TEACH FOOD – Developing a teacher's community of practice

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ABSTRACT

The National Food Institute (DTU FOOD) at DTU teaches and educates engineers for the food sector, the public authorities and the research communities. To meet these objectives faculty needs to be at the forefront of food science as well as in teaching and continuously develop the approach to how to teach. Learning environments with suitable student challenges requires devoted and involved faculty members, who continuously develop their competences in teaching. At DTU FOOD the faculty consists of scientist in a broad range of disciplines and cultures. TEACH FOOD was established to promote and enhance the development of community of practice, i.e. a Professional Learning Community (PLC) focusing on optimizing the learning outcome of the students. To achieve this, a 1½ residential seminar for all teachers was arranged. In the first seminar 76% of the teachers and the head of institute participated. Five core activities were identified and a series of half years seminars were started focusing on challenges in every day teaching experiences. The participation of DTU FOOD faculty members in the internal DTU conferences about teaching and learning has increased from 3 to 11 since the start of TEACH FOOD. These activities illustrate the extended willingness to discuss teaching and learning as well as share experiences from teaching at DTU FOOD exemplifying the growing PLC.

Keywords - Professional Learning Community, exchanging and sharing teaching experiences, development of teaching

I INTRODUCTION

DTU teaching structure

The Technical University of Denmark (DTU) educates around half of all engineers in Denmark. It is a single faculty university with 23 institutes and one centre (Centre for Oil and Gas – DTU). DTU has three campuses with the main campus in Lyngby. At DTU education in Bachelor of Engineering (B. Eng) (17 programs) and Bachelor of Science (B.Sc.) (18 programs) and Master of Science (M.Sc.) (28 programs) are taught. The B.Eng. programs are aligned with the international teaching concept CDIO (Conceive-Design-Implement-Operate) (Crawley et al 2007) where a predefined study plan is given with little

flexibility for the students, to ensure a complete integration of CDIO. For the B.Sc. and M.Sc. about a fourth of the course can be chosen individually.

At DTU students have approximately 20 teaching hours a week and are expected to devote around 45 hours a week for their study corresponding to full time study. DTU have introduced the "red dot project" (Hansen, C.T. et al 2014) transforming students from pupils to students acknowledging their responsibility for own learning. DTU support cross-disciplinary projects where students work as engineers solving reel life problems. This is called Blue Dot (Blue Dot, 2017). Blue Dot projects are extra curriculum activities where knowledge is put into action creating reel products that can be tested. The learning objectives of Blue Dots are to work independently and creative using principles of engineering and theories based on up to date methods.

DTU course evaluation and teacher training

All courses are evaluated by students at the end of the course, after exam and during the course. The two first evaluations are sent to the institute study board and commented; the last is used for adjustment of courses during the semester. At many institutes the evaluation function as a quality assurance of teaching and learning.

All teachers at DTU have to take a mandatory teacher training programme (UDTU) in order to become associate professors or have full course responsibility. This is given by LearningLab DTU (DTU LLab). DTU LLab is the main support function on teaching and learning and aim at inspiring and support teachers, students and management at DTU. DTU LLab contributes to development of the quality of study programmes, teaching and learning at DTU and draws on a large network both in Denmark and internationally (LearningLab 2017). Teacher's training and teaching development at DTU is based on the idea of "Scholarship of Teaching & Learning". In brief, this means that a faculty member works professionally with continually develop and improve own teaching practice and evaluate the outcome in order to understand how to improve. For staff with a long teaching experience at university level and which have been course responsible for some years but still are missing a structured training in teaching and learning "University Pedagogy for Experienced Teachers" (UP) exists and have the same objectives and content as UDTU. An educational coordinator at each institute trained by DTU LLab, coordinates the didactic training at the institute with special emphasis on newly appointed assistant professors, and make sure that they are enrolled at UDTU and are awarded an educational supervisor. The educational supervisors supervise and evaluate the new staff's teaching qualifications and potentials with feedback to , DTU LLab.

Background at DTU FOOD

Ten years ago, research institutes in Denmark were merged into existing universities to enhance the teaching capacity at university. It was politically decided that DTU FOOD, should be merged into DTU, whereby researchers with little or no background in teaching was transferred to an educational institution hereby becoming teachers and here had the opportunity to be educated in new teaching principles by DTU LLab and experience teaching without prejudice and focus on old tradition in how to teach.

