed by physiotherapy, with the first internet-supported, partly off-campus physiotherapy programme worldwide (15). Since 1973 the innovative medical curriculum (16) has proven most successful in recruiting physicians to Northern Norway (17). A subgroup of 24 students spend the last two years of their medical studies in the neighbouring Nordland county, and a similar distributed campus for 12 students is planned in Finnmark county from 2017. Our dentistry students spend six months in dentistry clinics throughout Northern Norway, and 93% of the dentists who graduated from UiT since 2009 are working in this northern region.

*Extensive collaboration with the clinical field:* Joint boards of education have been established between H-Fac and our main suppliers of clinical education, UNN and Tromsø municipality. To ensure long-term sustainable clinical placement venues, H-Fac has formalized agreements with collaborating hospitals and with all (groups of) municipalities in Northern Norway. In partnership with UNN, and as the first institution in Norway, the Faculty has established 35 combined clinical and teaching positions (80/20 or vice versa) for the allied health professions, of which 15 positions are reserved for students of nursing.

### **INTERPROF** – The plan for the Centre

*Organization and management:* Centre for Interprofessional Education in Health and Social Sciences (INTERPROF) will be organized in HelPed with a steering committee, Centre management team, international advisory board and a student advisory board. The aim of the Centre is to lead the pedagogical collaborative work between academic staff, students and the clinical placement field to design, implement and evaluate clinical learning activities across the traditional professional boundaries in health and social care.



INTERPROF – Centre for Interprofessional Education in Health- and Social Sciences

#### **Steering Committee**

Vice Rector for Education (UiT) Strategic Advisory Board (Education), H-Fac, leader University Hospital of North Norway (UNN) Municipality representative IRS-Fac (UiT) Student advisory board, leader Client Centre for Faculty Development (HelPed), director Interprof, leader Interprof, manager (secretary)

#### **Centre Management**

Centre leader, 100% Scientific Centre leader 10 % Centre manager, 50%

#### **Student Advisory Board**

1 student from each of the study programs in health and social sciences, H-Fac and IRS-Fac

#### **International Advisory Board**

Linköping University, Sweden VIA University College, Denmark University of Iceland, Iceland Centre for Interprofessional Education, Toronto, Canada



#### Departments of:

Community Medicine(ISM), Medical Biology (IMB), Clinical Dentistry (IKO), Health and Care Sciences (IHO), Pharmacy (IFA), Psychology (IPS), Clinical Medicine (IKM) and The Regional Centre for Child and Adolescent Mental Health – North (RKBU Nord)

#### Project partners:

*Faculty of Health Sciences, (H-Fac) (host institution):* H-Fac is the largest of six faculties at UiT, with 8 departments, more than 1000 employees, some 3100 undergraduate students and 355 PhD students. Each year, we admit 840 students to 11 health care study programmes<sup>3</sup>.

*Faculty of Sports, Tourism and Social Work, (IRS-Fac):* The Department of Child Welfare and Social Work (DCWS) forms part of the IRS-Fac at UiT. With its 48 employees, including 42 researchers, and nearly 500 students, it is the largest department of the Faculty. The DCWS offers BSc and MSc programmes in social work and child welfare at four UiT campuses (Alta, Harstad, Tromsø and Kirkenes). Four research groups are currently conducting research in the fields of Professions and Welfare Society, Diversity and Marginalization, Collaboration within Child Welfare and Social Work and Child Welfare. Together these two faculties embrace education for 13 undergraduate health and social care professionals, thus this project is directly responding to the "Practice project" conducted by UHR<sup>4</sup> including 19 different programmes

*Partnership with clinical placements*: As a core structure of INTERPROF, we have established partnerships with six selected providers of clinical placements representing diversity in size and in the organizing of health and social care, and with experience in, or possibilities for, interprofessional learning. *UNN* and the municipality of *Tromsø (pop. 73,000)* represent our main providers of clinical placements. *Lenvik (pop. 11,500)* and *Bardu (pop. 4000)* are rural municipalities with valuable experiences in IP learning through our common IP pilot studies. *Harstad (pop 25,000)* is hosting a UiT campus, and the local health authorities have great ambitions for interprofessional collaboration in health and social care. *Alta (pop. 20,000)* is the host municipality for the IRS-Fac and will be a close partner in a new distributed programme for medical students. Those six providers will be partners in the SFU-project, each offering two venues for IP learning activities in collaboration with students, academic staff and fellow providers. Health and social personnel from the municipalities/

<sup>3</sup> Biomedical laboratory science, dental hygiene, dentistry, medicine, nursing, nutrition, occupational therapy, pharmacy, physiotherapy, psychology and radiography, in addition to several postgraduate clinical specialities.

<sup>4 &</sup>quot;The university and university college board". Final report February 2016.

hospital will participate in the pedagogical and practical planning of learning activities, evaluation and research. The placements will serve as "good examples" for IPE – models in rural and urban clinical practice in Northern Norway.

*International collaboration (advisory board)*: The Faculty of Health Sciences at Linköping University, VIA University College in Aarhus and the Centre for Interprofessional Education at the University of Toronto are leading institutions with expertise of high relevance for the proposed IP-learning activities at UiT. The University of Iceland (HI) has established an interprofessional student-led health and social care service for fellow students. We will draw on all these experiences in our curriculum development for mutual benefit, share IP experiences and evaluations, arrange joint workshops and develop joint research projects and papers by means of INTERPROF adjunct positions.

## **Work Packages**



### WP1 - Teaching and learning in clinical placements

### WP leader: Nanna Hauksdottir

We will use our experience from IP pilots and research to develop a student-active and practice-oriented IP learning approach in collaboration with clients. Six typical placement sites will serve as models for the training of students' collaborative capabilities:

i) Preventive health- and social care
ii) Nursing homes
iii) Health- and social Centers (Health-houses)
iv) Home-based services
v) Mental health- and social care
vi) Patient pathways

Each of those IPE sites will be planned in two different - and collaborating - pairs of municipalities and/or hospital. All IP activities will include active participation of students on BSc and/or MSc level. Students who "make a difference": The model chosen is based upon Wenger et al.'s theory of situated learning (3), theories of shared decisionmaking with clients (18, 19) as well as our own experiences from Norbye's action research project (2). Students in their final undergraduate year work together with clients with real, complex and unsolved problems, selected by local health and social care providers. The students will form "mini-teams" of maximum 6-7 students from a minimum of three different study programmes. The students take on a real responsibility for handling the client's health or social problems, meet him/her as often as they find it appropriate during the IP learning period, and they finalize the IP "package" through a common report to local health and social providers for follow-up. To minimize traditional hierarchy in care, the teams are self-directed, they meet the client together, observe each others examination/assessment and discuss action plans together with the client. They learn about each other, and learn to respect each others' professional competencies. The mini-teams will have one common IP facilitator following their collaborative approach to fellow students and the client. In addition, all students have their own professional facilitator at back-hand to ensure professional quality of the care of the client. The optimal length of an IP learning activity is yet to be defined; in this project we will try out scenarios from two days up till two weeks. The IP pilot projects were successful: students' common reports impressed health and social care providers in the placements and may even initiate change their way of practice (2).

Competency domains for effective IP collaboration have been defined by two overarching frameworks (20, 21), which will form the basis for description of learning outcomes in the placements. The gain achieved by working together in groups towards a common goal has been described in terms of "social interdependence theory" (22, 23). Through student interdependence of each other's knowledge to achieve a learning objective, the learning outcomes become larger for each student than it would be if this student worked alone with the same problem. Our project aims to develop and implement this form of collaborative learning in authentic settings for students to experience the strength of learning interprofessionally together compared to learning in professional "silos".

New learning models in the various sites in municipal health- and social services as well as in the transition between municipality and institutional health care will be explored.

Workgroups will be formed for each placement site, including academic staff from all study programmes involved, health and social personnel from the municipalities involved, and clients; all supported by the pedagogical expertise at HelPed, the student IPE-board and the IPE-group.

*Aims for the workgroups:* To define student-learning outcomes; to organize and implement the learning activities; to initiate evaluation and to ensure faculty development for the personnel involved.

#### WP2 - Teaching and learning by means of digital technology (Inter-Dig)

#### WP leader: Rita Jentoft

Offering IP learning in real clinical placements to all students across 13 different study programmes<sup>5</sup> with different numbers of students can be challenging (24). There is a need to explore whether other solutions may provide the same or similar learning outcomes as the authentic clinical student group meetings with patients. A workgroup will be formed including students, academic staff and personnel from health and social care.

*Aims for the workgroup:* To define and develop digital platform where students can meet across study programmes together with clients in virtual settings; to define learning outcomes; to produce content and to implement learning activities where the educational use of digital resources/tools can stimulate students' work in achieving expected learning outcomes across geographical distances. Students will be engaged as co-producers of the content, producing video films together with clients or actors, or otherwise participating in producing digital learning material to support collaborative learning and the partnership with the patient/client. Research studies will be conducted to compare learning outcomes in real and virtual interprofessional settings.

#### WP3 - Faculty development

#### WP leader: Anita Iversen

Faculty development will be offered for academic staff and facilitators at the clinical placement sites based on their needs for enhancing knowledge and capability in the planning of learning activities and to facilitate students' IP collaborative learning. We want to facilitate a culture of collaboration and continuous quality improvement of facilitator expertise and teaching skills by conducting workshops, seminars and testing of new learning activities. Faculty development in IPE also includes generic pedagogical competencies such as describing learning outcomes, educational activities and evaluation, all according to the ideas of constructive alignment as well as competencies in digital didactics.

### WP4 - Evaluation and research

### WP leaders: Bente Norbye and Inger Njølstad

*Evaluation:* Kirkpatrick's model (25) will be used as a framework for evaluation of the students' learning process in the clinical placements. Summative assessment will be conducted at the end of each learning activity to assess the change in students' interprofessional performance. IP OSCE<sup>6</sup> will be tried out for that purpose. Clinical placement facilitators will use formative assessment during the IP period to fine-tune the teaching and learning approach to the students' feedback concerning their learning outcomes.

*Research:* Research will be carried out in collaboration with our national and international partners. Two research projects will include PhD students: i) Learning outcomes in clinical placements and digital learning arena. Main research questions will be: What kind of learning activity enhances the

6 objective structured clinical examination

<sup>5</sup> Current expected candidate production per year: nursing (166), medicine (84), psychology (31) laboratory assistant (20) pharmacy (25) occupational therapy (20) physiotherapy (25), radiography (24), dentistry (32) dental hygiene (12), midwifery (20)

students' interprofessional, collaborative capability? What are the enabling and constraining factors for learning IP approaches? ii) There is a gap in knowledge regarding faculty development initiatives and effects on IPE facilitation in different learning contexts (26). Observational studies will be included in the project to analyze the effect of the initiative both on the facilitation and on student learning outcomes. Master students will be invited and recruited to collaborate with the research groups and participate in evaluation of IP activities and research projects. A digital portal open for health services and across health educational programs will be a hub for IP themes subject for exploration and research that can involve students on different levels.

#### WP5 - Dissemination

### WP leader: Geir Lorem

A basic aim of the project is to disseminate its results very broadly, create models for effective IP teaching and learning in clinical work, models that can inspire and influence IPE worldwide. The important messages from this project will be to provide descriptions and discussions of how to design, implement and organize IP learning activities in authentic clinical situations together with clients. Experience of what is the optimal length of IP learning activities, and knowledge of what kind of IP learning can be beneficial in a digital learning environment. The target group is internal (own students, academic staff and leaders), connected collaborators (municipalities, hospitals, and collaborating universities/university colleges) and external (the academic society - researchers, teachers and leaders-, the health and social care providers, political stakeholders, clients of health and social care sector). *Internal dissemination:* will be conducted through internal seminars, workshops and educational conferences for students, academic staff and leaders together with the collaborating health- and social care personnel. The university intranet and the INTERPROF website will be used for communication internally and externally. The project will be discussed on a regular basis in the several management forums at H-Fac, and at the university level. The IPE-group and the Student advisory board will serve as participants and ambassadors for the project especially towards academic staff and students.

*Connected collaborators:* Dissemination to collaborators will be done through regular meetings on site and webinars. A journal club on IPE will be established for collaborating clinical sites together with students and academic staff.

*External*: Experience from the project will be presented at conferences, by scientific papers and popular science reports. Social media and blogs will be systematically used. The participating municipalities and clinical placements will take a central part in disseminating, serving as models for IP learning in clinical placements. Their experience will be systematically spread to other similar clinical placements through visits, meetings, seminars and conferences, and by their participation in research and dissemination of the experience gained in the project.



# **INFORMATION ABOUT THE HOST INSTITUTION**

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# **ABOUT THE CENTRE**

Name of Centre Centre for Performance-Based Electronic Music (PEM)
Is the Centre already established at the time of the application (yes/no)? □ Yes ⊠ No
Please name any consortium partners for the Centre [text]



## ABSTRACT

Describe briefly the aims as well as the current and planned activities of the Centre (150 words)

UiA's Department of Popular Music is the only institution in the Nordic countries offering tertiary-level education in popular music, from bachelor to doctoral levels. The Department has recently developed innovative pedagogical methods to further learning of necessary basic competence in musical theory, improvisation and ensembles, with technical efficiency, for autodidactic students, who use laptops as their main instrument. As a Centre for Excellence in Education, we aspire to realise our vision to 1) sustain, refine, and disseminate our experience in teaching electronic music and to make students become innovators in a new musical world where distinctions between creation and performance disappear, 2) expand our findings to be used also in the education of performers of traditional instruments who participate in a world of musical electronics, and 3) develop educational methods that qualify future musicians to creative collaboration with artists from the world of electronic visual media.



## **APPLICATION DOCUMENT**

The application must be written in English and follow the requirements set in this template. It must not contain more than 10 pages in Times New Roman, 12-point types, with lines spaced 1.5 and margins of 2 cm. Within this format, the applicant must provide:

### a) Documentation of educational quality in existing provision

The applicant must comment and critically reflect on themes and questions set out in the criteria, and compare their existing provision with similar provision within the same subject/discipline area, both nationally and internationally. Through this, the applicant must document that the academic community qualifies as a Centre for Excellence in Education.

### b) A centre plan

The applicant must comment and critically reflect on themes and questions set out in the criteria. The Centre Plan must outline the vision of the Centre, its strategy and plans. It must present the plans for the dissemination of knowledge and practices to its own institution(s) and to other educational communities as well as an evaluation and impact framework.

## **Appendices**

The following appendices must be included (and no other):

- 1. A list of references
- 2. A budget for the Centre for the first five-year period, including motivation for costs (see guidelines at <u>www.nokut.no/SFU/utlysninger</u>)
- 3. An action plan for the Centre, including milestones (no more than three pages)
- 4. CVs of the proposed Centre Leader and two to five key members of the Centre team (each CV must not exceed two pages)

All appendices must be in English.

## **Practical information**

The rector of the host institution must sign the application.

The deadline for submitting applications is set in the announcement of the call.

All applications will be published on the NOKUT website, alongside the expert panel's feedback.

## **APPLICATION DOCUMENT**

# **Centre for Performance-Based Electronic Music (PEM)**

The Department of Popular Music at UiA is the only institution in the Nordic region which offers students fully featured, specialized training in popular music at bachelor's, master's and doctorate levels, targeting both highly skilled studio musicians and innovative performing artists. We have recently developed special expertise in educating a new type of students: extremely talented young people, who do not seek admission after the usual years of practice on traditional instruments and the traditional practical and theoretical training by music teachers and music schools. Their main instrument is the laptop, and their musical development has evolved at home where they have been sitting alone with the PC, the Internet and maybe an electric guitar or synthesizer (Partti 2012).

These new students have brought a special energy and creative input to our popular music studies. Due to the learning environment, with a strong emphasis on group energy and student-initiated projects, the electronic musician clearly influences other students. We are enabling a new culture that combines performing excellence with strong creative elements. Using an artistic research-led workshop method, students, teachers and internationally-renowned artists perform and create together; our ambition is that having the status of the Centre of Excellence in Education will have enabled us, within five years, to further develop and disseminate models and methodologies for training both electronic and conventional musicians to participate creatively in the transformation of the musician's role, also transforming the music industry and culture in a broader sense. These are changes brought about by a performing sound culture made possible by new electronic tools.

The vision of the Centre of Excellence for which we are seeking support, is fourfold:

1) to maintain, further develop and disseminate our already accumulated experience and knowledge about how to organize *a new type of training* for *a new type of musician*, also integrating an original form of computer-assisted learning. We wish to develop the new electronic musician within our already existing environment of popular music education, with its focus on interaction and its commitment to taking risks together, and we will use this mentality as an engine for innovation in the music conservatory culture. An important sounding board for this work is our cooperation with the annual Punkt Festival in Kristiansand (<u>http://punktfestival.no</u>).

2) to collaborate with colleagues, particularly from the Norwegian Academy of Music (NMH, especially NMH's Centre for Excellence in Music Performance Education, CEMPE), to expand and strengthen our already existing skills into educating *conventional* musicians. An important motivation for this approach is that students with traditional instruments also live in a changing musical world, where electronics play an increasingly important role.

3) to collaborate with other colleagues, especially from the Bergen Center for Electronic Arts (BEK) and the Norwegian University of Science and Technology (NTNU) to develop new forms of education that will qualify tomorrow's musicians for *interdisciplinary interaction with artists from the visual media environment*, where electronic options are increasingly being integrated and utilized.

4) to utilize technology as both a medium of learning and as a medium under artistic control and formability, at a level that has not been seen before in the context of music education. In addition to the institutions mentioned above, a vital part of the project will be in cooperation with AEC - Association Européenne des Conservatoires, and institutions within this international network.

## The applicant

Since the late eighties, significant efforts have been made to create a modern and optimised educational environment at the Department of Popular Music, Faculty of Fine Arts, UiA (and these institutions' precursors). This development gained further momentum in 2011, when we moved to new premises at the university's Campus Gimlemoen that provided spacious and modern rehearsal and studio facilities of an international standard. Here, it became possible to satisfy a previously unmet requirement from students by taking the first radical step towards a new rhythmic music reality, through the creation of a Master's Programme for Music Management (2012), immediately followed by a Bachelor's Degree using a laptop as the main instrument (2013) and another in song writing (2015). We also contribute to the Faculty's undergraduate programme for music teachers. In 2015, we institutionalized the long-standing research behind these programmes in a *Popular Music Research Unit*.

Today, the Department of Popular Music has around 100 undergraduate students, of which about one third use their laptop as the main instrument, and about 45 master's students within the five specializations: Popular Music Performance, Electronic Music, World Music, Music Management, and Popular Musicology. In addition to this, there are 10 PhD students. A total of 30 professionals are employed by the Department, including 9 Professors, 6 Associate Professors, 12 university lecturers, in addition to temporary staff and technical and administrative assistance. The number of applicants for our undergraduate programme is high and has been rising. We had 179 applicants in 2013, 180 in 2014, 195 in 2015 and 211in 2016 competing for only 24 spots. Our graduate programme had 21 applicants in 2013, 36 in 2014, 25 in 2015 and after the creation of 5 different specializations we received 51 applicants in 2016, within which 11 were international applicants. Next year we expect an even greater share of the applicants to be international. The undergraduate programme has a high retention percentage, with 58.33% completing their studies on time in 2013, 56.25% in 2014, and increasing to 71.43% in 2015.

Regarding its education and research within the field of electronic music, the Department of Popular Music collaborates with the Mechatronics programme at UiA's Faculty of Technology and Science. (Mechatronics combines mechanics, electronics, and computer science.) These two programmes are also designated as the university's only *signature studies*: special focus areas highlighted as particularly significant for the university's profile and its scientific and educational proficiency.

The close cooperation with the abovementioned, internationally-acknowledged Punkt Festival is of significant importance to the Faculty profile. Students also benefit greatly from the opportunity to study abroad through the EU's *Erasmus* + Programme and AEC. The Faculty also boasts a comprehensive network of partners in Norway, Scandinavia, Europe, America and Asia, totalling around 20, some of which form the cores of even broader networks.

## The Existing Provision

## **Input Factors**

### The Centre's management and networks

The proposed Centre for Performance-Based Electronic Music will have *management* led by Professor Jan Bang in cooperation with Assistant Professor Henrik Johannes ("Jo") Brodtkorb, Higher Executive Officer Linda Mari Stiberg-Jamt, and a student. (CVs of the first three can be found in the appendix, the student will be appointed by the student council.) The Centre will have a *board* with members from UiA and key external colleagues. The Board Chair will be Professor Astrid Birgitte Eggen (UiA Pro-Rector for Education), other members will be Per Kvist (Dean of the Faculty of Fine Arts), Erik Gunvaldsen (Head of the Department of Popular Music), Professor Jan Bang (Director of the Centre), Assistant Professor Jo Brodtkorb (member of the proposed Centre's management group), Assistant Professor Hilde Norbakken (Department of Popular Music), Associate Professor Jon Helge Sætre (head of NMH's Centre of Excellence in Music Performance Education), Professor Dr. Phil. Stefan Gies (Hochschule für Musik Carl Maria von Weber, Dresden, and head of the AEC), a PhD student and a student (both from the Department of Popular Music). As noted below, the activities within the Centre will be organized as four *core areas*. To maintain the integrity of the work, the management will rely on a *working group* of those who are responsible for these areas and for the pedagogical follow-up. Finally, the Centre will establish an internationally diverse *group of partners* that will be called upon individually or collectively as advisers, lecturers, seminar participants, etc. – and whose extensive network will also be at our disposal. This group of partners consists of Professor Andrew Dubber (Music Tech Fest, Birmingham City University), Professor and composer Ambrose Field (University of York), composer and musician John Paul Jones (Led Zeppelin, etc, TBC.), sound engineer Asle Karstad (Maccaphone), Associate Professor Staffan Mossenmark (University of Gothenburg), Postdoctoral Fellow Heidi Partti (University of the Arts, Helsinki) and vocalist and sound artist Maja Ratkje (TBC). This structure ensures a thorough management of the proposed centre as well as positive input from all relevant parties.

## **Process Factors**

### Research- and practice-based education

A practical education in popular music must be based at the forefront of knowledge and practical experience gained from academic research within music and education, and from relevant artistic research and performing practice. This fourfold requirement is perfectly satisfied by our Faculty.

*Traditional academic research* is a requirement met through our work within the Popular Music Research Unit, which distinguishes itself by consisting of not only teachers and PhD fellows, but also master's students. Regarding *educational research*, the Faculty has a proficient music education environment in its *Department of Music – Classical / Music Pedagogy*, an environment which has also focused significantly on pedagogy concerning rhythmic music (see for instance Tønsberg 2007, 2013a, 2013b, 2014).

*Artistic research* in this relatively new area (Borgdorf 2006) is conducted regularly by the entire staff in all three forms ("on", "for" and "in") – often in close collaboration with the students, and in what would normally be defined as "teaching situations". Of course, artistic research is closely linked to *the artistic practice* conducted by the entire staff through their extensive concert activities both nationally and internationally, as well as their work as studio musicians.

Regarding the education's practical component, we will mention in particular our close cooperation with the *Punkt Festival*. Many prominent artists have contributed to the Punkt Live Remix project, including Brian Eno, Laurie Anderson, David Sylvian, Jon Hassell, and John Paul Jones. The programme will leverage Punkt's extensive network of such artists and involve them in creatively and educationally valuable situations with our students, benefitting both sides.

### Learning Methods

Two factors particularly distinguish UiA's education of students with the laptop as the main

instrument: *The first factor* is that the entrance examination no longer contains the traditional music theory element. The deciding factor for admitting students is the candidates' musical performance (with a focus on artistic expression rather than technical skills), as well as extensive interviews. *The second factor* is that traditional classroom education has virtually been abandoned, in favour of workshops and ensemble situations – collaborations not only with students from their own department, but also with students from other specializations. The *pedagogical* reason for this workshop method is that the students, aided by teachers, first of all shall learn from each other, in situations where creative collaboration requires certain skills and interpersonal capabilities. A *professional* reason is that developments in the area of rhythmic music occur so rapidly that it would be counterproductive to attach educational content to a fixed curriculum. Instead, one must base the education on experiences that both teachers and students are able to communicate from their active and productive participation in musical life. Instead of offering traditional teaching, it is therefore the teachers' task to help students absorb and reflect on their experiences, both concretely, and in an educational perspective.

Feedback from students regarding the programme's organization and execution is provided by our *Rhythmic Council*, composed of one student from each group.

## **Outcome Factors**

Since neither Norway nor other Nordic countries provide comprehensive educational programmes similar to ours, it is difficult to determine exactly how we stand in relation to other institutions. However, the high and continuously increasing number of applicants proves that the quality of our programme is acknowledged not just in Norway, but in the rest of Europe and beyond. The combination of musical performativity and technical investigation makes our profile, as we see it, unique also in an international context.

In order to ensure a broad and objective evaluation of students' graduation concerts, we always employ examiners from outside – from other institutions and from the professional music environment. Their assessments clearly show that candidates from UiA are on par with graduates from other types of popular music education, and equally coveted. This year, record companies like Sony and Warner attended our annual graduation festival to scout for talent.

Given that most of our laptop students start almost from scratch where music theory is concerned, we believe it is a clear sign of the strength of our educational programme that these students also obtain the best results in music theory, among all students who apply for the master's programme. The remarkable amount of time that these students dedicate to their education (working in the rehearsal rooms until late at night) is testament not only to the excellent facilities, but also to their dedication.

The programme provides an excellent basis from which to apply for a scholarship for Artistic Research, or to work as a studio musician, producer, composer, musician / artist or teacher. (Opinions from a number of students attest to the breadth of the programme and the students' background and expectations; see the reference list.) We also see our graduates emerge on the TV screen, whether it be in the limelight or in the background, or on talent programmes like *Idol, The Voice* and *Stjernekamp ("Star Challenge")*, and at the annual *Spellemannprisen* award show (Norwegian *"Grammy"*).

# The Centre Plan

## Innovation

If we achieve the status of Centre of Excellence, this will open up opportunities not only to consolidate the already existing innovations, but also to experiment with additional educational methods. The ambition is to create development, innovation and insight, primarily within five main areas:

## 1. Training of harmonic understanding and musical ear

A strengthening of the students' competence in music theory and their musical ear will positively affect their subsequent work opportunities and artistic practices in various genres after completion of the course, but the methods normally used when teaching students of traditional instruments would not engage the category of students focused on here. We have already made good progress in developing and researching educational methodologies and resources related to this issue. However, we envisage that *interactive software* could be an important new resource. This type of software would allow students to absorb information at their own pace, and let them evaluate their own skills and progression. Since the already existing tools are extensions of traditional pedagogy, a radical rethink is necessary. Development of these tools will begin immediately under the leadership of Assistant Professor Jo Brodtkorb, Professor Erik Gunvaldsen, and Assistant Professor Hilde Norbakken.

## 2. Freedom to shape one's own electronic medium

Performers of electronic music who apply to UiA normally utilize standard software. Already during the first year, we would like to develop an educational environment and methodologies that allow students to venture beyond the boundaries of the ready-made, and provide them with self-designed tools to modify, extend and supplement commercial software. We will also develop

methods for measuring the students' progress, both regarding technological innovations and how they use the new electronic tools in their performative and creative practice. Because of our already established cooperation with the Faculty of Technology, we can achieve these objectives, and also include the development of new physical interfaces between musicians and their electronic equipment within our educational framework. This work will be led by Assistant Professor Jo Brodtkorb.

### 3. Musical practice with technology

As initially mentioned, our students typically carry a personal story centred around the computer as a musical instrument. They are usually competent listeners and are skilled at creating soundscapes; two important elements of any musical practice. Often, however, they are inexperienced at improvising on their "instrument", and usually they lack experience when it comes to musical interaction. To improve these abilities, we propose a variety of methods:

3.1 Ensemble performance: electronic musicians interacting with musicians who play electroacoustic and acoustic instruments

An important part of the students' development is to find tools that are useful in a live context. We introduce students to various options and approaches: manual controllers, software like Max, Ableton Live, and plug-ins for other digital audio workstations. Moreover, students need to become acquainted with their instrument, they must internalize its functions and sound repertoire, and train to "muscularly" master the instrument. Musical ideas often present themselves in an instrumentspecific disguise, directly related to the musical tool at hand. This means that the medium must be internalized – its sonic repertoire must be immediately available for the subconscious processes. We study and rehearse two fundamental methods of live practice with electronic tools: *live sampling* and live remix. Live sampling means that the electronic musician has access to his fellow musicians' instruments through microphones or lines. He or she samples segments, processes these inputs electronically, and feeds the electronically-treated samples back into the mix so that they become part of the band / ensemble's overall musical output. Live remix typically implies that musicians on a main stage are sampled by electronic musicians in an adjoining room, where they reconstruct concerts into a new musical work, based on the selected samples. Successful improvisation requires the ability to maintain an open and direct channel to the subconscious, where the ideas originate, combined with focused listening and sensory / motoric skills – all of this executed simultaneously. To put oneself in this particular state of attention and focus, requires training. This work will be led by Professor Jan Bang and musician and sound designer Erik Honoré.

3.2 Processing of audio from students' own acoustic or electro-acoustic instrument Instrumentalists with acoustic or electro-acoustic instruments can connect their instrument, via different microphone techniques, to an electronic platform for audio processing. This allows for the creation of vastly varied soundscapes, and offers opportunities to cross genre borders and explore styles and expressions not usually associated with the given instrument. For many musicians, this is an exploration of a new world; a venture that will be greatly helped by systematization and instruction.

This work will be led by Associate Professor Ivar Grydeland (NMH), trumpeter Hilde Holsen, Jon Marius Aareskjold, and Erik Honoré.

3.3 Improvising in collaboration with a practitioner of live-sampling

When an acoustic or electro-acoustic musician enters into a musical interaction with a practitioner of live sampling, this is quite different from interacting with someone who plays an instrument more equal to what the musician is playing him/herself. This difference of method requires that the collaborating musician is sensitive to how long it takes for the musical events to unfold, both sonically and how the events are experienced. This sensitivity is an important aspect of interpretation that may be acquired through examples, conversations to heighten awareness, and practice. The initiative will focus on developing teaching competence within the field. This work will be led by Professor Øyvind Brandtsegg (NTNU), vocalist Sidsel Endresen, Associate Professor Ivar Grydeland (NMH), and Professor Jan Bang.