DTU FOOD teaches and educates engineers for the food sector, the public authorities and the research communities. The focus areas are prevention of disease and promotion of health as well as making it possible to feed the growing population and development of a sustainable food production. This creates a common domain for teaching and learning.

The strategic objectives for teaching at the DTU FOOD has since 2015 been to increase recruitment to the Master's degree in Food Technology and further development and optimization of the three existing study programs with high quality teaching. To meet these objectives faculty needs to be at the forefront of food science as well as in teaching and learning continuously development of all three education programs, namely the Master in Food Technology, the Bachelor of Engineering (Food Safety and Quality) and the Bachelor of Science (Food and Nutrition) based at Copenhagen University to recruit motivated students. Learning environments with suitable student challenges requires devoted and involved faculty members, who continuously develop their competences in teaching and learning (Vescio, V. *et al*. 2008).

TEACH FOOD

To face the DTU FOOD objectives and needs for faculty development, the director in 2015 set terms of reference. The TEACH FOOD project was initiated to strengthen the teaching at the institute. DTU FOOD faculty consists of scientist in a broad range of disciplines, embracing food aspects from technology, microbiology, toxicology, chemical analysis, nutrition to risk assessment.

TEACH FOOD was created to encourage discussion on teaching issues, study programs and to cooperate and improve the understanding of students learning. The overall aim for TEACH FOOD was therefore to create a community of practice (Wenger, E., 1998), i.e. a Professional Learning Community (PLC) (Vescio *et al*., 2008) focusing on optimizing the learning outcome of the students (Wenger, E. 1998). Communication among faculty members should also aim at development and optimization of the three study programs included at the institute. Inspiration for this work to create a PLC was gained from a similar, but not identical, project some years ago at the former institute of DTU Systems biology (Hellgreen *et al*. 2011).

Here an attempt to create an overview of present status is presented. By continuously focus on creating a community of practice at DTU FOOD, TEACH FOOD assume that deeper learning for students and improved knowledge sharing among the faculty will be the outcome, for the better of society.

II HYPOTHESIS/PROBLEM STATEMENT

DTU FOOD is faced with two important scenarios. The first scenarios are to change the given courses from traditional lecture based to courses with student involvement and – engagement. By changing the focus from the lecture to the students, changes are necessary and the teacher should be willing to "let go of control" leaving the responsibility for the learning outcome to the student (Ulriksen, L. 2014). This is in alignment with the DTU project red dot (Hansen, C.T et al 2014) where the responsibility for achieving deeper learning is transferred from the teacher to the students so they become capable students and not pupils for whom learning is connected to the teacher. The teacher's role is then transferred to be facilitators of learning outcome. To do so, changes are needed and modern teaching philosophy and methods should be used for enhanced learning and alignment of evaluation (Biggs and Tang, 2001). Furthermore, students will have to engage more active in the teaching when changes are made presumably leading to deeper learning. This framework will have to be established finally when the institute is moved to the central campus of DTU here in 2017, leading to a broader exchange of information and knowledge in faculty.

Secondly, DTU FOOD was merged with DTU now ten years ago. Before the merge teaching was not a primary focus area in the institute leaving teaching to be done, when time was available. This has now changed and a building of a society of teachers exchanging information concerning how to teach without fearing supervision is needed. Teaching is presently still something done individually with little knowledge exchange between fellow members of the faculty. This leads to a feeling of loneliness when dealing with problems as how to teach. Due to today evaluation of teaching is highly focused on the student perspective, the teacher can find him/her isolated and having difficulties in sharing problems encountered. By having focus on these two areas, we believe that deeper learning for students will be the outcome we hypothesize.