### 4. Electronically processed sound in other media contexts

Today, electronic music and other forms of electronically-based sound is found in virtually all media: in movies, in videos and video games, in visual art installations, on the dance stage, at the theatre as sound design, etc. Multimedia projects are often collaborations between artists from various art forms. The projects become arenas for exploration of audio-visual fields, cross-discipline approaches, as well as creative group efforts resulting in ground-breaking projects. In addition to artistic preparedness and reflection, the creation of such soundscapes requires highly-evolved technical skills and craftsmanship. The artistic requirements may lead to a critical and conscious attitude towards standardized technology for sound processing. Commercially available tools are not always suitable for this category of project, so customizing of new tools and solutions may be required. Artists in the electronic music field often work on the same technological platforms as visual / multimedia artists (for instance with *Max* software), a fact that allows for interdisciplinary exploration and development of new methods and tools. Also in this area, we will address educational challenges and seek new solutions for improved learning. This work is led by sound artist Yann Coppier (The Danish National School of Theatre and Contemporary Dance), Professor Erik Gunvaldsen, and Professor Trond Lossius (BEK).

## 5. Funding of student initiated-projects

As a vital part of the project, we will offer students within the AEC network the possibility to apply for funding for research and artistic research projects within the framework of the work packages.

## 6. Learning processes

The work within all main themes will be monitored and evaluated by our music education specialist team, led by Randi Margrethe Eidsaa in collaboration with Heidi Partti and CERM - Centre for Educational Research in Music (NMH). One of the issues that will be addressed is whether the focus on electronics in music performance influences gender representation among music students. Fortunately, there are indications that the former significant male dominance in popular music has entered a downward trend, also in the electronic world (Klausen 2012). In connection with the work packages we will also include two research fellows.

## Dissemination

A main characteristic of The Centre for Performance-Based Electronic Music's activities will be the student's own creative expression in a coached community. Therefore, the students themselves must be the key communicators of the ideas and insights brought about by the Centre. The model for this kind of communication is already incorporated in the current education: Through *Erasmus* +, students and their teachers visit other European institutions, meet their students and experience their teaching environments. This provides a unique opportunity to act as ambassadors for the educational thinking and practices developed by the Centre, communicating directly with peers from other environments and musical / pedagogical cultures. But in a world of social media, it is not always necessary to travel physically to meet peers and communicate insights. A substantial portion of our communication can be conducted through YouTube, Facebook and similar media where we can present recordings of learning situations, concerts, lectures, interviews with students and teachers about their experiences, and so on. Much of this will also be disseminated through the Centre's website. However, we will also use more traditional methods of communication to relevant audiences: we will seek to reach educational researchers and practitioners, popular music researchers, etc. through traditional peer-reviewed articles in relevant national or international journals, and through guest lectures, presentations at conferences and seminars, at workshops, etc., both at events that we organize ourselves, and those we attend. We will also reach peers who share our interest for artistic research through new channels for peer-reviewed "expositions", such as JAR (Journal of Artistic Research). Since the students' creative work will largely take the form of artistic research, the staff will assist students in placing their work there for particularly good projects and interesting creative results.

The Centre will also collaborate with the Punkt Festival and satellite festivals within its network to arrange international conferences where we present our activities.

## **Evaluation and Impact**

The Centre for Performance-Based Electronic Music will have a profound and extremely valuable impact on both students and staff, on the involved individuals and institutions, and on the electronic music world globally. The steps we have already taken to develop experimental educational practices, and the experience we have gained regarding music education in a field that is rapidly evolving musically as well as technologically, organizationally and economically, will not only be consolidated and continued, but also further developed to reflect the future we are entering. The interdisciplinary approach across what we usually regard as the "two cultures" (Snow 1959) represented by education and the Centre, could serve as a model for other innovative collaborations, both in the university environment and in the cultural world.

Our ambition is that the first five years as a Centre of Excellence can provide us with: 1) a number of artistic achievements (concerts, recordings, YouTube contributions, etc.); 2) descriptions of a number of innovative methods for educating the electronic musician, including fresh approaches to conservatory education; 3) a set of new and innovative electronic exercises and evaluation programmes for the new type of music students; 4) a number of peer-reviewed articles in music education journals and other professional media; and 5) a number of highly qualified candidates who are well-equipped to participate, both as creators and performers, in the new musical and sonic culture made possible by electronics.


# **INFORMATION ABOUT THE HOST INSTITUTION**

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# **ABOUT THE CENTRE**

Name of Centre Center for Computing in Science Education (CCSE)
Is the Centre already established at the time of the application (yes/no)? □ Yes ⊠ No
Please name any consortium partners for the Centre [text]



# ABSTRACT

Describe briefly the aims as well as the current and planned activities of the Centre (150 words)

A significant challenge in higher education is to renew the basic curriculum to integrate computing, to make the education research-near, and to prepare students for an interdisciplinary workplace. We have initiated a unique educational program with documented success where parts of the curriculum are redesigned to integrate computing, which allows students to engage in realistic and research-near problems. Our goal is to transform this activity into an internationally leading Center for Computing in Science Education (CCSE). The center will, in partnership with students, integrate computing throughout the whole curriculum, develop professional educational material to ease adoption at other institutions, establish a research activity to provide a research basis for the approach, and adapt and extend methods and practices to other institutions and disciplines, nationally and internationally. The center will transform education, build a culture for teaching and learning, immerse students in complex problems and prepare them for a lifelong career.



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All appendices must be in English.

#### **Practical information**

The rector of the host institution must sign the application.

The deadline for submitting applications is set in the announcement of the call.

All applications will be published on the NOKUT website, alongside the expert panel's feedback.

#### **Application Document - Overview**

The Center for Computing in Science Education (CCSE) aims to become an international hub for the research-based integration of computational methods in science educations. The center will:

- Develop material, approaches and study programs for CSE teaching and learning,
- initiate, support and disseminate research into effective learning and assessment methods, and
- implement practices in educations across disciplines in collaboration with key partners.

**Computing has changed the practice of science**: The growth in computer power over the past decades has radically changed the practice of physics and other sciences - and is expected to affect all aspects of society <sup>1</sup>. Problem solving using computers – *computing* – is now an integrated and central part of research, development, business and industry. To prepare students for a lifelong career, computing must therefore be an integrated part of science educations. Surprisingly, most education programs have not been updated to integrate computing.

Integration of computing will change science education: In physics nature is described using mathematics, and examples and exercises rely on solving mathematical problems. Therefore, physics and mathematics are taught in a coordinated and sequential manner. However, with only traditional mathematics at our disposal, only a few carefully selected, simplified physics problems for which we know the mathematical solutions can be solved. Unfortunately, these limitations have shaped the contents and form of the education and teaching practices, and have contributed to the view that physics has little or no relevance in the real world. Now, the growth in computing power has provided us with robust mathematical methods that allow us to solve practically any physics problem. Thus we are no longer limited by traditional mathematics. Students can learn robust, powerful and adaptable solution methods - computing methods - in which they write computer programs to solve problems using workflows similar to that of research or industry. Contents and approaches can be chosen for pedagogical or motivational reasons instead of mathematical limitations. Examples can be based on real data, and realistic and research-inspired problems can be introduced from day one. This calls for a redesign of the contents and form of the education to integrate the use of computing - opening new pedagogical challenges and opportunities.

**Computing in Science Education at UiO**: We have initiated a project to integrate Computing in Science Education (CSE) in a systematic and unified manner across different subjects. The goal is for students to learn computational tools as part of their introduction to mathematics and then reapply and adapt the approaches in physics and other sciences. The CSE project has had significant success based on enthusiastic individuals, strong student engagement and leadership support. We have coordinated courses in mathematics, numerical methods, and programming in the first semester to form a basis in skills and methods. Full integration of computing has been achieved in

some physics courses, with changes in curriculum, learning materials, teaching approaches and assessment methods. However, most courses in mathematics and physics have only partial or no integration of computing, and in other programs, such as in life sciences, computations are absent.

**Establishing a world-leading center**: Our ambition is to transform the CSE project into a world-leading *Center for Computing in Science Education (CCSE)*. The center will unleash the potential of CSE by implementing it fully in physics and by extending the approach to other disciplines and institutions - opening for interactive, creative, and collaborative learning approaches and providing students with essential skills. Since the research evidence for CSE methods is sparse, we need to build a CSE educational research activity to provide a research basis. Effective dissemination requires professional educational material. Integration in other disciplines with students with weak backgrounds in mathematics demands novel approaches through cross-disciplinary collaborations.

**Center profile**: This requires a coordinated and substantial development and research effort that can only be achieved through a center for excellence. The center will (i) develop research-based educational material and approaches in physics and other disciplines, (ii) build a CSE educational research activity, (iii) nurture a culture for cross-disciplinary teaching and learning in partnership with students, and (iv) adapt and extend CSE to schools, colleges and universities, nationally and internationally. The center will use CSE to transform practices and immerse undergraduate students in complex problems that motivate, foster creativity and prepare them for a lifelong career.

**Basis for success**: We are in a unique position to fulfil this ambition based on our documented excellence in research and education, student involvement, and stakeholder partnerships. Starting from 2017 the bachelor programs at the Faculty will be redesigned, providing an ideal time-frame to study the effect of changes in approaches, curriculum and program design.

#### Documented educational quality in existing provision

#### **Input factors**

**Excellence in existing CSE initiative**: The center builds on the Computing in Science Education (CSE) initiative at the Faculty<sup>2</sup>, a flagship project with strong leadership support and financing (700kkr/yr) which aims to integrate computing in undergraduate curriculums. The Dean of Education heads the CSE management group that allocates resources for development and student activities, organizes yearly conferences, evaluates and reports. CSE is prominent in the strategy of both the Faculty and the host Departments <sup>3</sup>, it is a key brand for the education of the Faculty, and it is often presented as an example of the outstanding educational quality of the Faculty and the University of Oslo <sup>4</sup>. The quality is demonstrated by external funding attracted to the project (4 mill. kr)<sup>5</sup>; partnership in an EU-funded iCSE center <sup>6</sup>; appointment by the Ministry of Education to develop a national guide for CSE<sup>7</sup>; invited talks at international conferences<sup>8-12</sup>, universities <sup>13, 14</sup>,

and at numerous national conferences, meetings, and workgroups<sup>15-23</sup>. The CSE activity has published five top-selling international textbooks with integrated computational approaches<sup>24-28</sup>, was awarded best article of 2015 in the pedagogical journal UniPed<sup>29</sup>, and has won the prize for excellent learning environment at UiO in 2000, 2011, 2012, and 2015; the national (Nokut) prize for educational excellence in 2012, and the Thon national educator prize in 2015 and 2016.

**Excellence in research**: The ability to develop an excellent research-near education and a new research-based curriculum depends on excellent research. Our faculty are internationally leading researchers<sup>30</sup>. Key faculty were group and center leaders for three Centers of Excellence in Research<sup>31</sup>. It was indeed the research collaboration in these cross-disciplinary, computationally oriented centers that initiated the educational collaborations across departments that forms the basis of CCSE. The educational research activity of CCSE builds on the Physics Education Research group in collaboration with Professors Stensaker and Strømsø, Faculty of Education, and the Physics Education Research group at Michigan State University<sup>32-35</sup>.

**Educational leadership and study program design**: CCSE will play a key role in the design, implementation and evaluation of the Faculty's new bachelor programs starting in 2017. The transition will provide a unique opportunity to develop programs and to evaluate the impact of program design, curricular changes, and teaching approaches. Resource allocation is monitored by education leaders who are part of the leadership groups at the Department and Faculty level.

#### **Process factors**

**Research-based and research-near education**: The development of a new curriculum is research-based in its motivation and in its realization: All faculty members involved in teaching have scientific activities that use computational methods, thus allowing a close coupling between research activities and curricular development. The integration of computing gives the students the skills needed to work on research-near and realistic problems early on, exposing students to realistic work methods and introducing a sense of wonder and exploration to undergraduate education. With these skills, students have contributed to research already from the second semester through organized undergraduate research activities. For example, using computational competence gained in the first semesters, a first-year student made a discovery that was published in the prestigious journal Proceedings of the National Academy of Sciences <sup>36, 37</sup>, and an exam project that combined physics and computations was published in American Journal of Physics <sup>38</sup>.

**Research-based methods and student learning**: The students are exposed to a wide range of learning methods from traditional lectures to innovative project-based research-near group projects and cross-disciplinary problem-based learning <sup>39</sup>. Many courses apply research-informed approaches to enhance learning and motivation. For example, "Fysmek1110: Mechanics" was one

of the first courses in Norway to use peer instruction with clickers <sup>40, 41</sup>, receiving exceptional student feedback <sup>42</sup>. The course "Fys3150: Computational Physics" has implemented project-based teaching with exceptional student feedback, such as "*I am a bit in love with this course. It is the best course I have ever taken*!" <sup>43</sup>. Good practice is studied <sup>44-47</sup> and disseminated to improve practice locally <sup>15, 48, 49</sup> and nationally <sup>16, 17, 19, 20</sup> through courses and seminars for the faculty, and in compulsory biannual seminars for teaching assistants to build their teaching competence.

**Assessment and monitoring of learning**: Assessment methods are aligned with the learning objectives and include: traditional, digital and oral exams, presentations, and peer and teacher reports. Science and math curricula are sequenced and require careful assessment of skill development to ensure progress. For peer and teacher assessment we employ a student-developed web-based delivery and reporting system, *Devilry*<sup>50</sup>, which the students are more satisfied with than commercial alternatives. This gives us direct access to the assessment system, opening for studies of teacher-student interactions and their effect on learning.

**Learning environment**: The students have a strong community and organize their own spaces and resources including a supercomputer <sup>51</sup> as well as a new 400m<sup>2</sup> learning center, designed for social activities and active learning approaches <sup>52</sup>. They organize student mentors to build social networks from the very first week and the Faculty finances a two-day seminar to build class identity.

**Student engagement**: Students play an active role in curriculum development, strategy processes, and quality systems. They develop CSE learning material and extend the use of CSE through summer internships. Students have developed and taught preparatory courses in programming and developed course blogs<sup>53</sup>. The 2014 NOKUT evaluation of the Bachelor program in physics<sup>54</sup> stated (p. 16): ".. the institute hired strong students to develop CSE further... The committee considers such a stimulating development of the field, where the students are included, as an exciting process. The measure is a good example on how the basic education can be research-near and give a closer dialogue between teachers and students... The students that the committee met with were enthusiastic about the measures associated with the introduction of CSE".

**Student feedback**: Student feedback is systematically used to improve teaching and learning with student organizations using focus groups, questionnaires, interviews and dialogue meetings as part of the quality system. In the StudentBarometer <sup>55</sup> our students report on "their possibility to affect the content and approaches of the program" and "how criticism and views from the students are followed through" with scores that are 0.8 and 0.7 above the national average (scale 0-5).

#### **Outcome factors**

**Student achievement**: The Physics BSc at UiO is the largest physics program in Norway. The program has the highest scores in the StudentBarometer with an overall score of 4.5/5 (second best:

4.2), student retention is 93% (83%) after 1 (5) semesters, and ECTS/year were 58 for students starting 2013 (national average: 40). Recruitment of women has increased from 25% in 2011to 38% in 2015 compared to 23% in physics nationally <sup>55</sup>. Special focus has been placed on understanding and improving first year retention through the research-near experience provided by CSE. The justification for the 2012 Nokut prize gives further evidence of the high standards achieved: "*Of learning outcomes described, the committee would highlight increased standards both in advanced subjects and in exams on the bachelor level. Students proceeding with a master degree are able to more quickly commence research since they are more operational in computational methods.*" Student achievement is documented by student research publications<sup>37, 38, 56, 57</sup> and awards: former CSE students <sup>58</sup> won the 2015 UiO innovation award for a series of teaching apps <sup>59, 60</sup>.

**Relevance of education**: The integration of computing into the science curricula answers to signals from research and industry that these skills are critical for a lifelong career. Almost all students continue with a master degree in physics. Educational relevance therefore includes results from the physics master program. Students are exceptionally satisfied. At studiekvalitet.no <sup>61</sup>, a database compiled by the science and technology organizations, physics at UiO is the top rated program with 100% of its students in relevant jobs. This is also reflected in the Candidate Survey <sup>62</sup> p. 32, where 93% of the alumni reports that they are "very satisfied" or "satisfied" with the outcome of the education, 59% have relevant jobs before graduation, and 87% have relevant work half a year after graduation. In the StudieBarometer <sup>55</sup> the physics program scores 4.4/5 on "Working life relevance", 0.2 above the second best. The competence of our students is in high demand. For example, 60% of the graduates with a master in computational physics (2003-2015) were recruited to PhD studies in fields such as life science, geoscience, chemistry and physics.

#### **The Center Plan**

**Vision**: The vision of the center is to develop a research-based foundation for the integration of computing into basic education and to become an international hub for this activity. The center will lead research-based development of new learning materials, methods and practices, study their effects and how they transform student learning and teaching culture, involve students deeply in the development of new practices and methods, and disseminate and adapt the practices and results across disciplines in collaboration with key partners.

#### Innovation

The CSE initiative has been a success with innovations in select courses. CCSE will build on and extend this success to provide a new, research-based curriculum with professional learning materials and methods for the *entire* basic physics curriculum. CSE will be adapted to new institutions and disciplines, such as to university colleges to other sciences, which requires the

innovation of new material and approaches beyond the scope of the current CSE initiative.

**Importance for higher education**: There is a general consensus that computing should be included in physics and science educations<sup>63-66</sup>, but most degree programs only include isolated computational courses, instead of integrating computing in the basic curriculum<sup>65</sup>. This is because integration requires coordinated changes in mathematics, computer science, and physics - a difficult task - and because there is a lack of high-quality research-based material and approaches. There is also an international effort to make undergraduate education research-near and cross-disciplinary. The CSE approach will provide students with the skills needed to engage in research-near and industry-near problems using realistic workflows and scientific approaches early on. This opens for collaborative learning, unleashes creativity and allows students to connect disciplines with each other and with reality - important factors for motivation and retention<sup>67</sup>.

**Novelties and transformations of current practices**: To unleash the advantages of CSE, the center will develop new textbooks, new problems, new teaching methods and new assessment methods that integrate computational methods – not only in physics, but also in supporting courses in mathematics and computer science. We will develop a research-based understanding for how computational methods and reasoning affects student learning of basic physical and mathematical principles compared to traditional practices, which teaching practices are effective and in what way, and how computing can make undergraduate education more research-relevant. We will develop and study case and project-based approaches that engage students in digital collaboration and creative problem-solving using real-world data - providing skills needed for a lifelong career. This transformation is challenging since traditional approaches have been finely honed over many years and poses a rare opportunity for a paradigmatic shift. However, since we have built a culture of trust and collaboration across departments, we can develop material and approaches and study their effect on student learning in mathematics, computer science, and physics simultaneously. This puts us in a unique position to build a sustainable curriculum that can be improved systematically.

**Innovation beyond physics**: Physics is a good starting point for a CSE reform because mathematics and computing are integrated in the practice of the discipline. However, computing is changing all sciences and all aspects of society<sup>1</sup>. The integration of computing, algorithmic thinking, and data will therefore gradually affect educations across disciplines, and experiences from CSE in physics will provide a foundation for adaptation in other sciences and disciplines.

**Student involvement in development and innovation**: Students will participate at all levels in development, evaluation, research and innovation in the center. Indeed, students are sometimes more competent than faculty to develop computational learning material and exercises. Students will serve as teaching assistants supported by pedagogical seminars and peer-support groups. Senior

students may participate in educational research projects to observe learning processes and interview students, thus enhancing their meta-understanding of their own learning processes. The center will fund student-driven innovation projects to develop learning tools and data-collection platforms, and organize research projects for bachelor-students.

**Relation to international developments in higher education**: Physics Education Research is an active international research field that has developed well-established best practices for physics educations<sup>41, 68</sup>. New contents and approaches must therefore be research-based to gain wide acceptance. Thus there is a need for a robust educational research activity on CSE to develop pedagogical arguments for how such a renewal will improve student learning, motivation, and retention. Teaching in the center will be based on best practices including student-active<sup>69</sup> and project-based methods<sup>68</sup>. We will systematically study learning outcomes using our open-source student delivery and feedback system, *devilry.org*, which will provide important insights into student learning. We will build on existing initiatives, such as Matter & Interactions<sup>70</sup> and Open Source Physics<sup>71</sup>, but our approach is far more ambitious as it combines changes in mathematics, computer science, and physics, and extensions to other fields.

**Key steps to be taken for the vision to be realized: from the present state to the ten-year goal Present state**: Existing interdepartmental culture for CSE with some excellent teaching practices and strong student engagement. Math and programming integrated in first semester. Full CSE integration in 2 of 6 basic physic courses and partial integration in other courses. Two textbooks have been published internationally. The research basis for methods and approaches is sparse.

**Five-year goal**: The center has initiated a research-based approach to curriculum change and teaching and learning methods in partnership with students. Full integration of CSE in 4 of 6 basic physics courses, with two new textbooks, 2 of 4 math courses, and 1 astronomy course. A pilot extension of CSE into biology; a pilot adaptation by an external partner; a pilot school interaction program; and pilot studies of learning outcomes and teaching methods in 3 courses.

**Ten-year goal**: The center is an internationally leading hub for research-based approaches to CSE, with a strong educational research activity; an international repository for methods and materials; and strong student partnership. Full integration of CSE into 6 of 6 basic and 2 advanced physics courses, 4 of 4 math courses, and 2 astronomy courses. Extensions of CSE to 3 other disciplines at UiO. Adaptation of CSE at 2 external partners. A well-running school interaction program.

We aim to achieve this through the following coupled work-packages (WP) and actions (A):

WP0: Administration and WP5: Dissemination are described in the text.

**WP1: Research-based development of teaching material**: *A1.1*: Develop a repository of teaching material and evaluation methods; *A1.2*: Develop textbooks and interactive and modularized material

with integration of computational methods and programming examples; *A1.3*: Study usage and effects using big data approaches, interviews, and observation; *A1.4*: Provide writer support including writing groups and use of students to improve texts; Develop CSE publishing tools; Build partnership with Springer on CSE book series.

**WP2:** Research-based development of methods and approaches: *A2.1*: Student-active learning: Develop, apply and evaluate traditional and new learning methods in CSE courses; *A2.2*: Develop and test research- and industry-near CSE cases in collaboration with stakeholders; *A2.3*: Develop and study methods for assessing student work and collecting data for CSE courses; *A2.4*: Develop and test methods that use innovative digital and physical learning environments; *A2.5*: Develop, test and evaluate study programs and courses; *A2.6*: Appoint a senior researcher to form a basis for the research activity and a conduit for transformative ideas.

**WP3: Develop a culture for teaching and learning:** *A3.1*: Develop school-university transition program and investigate effects on recruitment, retention, and results; *A3.2*: Improve student culture through student spaces, mentor programs and startup seminars; *A3.3*: Develop teacher culture through annual teacher retreat, teaching in teams, workshops and seminars with focus on teaching, and learning and curriculum development; *A3.4*: Develop quality systems and student evaluation methods to enhance constructive alignment and ensure quality development through systematic feedback and improvement; *A3.5*: Promote teaching skills renewal through pedagogical courses, educational sabbaticals, and career goals for teaching proficiency and excellence.

**WP4: Student-driven activities**: *A4.1*: Establish student partnership board; *A4.2*: Support educational research projects where students collaborate with pedagogical researchers; *A4.3*: Support student development of material, exercises and case studies; *A4.4*: Support that student teaching assistants develop, share and document expertise through mentoring, courses, and workshops; *A4.5*: Support student-developed instruction initiatives such as short courses, seminar series and science competitions; *A4.6*: Support student innovation projects; *A4.7*: Support research activities for bachelor students; *A4.8*: Support student internships in research and industry.

#### Additionality: Outcome and impact of the center that could not be achieved without support

The CSE initiative has produced exceptional results based on enthusiastic individuals paired with supportive students, leadership and a strong culture for collaboration. This is not a sustainable model for the high ambitions we have for the CSE activity. Further progress, dissemination and impact now depend on developing a research basis for the activity. This was argued by the Nokut evaluation in 2014: "*The Faculty should strengthen the CSE initiative by evaluating the consequences of the project*", and the Ministry-appointed work-group in 2010: "*The ministry should establish a national CSE Centre. This will be a resource for computing oriented education and will* 

collect teaching material, examples and tasks. The CSE Centre will also initiate and coordinate research which will study different aspects of computing oriented education in order to document the results and help establish good teaching practice". Well-founded research-based arguments and high quality, tested learning materials are needed to spread the practice across disciplines, nationally and internationally. However, there are no resources for a CSE educational research activity at UiO without a center. The ambition to turn CSE into an internationally leading research-based activity and to expand to other fields can therefore only be achieved by the coordinated effort of a center that combines internal and external resources and groups spanning educational development, research and practice as well as student partnership.

#### **Evaluation and impact framework**

The center will develop measures of progress based on milestones and deliverables in the activity plan and ten-year goals and development (i) in quality indicators at the individual, course/program and institutional level; (ii) in recruitment, retention and graduation rates; and (iii) in students scores on standardized and customized tests. Methods to assess student achievement and learning outcomes for CSE learning objectives will be developed, tested and applied, serving as benchmarks for dissemination practices. Scoring for CSE integration will be included in student evaluations.

**Contributions to institutional development**: The center will finance development and research of teaching and learning practices across the institution, and contribute to pedagogical education of students and teachers. The center will establish CSE quality committees with representation from students, teachers, leadership and external stakeholders to ensure that CSE elements are introduced in a coordinated way throughout the education. The CSE educational research activity will serve as a seed for the development of educational research at the Faculty.

**Value for money**: The educational research activity requires long-term financing, and will be reassessed after four years. The effect of short term financing to development, research, and student-driven activities will be evaluated based on contributions to milestones, deliverables and quality indicators and funding may be redistributed among the WPs to optimize value for money.

**Post-funding and exit strategies**: The educational research activity will be continued by the physics department and will have reached a standing that allows for funding through external projects. CSE will be integrated in study program design, curricula, and teaching practices beyond the center period. Tradition for teaching excellence will be embedded in lasting practices such as pedagogical courses, seminars, academic hiring, and a part of the student and teacher culture.

#### Dissemination, dialogue and communication through partnerships (WP5)

Learning material: New curricula require new learning material. The center will establish an interactive web-based repository for teaching methods, lectures, exercises and exams with

experiences and feedback from practitioners and students. An international textbook series will be published through a partnership with Springer. Research results on CSE approaches will be published internationally, presented at conferences by students and faculty, presented to university and government officials by Faculty leadership, and popularized for general media and blogs by students, faculty, and Faculty leaders. Experiences, results and methods will be presented at a yearly national workshop that will include systematic training of university teachers.

**Internal dissemination**: The center will host regular research seminars, seminars on educational practices, and CSE workshops to educate leadership, teaching faculty and students. The center will support teacher and student development projects to adapt approaches to new fields and establish scholarships for excellent students to work on CSE development or research projects of choice.

**Extension to new programs at UiO** will be organized through partnerships illustrated by the approach in biology: (i) Develop plans with leadership and senior faculty. (ii) Competent PhD students develop new materials and approaches in collaboration with seniors. (iii) Pilot courses are tested with biology students and adjusted, (iv) and integrated into regular courses by faculty. (v) Regularly investigate and adjust approaches, (vi) and evaluate and review with leadership.

**Extension to other institutions**: Transition mechanisms will be developed through a pilot at the University College of Southeast Norway and then extended to other institutions. **International extensions** will be done with key international collaborators such as Michigan State University, and through our international platform for educational and research partnerships, INTPART<sup>72</sup>.

**School partnerships**: The introduction of CSE may lead to new challenges for students as they transition from schools to university. We will therefore initiate studies of the transition process in partnerships with selected schools. For example, school classes with teachers can visit the university to work on a realistic, research-near project that integrates mathematics, computing, and physics taught by university teachers and student instructors, thus allowing us to address students and school teachers, in collaboration with the ProTed SFU at UiO.

#### **Organization and Partners**

**Center organization (WP0)**: The center is hosted by the Department of Physics, UiO. The center will be lead by its director, a coordinator and a WP leadership group. The board, with stakeholder representatives, will have oversight of budget and strategy. An advisory board with international authorities on computing and science education will meet biennially to advise and evaluate the center's performance. The center will host a new CSE educational research group with faculty, post-docs, PhD-students, collaborators from the Faculty of Education and adjunct professor Caballero from MSU. Active partners include the Univ. College of Southeastern Norway, Michigan State University, Valler High School and a consortium of research and industry stakeholders.



# COMMENTS

[Body text (150 words)]



# INFORMATION ABOUT THE HOST INSTITUTION

Host institution University of Stavanger			
PO Box address Postboks 8600 Forus			
Postal code 4036	City Stavanger	Place [text]	
Telephone 0047 51830000			
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# **CONTACT PERSON**

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# **ABOUT THE CENTRE**

Name of Centre Centre for Simulation-based Learning for Professions - SimLearn

Is the Centre already established at the time of the application (yes/no)?  $\Box$  Yes  $\boxtimes$  No

Please name any consortium partners for the Centre



# ABSTRACT

Describe briefly the aims as well as the current and planned activities of the Centre (150 words) SimLearn will educate professionals that are better prepared for practice and lifelong learning, through transforming higher education by implementing simulation-based learning (SBL). SimLearn will contribute to faculty development and new research-based knowledge about how to use simulation-based learning to improve student learning in higher education. As a research-based learning community, the centre will bring together and house renowned scholars from healthcare education, teacher education and engineering education, all experts on the use of simulation in their respective educational contexts. In close collaboration with students and professionals across professional borders and external partners, the centre will be a hub for sharing knowledge and developing SBL for the professions and professional training environments. Focusing on the use of advanced digital tools in safe learning environments such as laboratories, SimLearn will take a national and international lead in informing professions about how the use of SBL may promote continuous lifelong learning and practice development within and outside the academic and professional arena.

# **APPLICATION DOCUMENT**

The application must be written in English and follow the requirements set in this template. It must not contain more than 10 pages in Times New Roman, 12-point types, with lines spaced 1.5 and margins of 2 cm. Within this format, the applicant must provide:

#### a) Documentation of educational quality in existing provision

The applicant must comment and critically reflect on themes and questions set out in the criteria, and compare their existing provision with similar provision within the same subject/discipline area, both nationally and internationally. Through this, the applicant must document that the academic community qualifies as a Centre for Excellence in Education.

#### b) A centre plan

The applicant must comment and critically reflect on themes and questions set out in the criteria. The Centre Plan must outline the vision of the Centre, its strategy and plans. It must present the plans for the dissemination of knowledge and practices to its own institution(s) and to other educational communities as well as an evaluation and impact framework.

#### **Appendices**

The following appendices must be included (and no other):

- 1. A list of references
- 2. A budget for the Centre for the first five-year period, including motivation for costs (see guidelines at <u>www.nokut.no/SFU/utlysninger</u>)
- 3. An action plan for the Centre, including milestones (no more than three pages)
- 4. CVs of the proposed Centre Leader and two to five key members of the Centre team (each CV must not exceed two pages)



All appendices must be in English.

#### **Practical information**

The rector of the host institution must sign the application.

The deadline for submitting applications is set in the announcement of the call.

All applications will be published on the NOKUT website, alongside the expert panel's feedback.