III THEORETICAL FRAMEWORK

Communities of practice are formed by people who engage in a process of collective learning in a shared domain, here as teachers working for student deep learning in DTU FOOD study programs. This group share a passion and learn how to do it better as they interact regularly (Wenger, E. 2006). Three characteristics are crucial for a community of practice (Wenger, E 1998):

1. The domain
2. The community
3. The practice

First, the community of practice needs a shared domain of interest as a defined identity (Wenger, E. 2006). The teachers at DTU FOOD share commitment to student learning and own teaching practice development throughout their daily teaching and general training at either UDTU or UP. This community differs from the established community of research which aligns with the line of command. Teaching is cross-disciplinary between the departments in the institute. By TEACH FOOD, we established the second requirement, the community, who shares interests in student learning and continuously practice development are pursued by joint activities, discussions, shared information and helping each other. This support the movement from "feeling alone" to being part of a shared community working for improved education. The final requirement with a shared repertoire of resources, experiences, tools and ways of addressing recurring challenges sums up to a shared practice. This will be established through knowledge sharing and discussions at DTU FOOD at bi-annual teacher seminars.

The perspective of communities of practice affects educational practices along three dimensions:

1. Internally. By designing track for progressing of learning visual for the students and create cross-disciplinary course where students from multiple study program solve real life scenarios leading to motivated students (see also innovation).
2. Externally. By close cooperation with students hubs of innovation (DTU SKYLAB, 2017) and extra curriculum activities that are align with study program given the student opportunities that can lead to a "Blue Dot" diploma (Blue Dot, 2017). Finally, all education at DTU has advisory groups including representatives of industry setting the framework for competences in the study lines.
3. Lifelong learning needs continuing interest from the students. The university is in this context only part of a broader learning system. The University is not the primary learning environment. That is life in itself and the university creating alumni networks, graduates retain contact to the established learning environment at the university, hereby creating a symbiotic network of knowledge exchange (Wenger, E. 2006). Using"Authentic Learning" in complex scenarios an entrepreneurial mindset will be created and focus will not only be on Start-Ups (Fayolle, A. and Gailly, B. 2008).

Few empirical data have documented that learning community's support student learning (Vescio et al., 2008). The most significant factor for student learning is teaching quality, which is improved by continuous professional learning (Hord, S.M. 2009). The concept of a PLC rests on the premise of improving student learning by improving teaching practice (Vescio, V. *et al* 2008). Research support the idea that participation in a learning community lead to changes in teaching practice. When PLC is created a common core group is often identified (Wenger, E 2006). At DTU FOOD, TEACH FOOD represents this.

IV DISCUSSION

TEACH FOOD was divided into 4 minor projects (see figure 1), one for each study program and one for pedagogical development and establishment of a PLC. The last one formed a Task Force with two study leader, and the pedagogical coordinator at the institute. This paper describes work in progress. Since the introduction in 2015, implementation of the focus areas has been done gradually and here we attempt to show evidence of the ongoing process and its effect on teaching and learning. Implementation of e.g. course changes is delayed due to the standard procedures. This focus will be on creating the PLC and how this has and will improve teaching at DTU FOOD.

The Task Force, a representative from Human Resources and a representative from DTU LLAb planned a 1½ days residential seminar for teachers. The institute director and 35emplyeees (75% of the faculty) participated in the first seminar, facilitating a collective reference for faculty. This first seminar encouraged teachers to talk together across scientific disciplines and the main part of participants experienced teaching develop from loneliness to exchange of experiences and knowledge. Identification of core activities in TEACH FOOD resulted in the following five main activities included in the project time frame on figure 2.

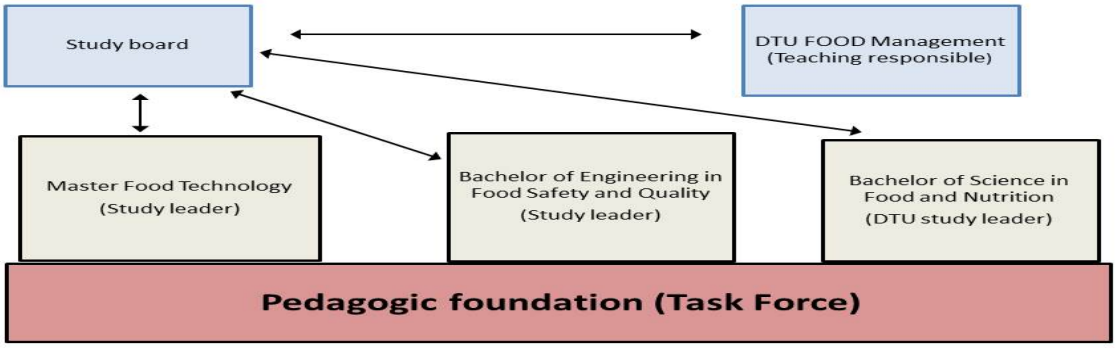

Figure 1: Organization of TEACH FOOD. At the top level we find management of course structure (study board) and resources management (head of institute). The three study lines are included in the middle and all are based on the pedagogic foundation. Responsibilities are in brackets.