#### **CENTRE FOR SIMULATION-BASED LEARNING FOR PROFESSIONS – SIMLEARN**

#### 1. Vision

To educate professionals that are better prepared for practice and lifelong learning, through transforming higher education by implementing simulation-based learning.

#### 2. Overall goal

The University of Stavanger aims at establishing a Centre for Simulation based Learning (SimLearn) that will transform pedagogical methods and study programmes for educating nurses, engineers and teachers locally, nationally and internationally. The Centre will contribute with new research-based knowledge on how to use simulation-based learning (SBL) to transform student learning through application of knowledge and participation in higher education. As a research-based learning community, SimLearn will bring together students, educators from higher education and experts from the professions to collaborate, learn and develop relevant and needed knowledge, skills and attitudes for the professions.

#### 3. Background

Higher education struggles to keep up with the speed of changes and new knowledge in the society and the professions. A potential gap between what students are being taught and what professions and social environments require, must be consciously dealt with. A core educational challenge is to prepare the students to meet and handle the practical complexity of today's work arenas in adequate ways. Working in future professions will be even more multidisciplinary and demand more collaborative and communicative skills with user groups compared to what we see today. The presence and effect of information and communication technologies (ICT) will require employees with attitudes and abilities to constantly handle new systems as they evolve. The student population entering higher education today is generally comfortable with digital tools and networks through their life in and out of school. They are also socially skilled when it comes to face-to-face interactions as part of a diverse urban living. And finally they understand the mechanisms of being part of a changing society. The students' own experiences and competencies must therefore be taken into account as a learning resource in higher education. OECD underscores a multidimensional trait of today's higher education where the students have vital contributions to the learning process in which they are a part. The OECD key competencies<sup>1</sup> focus upon the student's ability to act in heterogeneous groups, use various tools interactively and also to do this in an autonomous manner. In order to educate for this, the students should be involved as autonomous and responsible learners in heterogeneous learning environments and collaboration using tools interactively.

The University of Stavanger's (UiS) main driver for establishing a Centre for Excellency related to SBL, is to lay grounds for student learning and engagement across disciplines and professions, and to enable close collaboration with their professors and professionals. This demands transformed educational models that are far more flexible and practice-oriented, taking issues found in the everyday world of professional practice as their starting point. Issues embedded in a complex professional context should be informed by established theoretical understandings. Both students and educators should be perceived as learners co-constructing knowledge through complementary collaboration. (Fig 1). One future goal of higher education should be to establish a common understanding of the importance of lifelong learning for both students, educators and professionals. Coming together again and again for mutual learning activity, creativity, imaginative thinking and a culture of critically reflective practice should be the ethos. Educational models that promote transition of knowledge from distinct curriculums, motivating students to read and memorize theoretical knowledge in textbooks, are passé. The student's acquirements of more general lexical knowledge should be balanced and integrated in authentic situated scenarios from the professions they are educated for.

Fig. 1 illustrates the point that there is a danger of creating a gap between the practice found in professions and the theoretical knowledge distributed by the educators at the universities. It also illustrates that at least for UiS, around 3-5 % of the time used in the classrooms at the campus for the present could be defined as SBL.



Our ambition with SimLearn is to transform this "fact" in the next 10 years. Spending as much as 40 % of the time at campus on issues stemming from the professions in 2027, shows the paradigmatic revolution possible to realize with an educational model focusing on SBL. In the model, performing SBL is illustrated as a meeting place where students actively engage with

<sup>&</sup>lt;sup>1</sup> https://www.oecd.org/pisa/35070367.pdf

<sup>&</sup>lt;sup>2</sup> National Oilwell Varco: <u>www.nov.com</u>, Emerson Process Management AS (Roxar) <u>www.emersonprocess.no</u>, Aker Solutions:

educators and professionals in virtual/realistic situations. SBL in this understanding allows students to apply theoretical knowledge with decision-making, action, and guided reflection. It is a flexible learning process starting in practical scenarios from the real world, brought forward by the students themselves after meeting the professions through various forms of internships. SBL in this model involves a combination of team-based training and technology-based simulators, software programmes, or virtual reality devices that mimic the real world and stimulate critical thinking. A growing literature emphasizes the positive responses to SBL by students and improvements in skills. However, few academic institutions have systematically incorporated SBL in their higher educations, and little knowledge exists to support such an implementation process, how and when assessments should be performed, and the effectiveness of SBL to promote "real-world" action competencies.

# 4. Existing Excellency in the Region and at UiS

The Stavanger region has a particularly strong foundation in simulation much due to its position in the oil and gas offshore industry. Operations in a demanding environment has moved the industry to develop sophisticated, hi-tech solutions and practices for training, testing and simulation of operations in virtual and augmented reality. The regional competency cluster in simulation is thus the strongest in Norway.<sup>2</sup> The offshore industry relies on transportation of personnel, and Stavanger Airport Sola has become the major European hub for offshore helicopter aviation. Sola is also the headquarters for the Air Force 330 Squadron, the national rescue service. The requirement of periodically recertification of pilots has made the region attractive also to internationally leading companies offering simulators of the main helicopters of the industry, serving operators both regionally and worldwide.<sup>3</sup> Laerdal Medical AS<sup>4</sup> is a world leading developer of solutions for virtual life support training and patient simulations located in Stavanger. The region also represents other simulation-based environments in addition to offshore, medical and aviation, related to social and desk-top simulation, exemplified by Mediafarm AS, Mintra Trainingportal AS, OFFB, ASCONA AS and the NATO Joint welfare Centre.<sup>5</sup> Focusing on SBL has in many of the examples above to do with risk management and safety. Working in simulated learning environments is a significant way of reducing risk in complex operations. SEROS - Centre for Risk Management and

<sup>4</sup><u>www.laerdal.com</u> <sup>5</sup> www.mediafarm.no, www<u>.mintra.no, www.offb.no, www.acona.com, www.jwc.nato.int</u>

<sup>&</sup>lt;sup>2</sup> National Oilwell Varco: <u>www.nov.com</u>, Emerson Process Management AS (Roxar) <u>www.emersonprocess.no</u>, Aker Solutions: <u>http://akersolutions.com/, MHWirth: http://mhwirth.com/, IKM (IKM-Subsea): www.ikm.no/ikm-subsea-norge</u>, Petrolink AS: <u>www.petrolink.no</u>, Oiltec Solutions AS: <u>www.oiltec-solutions.com</u>, Rogaland kranskole AS: <u>www.rogaland-kranskole.no</u>, Keytos AS og Ableware AS: <u>www.kunchy.com</u>

<sup>&</sup>lt;sup>3</sup> Thales Norway AS: <u>www.thalesgroup.com</u>, FlightSafety International Stavanger: <u>www.flightsafety.com</u>, CAE: <u>www.cae.com</u>

Societal Safety was established by UiS and the International Research Institute of Stavanger (IRIS) in 2009<sup>6</sup>. Recently an initiative to establish a National Centre for Societal Safety (SASIRO) has been made for Rogaland county, with UiS and The University Collegde of Stord Haugesund (HSH) in the lead.

The Stavanger region has a long-standing and strong tradition for innovations and development through collaboration between academic institutions, professions and the industry. For more than fifty years, multiple stakeholders have been involved in developing educational tools to meet the growing and changing needs of the oil and gas industry. A full-scale test rig was built in the 1970s, and this has been continuously updated. Today it is one of the world's most advanced simulators. The first simulator for anaesthetics and intensive care (PatSim) in Norway was developed in 1993 by UiS. Engineering students have taken part in development tasks and the simulator is used in nursing education. The Society for Simulation Applied to Medicine (SESAM) was established in 1994 as a cooperative venture between UiS, Copenhagen University Hospital and Leiden University Medical Center. Laerdal Medical, established in 1940, is an essential partner for UiS concerning medical SBL. The company developed the training manikin "Resusci Anne" that revolutionized the training of cardiopulmonary resuscitation. For the next decades, Laerdal Medical developed medical equipment, patient simulators, and training strategies for healthcare. In collaboration with Stavanger University Hospital, Laerdal Medical and UiS, SAFER (Stavanger Foundation for Education and Research) was founded in 2006 as a simulation centre for healthcare (www.safer.net). This collaboration has placed Stavanger as a national and international centre for SBL and implementation into practice in healthcare, stimulating unique collaboration between students, clinical and pedagogical personnel, university educators, scientist and engineers to engage in active SBL, developing also new educational methods and strategies for implementation into practice.

<sup>&</sup>lt;sup>6</sup> <u>http://www.uis.no/research-and-phd-studies/research-centres/seros/</u>

The "Circle of Learning" is one such model increasingly used as an educational framework to promote sustained and continuous learning, putting the student in front (Fig. 2). Another model with a generic potential for learning is the "Formula of survival" (Fig. 3), highlighting the impact of educational efficacy and local implementation on patient outcomes. This model is used worldwide as a framework when trying to improve patient outcomes, but it also has a potential to inform teacher education and engineering. The same goes for Train The Trainers (TTT) courses, which have received international recognition. The courses are based on EuSim curriculum <u>www.eusim.org</u>.



#### **Healthcare education**

SBL has been increasingly utilized by all healthcare profession educations at UiS; nursing, critical pre-hospital care, and paramedics. Approximately ten weeks (15 ECTS, see MER, 2008) of the 3-year nursing education are spent on SBL and reflection upon practical skills in the simulation laboratory at UiS and at SAFER. Since 2013, nursing students from UiS and medical students from the University of Bergen have performed simulation-based team-training for patient safety together at SAFER, facilitated by both the nursing and the medical faculty. Feedback from students has been overwhelmingly positive.

The Department of Health Studies collaborate with national, Nordic and international simulation environments. NTNU/Gjøvik is a national partner collaborating with the "Research group on Safety and Quality of Care in healthcare", with professor Marie Louise Hall Lord and associate professor Randi Ballangrud. The partners have an agreement regarding supervision of PhD students and research in simulation. In the Nordic countries, researchers in the research group collaborate with professor Hans Rystedt, University of Gothenburg, Sweden, Project researcher Minna Silvennoinen, the Agora Center in Jyväskylä University, Finland and Peter Dieckman, CAMS in Copenhagen, Denmark. Internationally, researchers in the research group collaborate with associate professor Michelle Kelly, Curtin University in Perth and professor Debra Nestel, Monash University in Melbourne, Australia, and Dean Pamela Jeffries, The George Washington University School of Nursing, Washington DC, USA.

#### **Teacher education**

In teacher education simulation based learning is nevertheless still in technological infancy. Here you will find some contextualization or creation of scenario-based learning. Systematic reflection is often seen as more important than real context simulation, indicating that the complexity and variability of authentic situations of teaching and learning are difficult to recreate and control. There

is, however, a need of further studies that implement new technology and improved contextual simulations. At UiS, we have conducted a design experiment (2012-2015, NRC project) to investigate student teachers' learning in simulated situations using Lesson Study, involving among others prof. Elaine Munthe, prof. Raymond Bjuland, and associate prof. Nina Helgevold. Developing digital stories and digitalizing history is an approach used in the Humanities subjects, and collaboration with researchers and teacher educators in Denmark will be central to the work in simulation, e.g. researchers in scenario-based didactics prof. Jeppe Bundsgaard, prof. Vibeke Hetmar, prof. Morten Misfelt, and other colleagues at Aarhus University, DPU and University of Aalborg. The Faculty of Arts and Education will have a new Didactic Digital Laboratory ready by February 2017. This is a 100m2 laboratory with the most advanced equipment in learning technology available, including VR hardware and software. In addition, three new rooms for instruction will be furnished as learning environments for the future, creating space for SimLearn in teacher education.

#### **Engineering education**

All engineering educational programmes have always included student laboratory work. Through models and simulation, the students have gained a deeper understanding of the underlying theory and different applications of the theory. Today this laboratory work also includes the use of virtual reality (VR) instruments, allowing the students access to simulated instruments which in the real life would be too expensive for the laboratory budget. Such simulated laboratory work can even be done on their private PC, cooperating with others, and could easily be updated according to the technological developments. In relation to safety, a new simulation-oriented cluster from various industries is established by the organization Greater Stavanger (http://greaterstavanger.com/eng). The actors are brought together to develop software and hardware for simulation, relevant scenarios, promote various services and educate. The faculty is also part of a new national network for medical simulation in health care just established, April 2016<sup>7</sup>, underscoring the value of working cross-disciplinary. This is also the idea behind an EU project "Triangulum" (www.triangulum-project.eu) where UiS and the engineering education play a part in developing smart houses in smart cities.

#### UiS Department of e-learning - NettOp

NETTOP-UIS is the university's e-learning department and a leading e-learning developer in Norwegian academia. The department was established in 2000 and has since then developed a substantial portfolio of digital and online learning resources. A web based bachelor programme in

<sup>&</sup>lt;sup>7</sup> https://www.deltager.no/getdocument.ashx?i=431&a=159277&h=64E5E8103D02658B2F09E5EA6D5DA870

nursing has been of the most extensive tasks, which required the development of more than 120 tailor-made multimedia e-compendiums and podcasts substituting lectures<sup>8</sup>, several game-based solutions on critical subjects in treatment of drugs<sup>9</sup>, various MOOCs, including medication calculation<sup>10</sup> and hundreds of YouTube videos on practical procedures<sup>11</sup>.

Other examples of NETTOP's portfolio relevant to the SimLearn are sets of tablet-based applications for the collection of research data<sup>12</sup> and adaptive exercises on interest rates<sup>13</sup>, simulations of the influence of illegal drugs<sup>14</sup>. Finally, there are examples of potential dissemination strategies for SimLearn such as UiS' presence on NRK (national public broadcasting)<sup>15</sup>, and the UiS series "Fysikk-minuttet, Julekalender 2015" (Physics-minute, Christmas Calendar 2015)<sup>16</sup>, that was published both on www.forskning.no and the regional newspapers Stavanger Aftenblad (www.aftenbladet.no) and Fædrelandsvennen (www.fvn.no).

#### International collaboration and network on an institutional level

UiS is a member of The European Consortium of Innovative Universities (ECIU) (www.eciu.org/teaching-and-learning). Our common vision underlines that "teaching in higher education really matters". All members of ECIU share a commitment to the development of highquality educational practices that promote innovation and the pursuit of excellence in teaching and learning. Furthermore, ECIU has a specific interest in seeking out creative, learning-centred and future-focused teaching approaches that foster social entrepreneurship and smart use of technology. The mission is to challenge conventional thinking. Partners in ECIU include among others The University of Twente in the Netherlands, The University of Aalborg in Denmark and the University of Monterrey in Mexico. All three universities have developed SBL in essential ways that are important for SimLearn; Aalborg in close collaboration with local industry and business, Twente in relation to technological and digital based simulation, and Monterrey in relation to a humanistic and holistic approach to SBL. Part of the centre plan is to apply for participation in another consortium, The Open European Consortium - www.oeconsortium.org. This consortium is part of a world-wide movement with an overall aim to distribute and make all pedagogical and didactical resources used in the learning activity. As of yet, no universities represent Norway in this consortium.