Tools were identified from the discussions on teaching and learning at the seminar as a lot of case stories from industry and authorities available for application in teaching problem and case based (De Graaf, E. and Kolmos, A. 2003) .

Development of the study lines

The first crucial step (figure 2) for obtaining motivated and well-trained students were identified at the residential seminar to ensure transparent development of the three study programs. For each of the three study programs, the appointed study leader created series of meetings where content of courses and progression of teaching and learning are debated. Overlap in course content was identified and reduced. By creating individual communities of practice for each education program and involving all course responsible, information has been shared and understanding of the progression identified

The concept of a competence matric, obtained from CDIO (Crawley, E. et al 2007) was applied in M.Sc. for the development of two study specialization. At M.Sc. two courses are obligatory for all candidates. One of these courses (course no. 23101) has been adapted to include more broad and general competences essential for both specializations.

Competence matrices for personal and professional competences have been redesign in the B.eng. according to adjustment in the study program and each course responsible has given their contribution. This has been aligned to identify what courses contribute to the final learning objectives of the education. Increased average grade (from none to 5.9) for the 40 students indicate a raised interest in this study program from 2013 to 2016 among students.

For B. Sc. where study line responsibility is at KU, focus has been on creating a new important cross disciplinary course at the first semester and showing progression in food technology from this course to DTU courses taught on fifth semester.

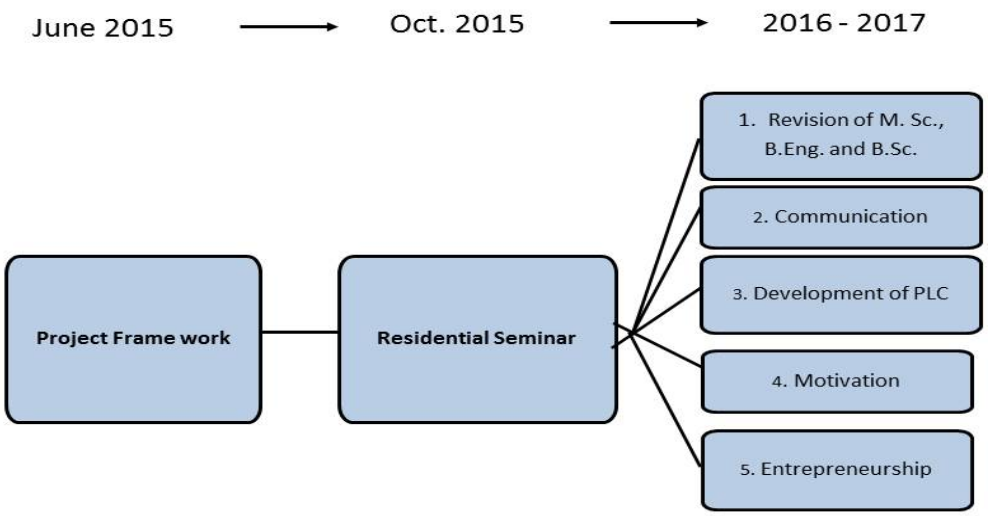

Figure 2: *Time frame for TEACH FOOD with the five core activities. The project will end in 2017 and the core activities will continue based on teacher motivation.*

Communication

The second activity identified were a need for a clearer profile for each study program, both internally and externally. The first result of the seminar was a name change for the B.Eng. from “Food analysis” to “Food safety and quality” hereby focusing on what the student learn and not what they do. Among the student this change has been achieved positively and they now understand the learning objective of the education. The name has made it easier for industry to understand what graduates can do and to differentiate these graduates from other education programs in Denmark. A course of fifth semester has been changed to sensory evaluation, a discipline requested by the advisory board for this education.

The teaching responsible at DTU FOOD has initiated a communication strategy for all study programs for students and future graduate employers. The work which will be launched in autumn 2017 has included involvement of study leaders, study board, task force and communication personnel at DTU FOOD.