<sup>&</sup>lt;sup>8</sup> <u>https://www.youtube.com/watch?v=K6aQ8\_Y1Tds</u>

<sup>&</sup>lt;sup>9</sup> <u>http://www1.uis.no/fag/Sykepleie/betatest/web/</u> http://www6.uis.no/Fag/Sykepleie/betatest/medihand/index.html

<sup>&</sup>lt;sup>10</sup> http://www.mooc.no/course/legemiddelregning-2/

<sup>&</sup>lt;sup>11</sup> https://www.youtube.com/playlist?list=PL1Oi4O0iZ7ibhZyhe1siM5t\_UW7jEf4Fa

<sup>&</sup>lt;sup>12</sup> https://www.youtube.com/watch?v=bdyL2EhXylQ

<sup>&</sup>lt;sup>13</sup> http://rentetabellen.nettop.hopto.me/

<sup>&</sup>lt;sup>14</sup> http://www1.uis.no/fag/learningspace\_kurs/phs\_ts/lesetester/sentraldempende/start.html http://www1.uis.no/fag/Learningspace\_kurs/PHS\_ts/Lesetester/ovelse24/start.html

<sup>&</sup>lt;sup>15</sup> https://tv.nrk.no/serie/kunnskapskanalen/MDDP17002415/23-01-2016

<sup>&</sup>lt;sup>16</sup> https://www.youtube.com/playlist?list=PL1Oi4O0iZ7iYL45sY9h4iR2Ax4HhHOi6H

# 5. The Centre plan

SimLearn will be organized as a learning hub integrated with the ordinary institutional practice at UiS. Here students, university educators (Faculty), researchers and professionals will be invited to work together and engage in collaborative learning.



As illustrated more concrete in fig. 5, student groups will get together with professional actors and faculty in SBL forming cross-disciplinary educational networks. There will be project managers for both engineering, healthcare and teacher education responsible for the SBL activity, making sure that this way of learning gets the necessary support. The project managers will be a team securing cross-disciplinary collaboration. To support project managers, experts on eLearning and on developing digital content for higher education will help with digitalization of all deliverables and with creative and effective types of disseminations. A senior project manager will have the overall responsibility for running SimLearn as learning hub on a daily basis. He/she will represent SimLearn externally, laying grounds for future networks and collaboration, but also evaluating the centre's internal guidelines and strategic plans. The senior project manager will also have a Steering committee to play ball with, a committee consisting of internal leaders and scientists from the internal faculty of UiS, but also from international partners.

#### SimLearn personnel

Required core SimLearn personnel and involvement are a Senior Project manager 100%, a Finance controller/administration 50%, NettOp eLearning 100% (or 2x50%), a Student (20%), a Project manager(s) Healthcare educations 100% (or 2x50%), a Project manager(s) Teacher educations 100% (or 2x50%) and a Project manager(s) Engineer educations 100% (or 2x50%).

## 6. Work Packages

The work packages (WP) with concurrent activities/tasks and milestones are described in further detail in Appendix 3 Action plan for the Centre, including milestones.

#### WP 1: Readiness and faculty development

Readiness and faculty development strategies are critical in order to realize the vision of SimLearn. Historically and internationally it has been up to university-based faculties themselves to enhance their instructional skills, but with the new demands of society and expected learning outcomes, we are looking at a paradigm shift in higher education. Higher education is in need of systemic measures that are able to enhance competencies at scale. A very important work package is therefore to develop ways of establishing knowledge and skills needed to practice SBL among faculty. To achieve this, all levels of leadership are needed, technology support is essential, space or instructional rooms that are suitable for such activities are essential, and it is crucial that faculties experience a need for change and possibilities for change without too much effort or uncertainty. Systemic university-based faculty development is an issue that is important internationally, and development in this area will therefore be of international value. The centre aims at creating collaborative learning opportunities and establishing a community of practice for students, educators and professionals.

#### WP 2: Redesign curricula (study programmes) and develop SBL

Digital competence is often implicit in education for nursing (a common learning outcome is: must be able to use relevant tools, techniques, procedures and communication forms), and more explicit in engineering (who are expected to be digitally competent in use and development) and teaching (who must be able to use digital learning tools and educate children and adolescents with digital competence for tomorrow's work force). Still, education programmes for these professions rarely have defined digital strategies that describe how students will acquire new digital competence in a coherent way over the course of a 3-year or 5-year programme that are necessary for tomorrow's engineers, nurses and teachers. Furthermore, study programmes do not incorporate SBL as a means to develop such knowledge and other kinds of professional knowledge and skills that are necessary in the 21<sup>st</sup> century. This task is undertaken by SimLearn: to redesign curricula and develop SBL to reform the education of professions in close collaboration with the students. The aim is to make the students better prepared to engage in collaborative practice in an interdependent, global working environment. It is crucial to develop processes to include SBL in curricula, and develop SBL based on student's experiences.

#### WP 3: Pushing state-of-the-art forward in SBL

SimLearn will push state-of-the-art forward at an international level. This can be a daunting task for a centre based in Norway where SBL has not developed as systemically as at some other major universities abroad. Also, changes take time, and what SimLearn aims at doing is to change the ways of thinking and the ways of teaching. This is basically to change a culture. However, we do believe this will be achievable for several reasons: 1) we are building on existing strengths which are – in some areas – well beyond a national level and at a top international level. 2) we already have and are building new learning labs for SBL that include state-of-the art technology and facilities that bring the workplace onto campus, and we have established partnerships with workplaces in all professions together, making it possible to learn across programmes and disciplines. This will encourage systems thinking and team learning, and create a platform for systematic development and use of SBL in various formats throughout programmes and curricula, and thereby also transform student assessment. Also important is to execute SBL to build experience; SimLearn aims at making more than 30 % of the students' time consume in the educations SBL-related.

#### WP 4: Research-based innovation and innovation research

All three work packages described briefly above will be accompanied by rigorous research making it possible to push the field forward, both concerning development of SBL educational programmes in higher education, the creation and outcomes of systemic professional development for faculty in higher education, and not least on SBL in education for the professions (both new ways, new technology, and a broad range of outcomes). Research will allow for knowledge development both within and across professions, emphasizing possibilities for cross-professional learning in higher education and also emphasizing efficiency of learning within and across professions. Critical perspectives on limitations and possibilities will bring knowledge forward and enable others to make professional judgments based on rigorous research.

#### WP 5: Dissemination

Dissemination can be related to at least three outcomes: dissemination for awareness, dissemination for understanding, and dissemination for action. SimLearn will address all three outcomes in a systematic way, also with the intention to reach different populations/groups. All participants in SimLearn will be engaged in dissemination in various ways. SimLearn will conduct continuous review studies of SBL nationally and internationally, and also develop a digital platform for dissemination. Research results will be published, share leaning activities will be focused and SimLearn intends to share all resources used, to generate new understandings for developing educational programmes in general and SimLearn in particular.

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# COMMENTS

[Body text (150 words)]



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#### **ABOUT THE CENTRE**

# Name of Centre Centre of Excellence in Science and Technology Teaching (CESTEC) Is the SFU already established at the time of the application (yes/no)? □ Yes ⊠ No Please name any consortium partners for the Centre EnergiRike, Statoil, CMR, Haukeland Hospital, HiB, Borregaard, BTO



# ABSTRACT

A *Centre of Excellence in Science and Technology Teaching* (CESTEC) will be established in response to the expectations that research and higher education shall contribute to innovation in society. CESTEC will develop new tools, best-practice examples, and relevant resources to reshape course contents, student activities and study-program structures. The centre will focus on targeted collaborations where students, university staff, and enterprises in the public and private sectors forge a better platform for cooperation and communication. CESTEC will interact with industry to foster emphasis on industrial research challenges in problem-solving assignments and projects; societal challenges will be dissected to find out what the problems are in terms of science and technology. Research projects in science education will be launched to study impact and learning outcomes of the new activities. A new educational framework will be developed so that, when implemented, students and staff alike will contribute to critical thinking and development of innovative ideas.



## THE CENTRE PLAN

#### **MOTIVATION AND VISION**

The framework for higher education and research has been through a significant political transformation since World War II. The shift is often credited to Vannevar Bush, who argued that science and technology is the key to social and political progress (1). This report paved the way for the establishment of research councils and research institutes in many countries around the world, including Norway, and generation and transfer of research-based knowledge became a visible enterprise in the country. When the Innovation Proposition (2) was passed in Parliament some seven years ago, universities were given additional tasks and are now expected to arm students with the skills and knowledge required to generate ideas and leverage technology. In order to meet this expectation, students graduating from our study programmes need a clear understanding of how science underpins our society and is a crucial tool to solve the challenges of our time. During the past decades there has been a massive convergence between disciplines. New research domains such as bio- and nanotechnology have evolved as inherently cross-disciplinary fields. We believe that our students will become better qualified to meet modern challenges when exposed to innovative applications of science and technology. The study programmes will be transformed to provide the students with knowledge to see the broad perspective and potential impact of being a professional, modern scientist. Collaboration with industry and enterprises, communication with stakeholders, dissemination of scientific findings, fostering a culture of social responsibility and professional integrity will be key components in this transformation. Following Louis Pasteur's motto from 1854 "Chance favours the prepared mind", our goal is to prepare the students' minds to

contribute forcefully to generate new knowledge and develop and implement new technologies that will contribute to a sustainable society.

We want to establish CESTEC, illustrated in Figure 1, as an instrument to transform our study programmes in pursuit of this vision. The role of the Centre will be to actively filter the emerging needs in society, in research and among students to develop the educational framework needed for them to apply and communicate science in an innovative and effective fashion in society at large.



Figure 1: CESTEC, represented by the red triangle, will connect the study programmes and the 'world outside'.



#### STRATEGY AND INNOVATION

The overall objective of this SFU initiative is to enable the students to apply Basic Science and Technology (BST) to meet needs in industry and society. In order to achieve this, we will 1) develop study programmes that give students in-depth knowledge to meet these needs; 2) create arenas for training the students in communicating with stakeholders engaged in application of science in society; and 3) promote and facilitate a transition toward evidence-based science education (3). These goals will be achieved through realization of the following five integrated missions:

# Mission 1: Establish stronger bonds to research institutes, industry and enterprises; WP1 in the action plan

Organize an active consortium with external partners and create space, both physical and virtual, for sharing knowledge, experiences and ideas. Through this consortium site visits and internships will be organized to increase awareness of present challenges in society at large. As a part of the progress, students will be familiarized with enterprises and current challenges in the students' early years. An active recruitment of new partners in industry and enterprises will be undertaken. Adjunct Professors for educational development within innovation, creativity and communication will be employed and an online newsletter for outreach and information will developed.

#### Mission 2: Enhance the relevance of the teaching contents; WP2 in the action plan

Build a culture among teachers and students to identify and bring in relevant challenges, data and expertise. Establish a resource centre containing tools, literature, contacts, instruments and examples for teacher support. We will develop educational tools to increasing students' knowledge of international guidelines regulating science and technology in society - a competence which is of crucial importance in the global economy. A teacher's forum to promote awareness among the teaching staff about the importance of demonstrating industrial/societal relevance in regular courses will be established. Up-to-date examples from the industry tailored to the students' competence levels will be provided through the Centre consortium.

#### Mission 3: Renew the design of assignments, exercises, and tasks; WP3 in the action plan

Train students in applying basic knowledge to solve relevant problem and interact with stakeholders. Develop and implement teaching activities that foster students' creative problem solving and communication competences and provide realistic problems anchored in current challenges tailored to the students' competence level. There will be focus on solving practical



problems, made possible by giving students access to laboratories and technical workshops where they can explore their own ideas. The Centre will arrange for consultancy assignments where the students can choose to solve a specific assignment from a company that represents a current challenge for the industry. The assignment may be solved by a single student, a group of students or several groups delivering on the same problem definition. Internships for students to experience authentic problem solving and participation in collaborative and creative reasoning will be organized. Communication to various audiences will be implemented as an integral part of the learning process.

#### Mission 4: Establish educational research and evaluation; WP4 in the action plan

Establish a research program to monitor and evaluate the effects and learning outcomes of missions 1 - 3 and develop mechanisms for adjusting BST education to industrial and societal needs. We will optimize teaching for learning through a cyclic refinement of the study programmes. In order to facilitate this development, the Centre will engage in research on effects of different types of assignments and exercises on students' learning outcomes (4 - 5). These assignments and exercises will reflect both formative and summative assessment of the students. Whereas formative assessment involves monitoring of student learning, provision of ongoing feedback, and use of low-stakes testing, summative assessment implies high-stakes testing in terms of evaluation of the student at the end of the unit by means of a comparison against a standard of excellence. The effects of different types of formative and summative assessments will be investigated by relating them to course experience, and to students' approaches to the new learning activities in WP1-WP3. By applying alternative modes of student assessment (e.g. formative assessment) it may be possible to enhance the students' experience of learning quality (course experience) which produces deeper processing of the learning material (deep approaches to learning).

#### Mission 5: Disseminate best practise for action and reaction; WP5 in the action plan

Systematically document and share the outcomes of implemented actions to improve the quality and relevance of the BST. Inform about best practice to stakeholders, nationally and internationally through open-access databases, virtual educational tools and annual conferences on science-and-technology education. Together with the students and the consortium partners we will actively disseminate the results of student internships and project collaborations and findings through printed and electronic media.



#### **IMPLEMENTATION AND ORGANISATION**

CESTEC draws its strength from the complementarity of the Department of Chemistry (KI) and the Department of Physics and Technology (IFT) with comprehensive inter-disciplinary expertise in classical physics and chemistry, nanoscience, petroleum and process technology, the consortium of partners in the public and private sector, and the Department of higher educational research at the

University of Bergen. We know from surveys among our partners, our students and our alumni that our above stated missions are wanted and needed. The project activities will be implemented through five work packages (WP), to address the above stated missions (Figure 2). The specific actions under each work package are listed in the action plan from A1-A33. **WP1** (WP leader: Geir Ersland) will establish the centre headquarter and infrastructure and secure management of activities. monitoring of progress and reporting. WP2 (leader TBA) and WP3



relationship between work packages

(leader TBA) will deliver new tools, best-practice examples, and relevant resources to reshape course contents, student activities and study-program structures. The Centre takes on the task of updating our teachers on the modern development in organised student activities that facilitate motivation, creativity and learning. The aim is

to equip our teachers with new tools to improve the attainment of learning goals based on scientific approaches to gauge what students actually are learning in **WP4** (WP leader Åge Røssing Diseth).

The Centre will be organised as shown in Figure 3. The Centre will be managed and operated by a team consisting of a leader and chair (Assoc. Professor Geir Ersland), a cochair (Professor Leiv K. Sydnes) and an



Figure 3: CESTEC organisation



administrative leader (Dr. Hege Ommedal). The Centre leader will have complete financial responsibility, handle NOKUT reports and communications, facilitate and arrange regular meetings with stakeholders, and maintain communication with teachers and students to inform about CESTEC activities, including results from the educational research. The management will be responsible for initiating the work packages. The Centre will have a Board consisting of the department heads from KI and IFT, Pro-Dean for Education, three external member from the consortium and two student representatives, which will monitor the CESTEC activity. A Scientific Advisory Board with two national and two international specialists will also be established to obtain constructive scientific feedback. The CESTEC consortium consists of cooperative partners: STATOIL, Haukeland University Hospital, Christian Michelsen Research and Borregard, and will expand through active recruitment of new partners. Innovation clusters and organisations as EnergiRike, GCE Subsea, NCE Maritime and Clean Tech take part in the consortium. In addition to being involved in specific projects students with good ideas will be encouraged to develop their idea through the Accel Student program. Accel is arranged by BTO in close collaboration with Bergen University College. Special-designed Accel Student courses will be developed for CESTEC students.

#### EVALUATION, IMPACT AND OUTCOME

The outcome of CESTEC, if awarded, will be a strategic framework of how innovation may be implemented and adopted as part of higher-science-and-technology education. The funding and recognition that follow the SFU award will provide the means for an innovative shift within science- and-technology teaching that otherwise would not come to be. To enable continuous improvement in this regard and stimulate institutional development over time the Centre will carry out evaluations of the new learning activities based on feedback from industry advisors, students, and alumni. This will be complemented by scientific approaches to gauge what students actually are learning in WP4. We will be able to draw on the experience, insight and expertise of the bioCEED Centre of Excellence (CoE) at UiB. bioCEED is deeply engaged in the development of evidence-based teaching in biology as well as student-active teaching and reversed-classroom techniques. The Centre is expected to generate significant funding from our partners in industry to maintain and further develop the targeted collaborations with industry partners and to improve the educational framework post the lifetime of the CoE.


### **QUALITY IN EXISTING EDUCATION**

The research at the Department of Physics and Technology and the Department of Chemistry aims at understanding nature from her building blocks of matter and the origin of the Universe to industrial manipulation of matter to harvest products in a sustainable fashion. The education at UiB is based on this research and its applications and the quality of this education is anchored in an extensive quality assurance system described in the University's Handbook for Quality Assurance of University Education.<sup>1</sup> The ambitions are high, as reflected in the University strategy (2016-2022), which states that i) *UiB shall educate Norway's most attractive candidates* and ii) *by 2022*,

a total of 85 per cent of the degree candidates will have a relevant job two years after they complete their education.<sup>2</sup> The ambitions of CESTEC is also anchored in our Faculty Strategy: Our education shall give insight and personal development, and provide important competence to research, the working sector and Society<sup>3</sup>.



Evaluations from students, teachers and program evaluators Figare used systematically for this purpose, and the changes ass



Figure 4 Key elements in the cyclic quality assurance system at UiB.

implemented are presented in the UiB Education Quality Database.<sup>4</sup> NOKUT stated in their 2014 evaluation of the University of Bergen that the study-quality work at UiB has high priority and that UiB has an established a system for quality assurance in education that is suitable to achieve the goals for the quality work<sup>5</sup>. This contributes to the ranking of University of Bergen among the 100 top universities in Europe.<sup>6</sup>

<sup>&</sup>lt;sup>1</sup> <u>UiB "Quality Handbook"</u>

<sup>&</sup>lt;sup>2</sup> <u>UiB Strategy Ocean Life Society</u>

<sup>&</sup>lt;sup>3</sup> MN strategy 2016-2022

<sup>&</sup>lt;sup>4</sup> UiB Education Quality Database

<sup>&</sup>lt;sup>5</sup> NOKUT evaluation report for UiB 2014

<sup>&</sup>lt;sup>6</sup> <u>THE 2016</u>



#### **INPUT FACTORS**

#### Anchoring and engagement

The SFU initiative is fully supported at all levels at UiB. Through partnership agreements there is also solid support in the enterprises in the private and public sectors. The study programmes are provided with funding and manpower from the KI and IFT departments, and teaching support from other MN departments.<sup>7</sup>

#### **Research strength and quality**

KI and IFT have strong research groups in physics, chemistry, nanoscience and petroleum research. The researchers' excellence is documented by partnerships in Norwegian Centres of Excellence<sup>8</sup>, extensive external funding from prestigious institutions<sup>9</sup>, as well as collaboration in international research networks<sup>10</sup> and PhD research schools.<sup>11</sup> The researchers publish actively in national and international journals and several staff members act as editors of scientific publications.<sup>12</sup> In 2014, 30 % of the published papers were at level 2.<sup>13</sup>

#### **Education strength and quality**

KI hosts the BSc and MSc programmes in chemistry, of which the former was awarded the prestigious EuroBachelor label in 2014<sup>14</sup>, and in nanoscience and nanotechnology. The nanoprogram introductory course *Perspectives in Nanoscience and Nanotechnology* was awarded the prestigious Owl award for high quality in education at UiB.<sup>15</sup> KI is also a partner in the Erasmus Mundus *EMQAL* program<sup>16</sup>. Each SFU study programmes is chaired by one experienced educational leader and administrated by one member of the study-administration staff. New members of the teaching staff without documented pedagogical competence are obliged to take courses in university pedagogy. The teachers are highly valued by the students as reflected by students' evaluations and awards received.<sup>17</sup> All education-administrative staff holds at least a master's degree, with significant academic competence within the basic natural sciences or

<sup>&</sup>lt;sup>7</sup> Study program construction: <u>BSc Chemistry</u>, <u>BSc Physics</u>, <u>BSc Petroleum and Process Technology</u>, <u>BSc Nanotechnology</u>

<sup>&</sup>lt;sup>8</sup> Centres of Excellence: <u>Space Science</u>, <u>Petroleum research</u>

<sup>&</sup>lt;sup>9</sup> External funding for excellence: BFS (<u>2006</u>, <u>2009</u>)

<sup>&</sup>lt;sup>10</sup> <u>CERN</u>, <u>SNBL/Grenoble</u>, Norwegian Centres of Excellence (<u>Space Science</u>, <u>Integrated Petroleum Research</u>)

<sup>&</sup>lt;sup>11</sup> Nano-network PhD Research School, Petroleum Research School of Norway

<sup>&</sup>lt;sup>12</sup> Naturen 03/12

<sup>&</sup>lt;sup>13</sup> DBH: <u>Publication at MN UiB 2014</u>

<sup>&</sup>lt;sup>14</sup> Eurobachelor at Department of Chemistry

<sup>&</sup>lt;sup>15</sup> The Owl Award, The Owl award to Perspectives in Nanoscience and Nanotechnology, 2010

<sup>&</sup>lt;sup>16</sup> EMQAL

<sup>&</sup>lt;sup>17</sup> The MN Best Lecturer Award (<u>2009</u>, <u>2011</u>, <u>2014</u>)



university pedagogy. Student mobility<sup>18</sup> strengthens the international experience which is highly valued by employers.<sup>19</sup> Both departments regularly welcome international colleagues and students.<sup>20</sup>

#### Infrastructure

The departments are well equipped with state-of-the-art instruments, including a helium microscope, a nano lithography lab, a multiphase flow laboratory (IFT) and a 850 MHz NMR spectrometer in the new Norwegian NMR platform<sup>21</sup> (KI), which are extensively used by BSc, MSc and PhD students under supervision. <sup>22</sup> Students' value access to such instruments and this is a motivation factor in the study programmes. <sup>23</sup> The departments are well experienced in providing high-quality teaching in laboratory training supervised by highly competent laboratory engineers. The high-capacity student-training laboratories are designed to ensure solid HSE-quality standards and mandatory student HSE courses are in place. In addition, several of the scientific personnel at the departments are involved in innovation and commercialisation projects and entrepreneurial start-ups with BTO. The Departments are also actively engaged in several industrial and research clusters in the region.

#### **PROCESS FACTORS**

In the three first semesters, basic and well established knowledge is taught. From the fourth semester, more advanced and research-oriented topics are covered, leading to MSc studies that focus on individual research and advanced theory. Here, students contribute to new knowledge through their original research performed under supervision. This is in alignment with the  $E(N)QF^{24}$  that emphasizes that students gradually gain more advanced knowledge as the studies progress. The innovative teaching and assessment methods in *Perspectives in Nanoscience and Nanotechnology* (student-active learning in research-based internships, written reports, oral presentations) and the research-preparing *Projects in Physics* (scientific project work, written reports, oral presentations), the communication course *Scientific communication in English* and the *Bachelor's Project in Chemistry* (scientific work methods, library course, HSE in chemistry,

<sup>&</sup>lt;sup>18</sup> DBH: Exchange students (in/out) at KI and IFT

<sup>&</sup>lt;sup>19</sup> StuderiUtlandet.no

<sup>&</sup>lt;sup>20</sup> DBH: International students at KI and IFT

<sup>&</sup>lt;sup>21</sup> Norwegian NMR Platform

<sup>&</sup>lt;sup>22</sup> Laboratory research instruments at  $\underline{KI}$ 

<sup>&</sup>lt;sup>23</sup> MSc Nano evaluation report 2014

<sup>&</sup>lt;sup>24</sup> European Qualification Framework (EQF), Norwegian QF



scientific project work, written reports, oral presentations) are examples of best practice in teaching and assessment methods with high transfer value.

The course *Industrial Organic Chemistry* has significant industrial relevance with specific R & D development tasks related to real industrial processes and a strong focus on HSE elements in industry. The departments are strengthened by several adjunct professors from industry teaching advanced courses with high relevance for science application outside the academia. The research group for Petroleum and Process Technology (PPT) has numerous national and international research collaborations, both with academic and industrial partners<sup>25</sup>. It was ranked top 4 of 20 in RCN's evaluation of basic and long-term research within technology in Norway<sup>26</sup>. At BSc level, the PPT students are exposed to industry through excursions to Statoil. Most MSc students work with international institutions during their master work and field courses and task are provided in close cooperation with industry.

The academic qualities of the teachers are a key to a successful SFU centre. A recent survey among students and alumni reveals that these qualities are present at IFT and KI. The purpose and task of CESTEC will be to develop, on the basis of the innovative practises described above and input from students and external partners, a teaching approach that will be implemented in all the study programmes involved on the BSc level. On this basis, we strongly believe that CESTEC will transform the study programmes so that the graduates will be well qualified to apply Basic Science and Technology to meet needs in industry and society.

#### Students as active key players with engagement and ownership of learning

The students represent a strong pillar in the education environment as teaching assistants and mentors. Senior students are active in recruitment and social activities<sup>27</sup> and highly valued by the junior students and the department's staff. The students are agents of educational development by direct involvement in ongoing processes for improving quality in the study programmes and individual courses. The students have a clear voice in educational debates and contribute actively through their representatives in the decision-making program boards. Student feedback is provided

<sup>&</sup>lt;sup>25</sup> NorTex petroleum cluster

<sup>&</sup>lt;sup>26</sup> www.forskningsradet.no

<sup>&</sup>lt;sup>27</sup> Welcome week, MN Information week, International Week, Career day, and as ambassadors to secondary schools



in group discussions that enable rapid adjustments of practice, if necessary. The student organizations are key players in student-social-welfare work in close collaboration with the education leadership in many ways, like working for improvement of the physical learning environment and strengthening the social network among the students.

#### **Outcome Factors**

#### **Content, quality and relevance**

Surveys among the departments' students show that the key quality elements in the study programmes are good teachers and supervisors. The human resources in the teaching and supportive staff are highly valued. Although most MSc graduates find a relevant job during the first year after graduation, surveys have revealed that our BSc study programmes, and to a certain extent our MSc programmes, lack work relevance in the sense of being incomplete in professional training in innovation, creativity and communication. CESTEC will be established to fill this gap.

#### Key student data

The MSc students in physics and chemistry are above national average in ECTS production. The BSc students are on national average. The completion rates are not easily comparable between institutions due to differences in program structure and content. However, the number of MSc graduates in physics and chemistry at UiB, UiO, and NTNU from 2012 – 2015 indicate that UiB's programmes perform above average. We are pleased that the total number of applicants to BSc Nano and Chemistry in 2015 was the best in the last four years with 52 and a 42 % increase from 2012, respectively. Key figures for student data will be sent upon request.



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#### ABOUT THE CENTRE

Name of Centre Centre of Excellence in Applied Digital Journalism (CADJ)	
Is the Centre already established at the time of the application (yes/no)? □ Yes ⊠ No	
Please name any consortium partners for the Centre [text]	



#### ABSTRACT

VUC has a strong tradition in educating journalists with highly developed practical skills and high competetiveness in the media labour market. A strong emphasis on internal and external practicum periods lies at the core of the VUC journalist teaching. Building on this foundation, yet aware of the major technological and organizational changes in the media industry, the CADJ will provide development of future journalism education. At CADJ students will engage in *creative practice as well as critical reflection upon the role of digital journalism in democracy*.

To meet this goal, CADJ will:

- 1. Provide a learning environment where students, media partners and technology developers collaborate around new forms of digital journalism
- 2. Support students in developing an international and entrepreneurial focus in their journalism careers
- 3. Enhance student reflectivity on the impact of technological innovation in the role of journalism in democratic societies across the globe

## **Centre of Excellence in Applied Digital Journalism (CADJ), Volda University College**

#### Profile and Vision for the Centre of Excellence

Volda University College (VUC) was founded 150 years ago as the first teacher training college in rural Norway. Today, it offers one PhD programme (joint degree with Molde University College), six Master's programmes, more than 30 undergraduate programmes, about 450 courses and serves nearly 4000 students. The college has five faculties: the Faculty of Arts and Physical Education (AKF), Faculty of Social Sciences and History (ASH), Faculty of Humanities and Education (AHL), and Faculty of Media and Journalism (AMF). VUC has a leading national position in media and journalism education in Norway, having educated many of the most important and influential journalists in the country over the last forty years. The Faculty of Media and Journalism offers one of Norway's longest established programmes in journalism, PR (strategic communication) and animation production. The animation study programme is an internationally acclaimed animation education, recently awarded with an Erasmus+ strategic partnership programme (Euro-anime). In addition, AKF also has an array of programmes in media, ICT and design. This currently makes the different media and journalism related study programs at VUC the largest media education milieu in Norway.

The key success of our journalism programmes is a structure that integrates regular courses with extended practical periods (practicum). The Degree program has four periods of mandatory practicum, of then weeks duration each. During the three first periods (internal practicum), students work under the guidance of an editorial team of experienced faculty members, and in collaboration with industry partners, to report on local, regional, and national issues. They also collaborate with other programmes such as PR, in courses in journalism and communication management during simulated crisis rehearsals. In their last semester (external practicum), students are placed in the national broadcasters or in regional media enterprises where they work as journalists in a professional newsroom.

The practicum offers students a unique way to engage in scaffolded real-world learning activities in an safe and creative environment, where they have time to discover, test, and evaluate the skills and competencies they will need in their future careers in journalism. Yet in order to maintain the quality and standing of its journalism programme and relevance of its teaching model, VUC has understood the need to transition into models for practicum that can take into account the ongoing technological innovations across all media sectors. As part of this transition, VUC is launching the Centre for Applied Digital Journalism (CADJ) linked to the Centres for Excellence in

Education Initiative. CADJ will have a central role in enhancing the digital expertise within journalism education at VUC. The main goal of the proposed Centre of Excellence in Applied Digital Journalism is to *engage students in creative practice as well as critical reflection upon the role of digital journalism in democracy*. To meet this goal, CADJ will focus on the following objectives:

- 1. Provide a learning environment where students, media partners and technology developers can collaborate around new forms of digital journalism
- 2. Support students in addressing the need of an increasingly international and entrepreneurial focus in a journalism career
- 3. Enhance student-reflectivity on the impact of technological innovation in the role of journalism in democratic societies across the globe

These objectives will be met by exposing students to a variety of emerging national and international digital journalism practices throughout their practicum, and also through providing opportunities for active student-participation in the global network on digital journalism hosted by CADJ.

#### **Outcome factors**

In the national student survey about quality of education in 2015, the VUC journalism bachelor's programme in journalism scored an outstanding average of 4.8 out of a maximum of 5 on the "overall assessment" scale. The average score among the bachelor's journalism programmes was 3.9. VUC students perceived the studies to be "engaging", and "the learning environment" and "work relevance" to be excellent. The quality of journalism education at VUC also contributes to a high completion rate. According to DBH (the Database for Norwegian Higher Education Statistics) 2015 data, VUC has an average of 55.18 ECTS credit points per journalism student. This is far above the closest competitors, since no other bachelor's journalism programme in Norway produced more than 52.3 ECTS credit points per student.

Feedback from leading Norwegian media houses also shows that VUC journalism education and the structure of practicums has an excellent reputation for producing journalists with strong and relevant skills. According to our partners from the nationwide TV2 and Aftenposten, "students' internal practice in the study is very important. We see that students from Volda often have a more practical approach to the labor market than other media students" (Ida Dypvik, responsible for practice students in TV 2), "students from Volda withstand comparison with anyone, and the school is considered by many in the industry to be among the best journalism educations in the country. We are in great need of students who have thorough practical training in the journalistic profession, and I find that students from Volda have this" (Atle Jørstad, Head of News, Rampelys in VG) and "journalism students from Volda who have had practice in News Division has consistently kept a good level - both in terms of journalistic quality and engineering/technology" (Stein Bjøntegård, Publishing Editor, NRK News Division).

In fact, our partners view the external practicum as a way to recruit our best graduates. A survey conducted amongst journalists trained and educated at VUC between 2007 and 2012 (Halvorsen 2013) shows that 69 % of the graduates were employed as journalists, an additional 13 % worked with communication, while almost none were unemployed. These figures are very strong considering the on-going downsizing of journalistic staff in media houses in Norway.

In our internal evaluation in 2015 of the practicum period and its relevance to the employability of our candidates, 60 % of graduates currently employed as journalists reported that the practicum was very relevant to their careers and that it had increased their work opportunities. External assessments show that through the practicum, our students are well trained to enter a professional newsroom even before graduation: a team of six Volda-students received in 2009 a SKUP-diploma, one of the highest awards within Norwegian journalism, for a reportage produced during practicum.

#### **Process factors**

A shared scientific goal for media research and education at VUC is to contribute to the international body of research, while also acknowledging the college's traditions in practical media and journalism education. A common ground is thus a strong relationship between research and teaching hands-on media education, providing research-based teaching for BA-students of journalism, PR, animation, media production and design as well as the MA-program in documentary and journalism.

The balance between theory and practice in journalism education has always been, and still is, vividly discussed in Norway. Students need basic knowledge to do proper research and ask informed and challenging questions. However they also need communication skills in various forms, so that they can function efficiently in newsrooms. Professional training of practitioners must possess an element of "learning by doing", yet in the field, pressures for performance tend to be high, time limited, and mistakes costly. The concept of practicum (Schön 1988) is therefore one of the most important building blocks of the VUC journalism program. For decades, we have continuously worked on improving the effectiveness of our practicum as a context similar to a real-world newsroom, a learning space where students undertake projects that simulate and simplify practice or work on real-world projects under close supervision. Evaluation of student work takes place continually throughout the practicum, and ownership of learning is promoted by involving students in the administration of editorial tasks in collaboration with their more experienced peers

(the teachers). Also, representatives from the students regularly meet the staff and Dean in the "Faculty Council", a body that is an important part of governing the faculty. Students regularly meet staff in evaluation meetings throughout the semester where students are free to discuss any matter they like and both criticize and give positive feedback. The Faculty takes this feedback seriously and we regularly use the feedback as basis for changes in teaching and for improving our infrastructure and updating our equipment.

#### **Input factors**

Faculty of Media and Journalism has highly qualified staff, including three professors in journalism and experienced journalists, editors and media technicians. Our staff has long professional experience in TV, radio, print and online news production from Norwegian media houses such as Klassekampen, NRK, TV 2, VG, Morgenbladet, Nettavisen, Dagbladet and Sunnmørsposten. The Faculty of Media and Journalism has a far higher number of teachers recruited from the media business than any other university or university college in Norway, and these teachers spend as much as 80 % of their time working with the students in practical settings. We dedicate as many as six teachers and two full-time technicians for periods of two months each semester to the practicum: two teachers for TV, two for newspaper-work, one for radio and one for web-publishing and technical assistance. Teachers also invest a considerable amount of time before and after practicum preparing the students or debriefing them. All in all, a work-intensive and costly way of teaching, but a way of using our resources we will continue with, based on the success of this way of working reported by our students and industry partners.

We also allocate large sums to new technology and our aim is to use the same equipment students will find in the newsrooms. The rate of change in technology is rapid, and this forces us to constantly buy new technology to be up to date. Examples from 2015/16 are investment in 360 degree-video, streaming equipment for mobile networks and VR-technology. In addition, we invest time in building industry partnerships for lab-based teaching units. As a result, a range of industry partners have collaborated with their expertise on technology development for news production (e.g. Google NewsLab and Google IoT), digital newsroom workflows (#SMP Lab, the digital media laboratory for the regional newspaper Sunnmørsposten), and web documentary production (NRK P3 Dok, the online documentary production unit of NRK).

Our student community is actively involved in the shaping of the focus and goals of our programmes and CADJ as a whole. In our evaluation rounds, student representatives, while

supporting the current structure of practicum, call for a more transmedial and digital focus in our curriculum, stating that

"Without internal practicum, the external practicum would be completely hopeless. In my situation, I was ready for work when I started at VG, which is incredibly important for future job prospects... (yet) digital journalism is super important. Everything happens digitally, what you see now is that the printed newspaper has been transported over to the Internet. I think that digital platforms have a huge potential that media does not entirely use. If Volda could offer such a centre, journalists from here could go out in the media, and perhaps offer a fresh and different view on how journalism should be conveyed to people" (feedback from third graders after practicum in Spring 2016).

As first steps in this direction, in 2015 and 2016, VUC has established broad collaboration across the Google organization, with teams from Google News Lab, Developer Relations, Geo and Education. Our partnership spans several fields such as the use of Virtual Reality (VR) in journalism, hardware and software for 360 degree video production, tools and experiences for data mining and visualization, and more. Google staff have given several lectures both over video conferencing and in-person to students at VUC, and as they express in their letter of support that they are "thrilled to continue the collaboration with VUC, and looking forward to see how the Centre for Applied Digital Journalism can further the cause of educating tomorrow's journalists to employ a data driven and digital approach to journalism" (Tarjei Vassbotn, Head of IoT Developer Relations, Google HQ).

Through in-depth feasibility studies and in broad dialogue with industry participants in the pilot project prior to CADJ, we found obvious potential for closer interaction with both media and technology partners on the topic of media education in an age of transformation and disruption. We have taken steps to work in closer symbiosis with media development actors to address the significant need for digital development. As our partners point out, "teachers have a responsibility to cultivate the digital competencies of their students and to create enthusiasm around the countless opportunities we have to present and convey journalism digitally" (Nina Selbo Torset, Aftenposten).

As a partner of the technology-based media innovation cluster NxtMedia, VUC is in close cooperation with national and international partners. These include The Department of Computer and Information Science (IDI) at NTNU. VUC was also a major co-arranging partner in Nordic Data Journalism Conference in 2015 (400 participants), and provided jury resources to NODA Awards 2016. Status as a Center of Excellence in education will, according til Project Manager

Trond I. Hovland, provide "interesting and important repercussions both regionally and nationally. NxtMedia additionally develops a Nordic cooperation between multiple media labs, where we expect VUC to build up an increasingly important position." Also, in cooperation with partners like Nordic Innovation House (Innovasjon Norge, Silicon Valley), VUC is monitoring new emerging media tech startups and businesses having impact on new digital media production. Among these are the Palo Alto based company ThingLink, whose visualisation technology is used in the internal practice at VUC. Throughout 2016, the Silicon Valley-based VUC-ADJ partner WeVideo has supported us with a pilot project aiming to leverage cloud and mobile technology to strengthen next generations' journalism.

The on-going monitoring and identification of trends and technology-based media innovations with impact in the media industry means that at VUC we can quickly implement these into the student practicum. This allows our candidates to be operative at a high digital level when they enter newsrooms. For instance, the cloud and mobile technology described above is currently being adopted in major news organisations in Norway parallel to and even after our integration into VUC classrooms.

The Administration at VUC is also highly supportive of the centre project. The centre will be organized directly under the Director of Economy at VUC. A new "Media House" is programmed to open in the Summer of 2019 at the VUC-campus. This building will house the media related study programs at VUC, and will also be the location for CADJ if the Centre of Excellence status is awarded to Volda.

#### The Centre Plan

CADJ will build on a strong tradition for applied professional education in Volda, and will act as a catalyst for transforming and bridging existing programs across faculties. Through this collaboration, we will meet the needs and requirements of our students in a rapidly changing media landscape. We also aim at contributing to secure the very important role of independent journalism in our democratic society, and to open our practices in this area for anyone who wants to learn more about how this can be achieved.

The centre will focus on innovation in the field of digital journalism education through the implementation of the following **objectives and projects**:

*P-1:* Provide a learning environment where students, media partners and technology developers can collaborate around new forms of digital journalism.

The focus of this package is to create online and blended spaces where the existing campus-based practicum model can be expanded. This will require observing and improving how students learn to be strategic and flexible in serving local and global audiences across multiple and dynamic information creation and distribution platforms. It will also require engaging students, teachers, and industry partners in collaborative media lab activities in order to explore the transfer of knowledge across different levels of expertise and experience. The goal will be to strengthen and expand student's practicum opportunities in traditional and emerging newsroom contexts, through cooperation with national and international news organizations and technology companies in digital learning platforms.

# **P-2:** Support students in addressing the need of an increasingly international and entrepreneurial journalism career.

VUC has a solid tradition teaching students how to produce journalism of societal importance. However, for the VUC journalism program to survive, succeed and develop, we recognize the need to communicate to students the technological and entrepreneurial skills they must nurture throughout their future careers. VUC wants to focus on what has been named "entrepreneurial journalism education" (Mensing & Ryfe, 2013). CADJ will build upon the already existing practicum tradition at VUC and expand it to include a focus on innovation in information gathering and distribution. The aim will be to nurture student innovation in critically engaged digital journalism. Within the internal digital practicum, CADJ will work as an incubator for studentdriven experimentation and entrepreneurship, from content, to production methods to technologies.

## **P3** - Enhance student reflectivity on the impact of technological innovation in the role of journalism in democratic societies across the globe

In this package, activities will be divided into two distinct clusters: Student Development and Media Innovation. Our goal will be to use research activities to expose students to a variety of emerging national and international digital journalism practices as well as provide them with opportunities to actively participate in a global network on digital journalism.

In the cluster for *Student Development,* the ongoing data collection and analysis activities from continuous evaluations of candidate development throughout education and career will be further systematized. Studies will focus on how media industry changes, how changes in the social function of journalism impact student careers, and what measures can be taken through program redesign and continuing evaluation. The cluster for *Media Innovation* will gather current research at VUC on disruptive digital practices and innovation in media industry. This includes recently awarded funding from the Norwegian Media Authority RAM program (NRK P3 Dokumentar), as

well as the OMEN Project (Organizing for Media Innovation) in collaboration with Oslo and Akershus University College (HiOA).

#### **Centre Structure**

**Staff:** CADJ will have a Centre Director (Assoc. Prof. Ana Laws, responsible for P-2), an Associate Director (Tormod Utne, responsible for P-1), two Research Fellows (PhD Candidates), an Evaluation and Development Group (student representatives and teaching staff), two Research Groups (Prof. Kåre Heggen, Prof. Paul Bjerke, Assoc. Prof. Ivar John Erdal), an Advisory Board (media industry and international academic partners) and one part-time administrative staff.

#### **Partners:**

*Advisory Board:* Assoc. Prof. Stephen Barrass, Head of Media, University of Canberra; Ingeborg Volan, Innovation and Editorial dev. Director, Adresseavisen (Polaris Media) and President of Norwegian Online News Association (NONA); Tarjei Vassbotn, Google HQ; Nareas Sae-Khow, NRK P3 Dok; NxtMedia (National and Nordic Network); SMP Lab (Polaris Media/Sunnnmørsposten)

*Practicum partners:* NRK, TV 2, VG, Dagbladet, Aftenposten, Dagens Næringsliv, Nettavisen, Adresseavisen, Bergens Tidende, Vårt Land, Dagsavisen, Stavanger Aftenblad, Sunnmørsposten.

#### Added value and innovation in the international arena

The extra funding provided by NOKUT for the establishment of CADJ will help implement the digital journalism vision for VUC in a number of ways. Firstly, it will accelerate the development and testing of the digital practicum and of new teaching courses (Flagship courses) prior to formal launch, as part of the established courses. These flagship courses will be developed under a structure of continuous evaluation and testing in close collaboration with students and industry actors. Secondly, it will aid in the implementation of the adoption of new teaching methodologies for media across other disciplines. Thirdly, it will provide funding for the establishment of a national network, and funding for expanded international network building as well as dissemination activities. Finally, it will help consolidate and maintain the current system for evaluation and development of teaching, career development, and research on journalism and media industry development.

CADJ will encourage teaching in digital journalism that embraces new forms of participation and new narrative forms and technologies, having as goal the continued improvement of the role journalism (and journalism education) plays in democratic societies.

#### **Evaluation and Impact Framework**

The Evaluation and Development Group will undertake periodic evaluation of centre activities. This group will involve the centre director and associate director, one student representative from each cohort (first, second and third year students), and two permanent student representatives from the Volda Student Parlament (Studenttinget i Volda, STiV) and Volda Journalism Student Association (Journalistikk studentlag). These representatives are nominated in internal elections of the various associations and cohorts.

As part of **P-3**, two research clusters will be established. Each cluster will provide knowledge that will be valuable input to the evaluation and development of centre activities. The Student Careers cluster will establish a system for evaluating each internal practicum period as well as the external practicum period. The research group will also send surveys to journalists educated at VUC at regular time intervals. These studies will provide vital information about journalist career paths, work tasks, and skills needs. The Media Innovation cluster will provide useful information about organizational development, changes in how journalism is organized, and applications of new technology in the newsrooms. Master students will be invited to do their thesis as a part of one the research groups.

#### Dissemination

Our dissemination activities have three target groups: students, journalism professionals (former alumni, industry partners and other media actors), and other higher education institutions in Norway and internationally. The centre will conduct the bulk of its on-campus dissemination activities for students at the media learning space close to the training area for radio-, TV- and newspaper/digital practice newsrooms at the Faculty of Media and Journalism. The physical learning space will operate close to the on-campus digital desk as a hub for news distribution and digital storytelling. We will encourage students to have an active role in dissemination activities through seed funding and student grants. Another dissemination activity will include online publication of digital journalism resources created during digital practicums, as well as the publication of a textbook. Dissemination activities for journalism professionals, former alumni, industry partners and other

media actors will be based around online activities hosted via the centre's international network for digital journalism. The online network (social media and websites) will gather participants from around the globe in regular synchronical and asynchronous virtual meetings and training sessions. Dissemination to other higher education institutions in Norway and internationally will be done via a yearly symposium, conference attendance and other traditional publication activities. The Centre will also offer campus visits for graduate students and academic members of our network.

#### Timeline

A timeline is attached as part of the Centre Activities description document.

#### Exit strategy

To ensure continuation of centre activities, VUC commits to finance one work year to be used for leadership and management of the centre after the initial funding period is over. In addition, internal activities will be continued (practicum and internally financed research). During the funding period, a permanent system for evaluation and development with high degree of student involvement will be established in journalism programmes at VUC. Funding will complement current investment in production equipment and expand it to include cutting edge web technologies. Investments in acquisition and skills building in advanced web infrastructure will enable us to deliver continued education courses and modules for partners and other external students. These activities will ensure further web infrastructure renewal. During the initial five-year period of NOKUT funding, we will also seek additional funding from other organisations such as Fritt Ord and the RAM programme for the Norwegian Media Authority. Research and teaching activities will continue under internal financing. Dissemination activities will continue in partnership with other network members in a more modest scale.