Development of PLC

The Task Force has planned and coordinated biannual ½ day seminars for faculty members. For each of these meetings approximately half of the faculty participates including full professors. The shared interest in student learning and continuously practice development by these joint activities, discussions and shared information and knowledge were believed to establish a shared community of practice working for improved education at DTU FOOD (Wenger, E., 1998).

The first meeting was held in March 2016 with focus on exams. Representatives from DTU LLab introducing the theory followed by lively discussions on how to establish exam activities corresponding to learning objectives. The seminar inspired the teacher in food chemistry (23302) to change the exam to include overall open questions covering curriculum for the students to apply own examples prepared in advance instead of randomized questions with no prior idea on what is relevant from the curriculum. This increase the student learning due to an increased focused preparation for the exam at a higher level of Blooms taxonomy (Anderson et al., 2001). Results will appear in June 2017.

The second seminar in September 2016 included ideas and inspiration on student midterm evaluation with a practical example from a teaching situation. Emerging teaching technologies were presented with an example of development of a Coursera e-learning course. Active discussions and questions to the presenter indicated interest and willingness to adapt new technology and techniques in own teaching.

At the third seminar in March 2017 a discussion on career framework (Career Framework, 2017) and teaching portfolio development were discussed. Methods of quantitative measuring increased student learning were lively discussed with suggestion on use of e.g. exam grades, student pre- and post-tests as well as student course evaluations. The study board will look into if evaluations can be used. At the meeting it was suggested that extra curriculum activity required for UDTU participants could be used as an inspiration to the DTU FOOD teachers. The language in student approach was discussed as an attempt to establish practices in the community (Wenger, E. 1998). Teachers have some difficulties when addressing students as kinsmen/engineers (not so well trained) or pupils. Students often complain and feel that teachers look down upon them and do not recognize them.

Input for seminar topics has until now come from the Task Force. At the recent seminar faculty members started to come up with ideas on topics relevant for seminars in the future. Next seminar in September includes a presentation of use of personality evaluation for establishment of project groups at M Sc.

The DTU FOOD faculty members participating in the internal DTU conferences about teaching and learning have increased from 3 to 11 since the start of TEACH FOOD: Twice has DTU FOOD been among DTU institute with most faculty attendees. For the newly established "development of teaching" price a member of the faculty at DTU Food was the runner up in fall 2016. In addition at least two faculty members from the DTU FOOD contribute with presentations at the internal DTU conference every time.

Motivation

Involvement and increased focus from DTU FOOD management with visually recognition of teaching and teachers has increased focus on student teaching and learning at the whole institute. News on teaching are presented at quaternary presentations by the head of institute. Last year the task force members were presenting their motivation for teaching and learning at the yearly institute day. Since then, this group has experienced that colleagues have increased interest in teaching and learning realized as frequent questions and interest in e.g. student projects. It is acknowledged, that colleagues find it inspiring to teach. The recognition and visualization of teaching results in more motivated teachers indicated by even professors participate in teacher seminars and willingness to discuss teaching practices.

Entrepreneurship

Entrepreneurship should be included in relevant courses and be transparent for students. Courses part of the master education curriculum has been tweaked to result in a clear progression in innovation and entrepreneurship. These allow the student to take innovative ideas generated in courses at the beginning of their education and work with them through the following courses. Different courses in the study plan supplies the necessary engineering competences that can be put into play in this *wheel of innovation* that also include extra curriculum activities in cooperation with SKYLAB (SKYLAB 2017) and finalizing in Blue dot diplomas (Blue Dot., 2017). The number of students taking courses in this *wheel of innovation* has gradually improved from 78 in 2007 to 95 in 2016 and money has been granted by the Danish entrepreneurial fond to create a national competition in food innovation. The first student spin-off company was registered in fall of 2016

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VI CONCLUSIONS

A PLC is developing at the DTU FOOD. After increased focus from the DTU FOOD management and establishment of TEACH FOOD colleagues are after one and a half year already discussing teaching in the hall, at the cantina, and at the DTU FOOD biannual workshops with approx. 50% of all faculty members participating each time.

Study leaders have included relevant faculty in a systematic establishment of course matrixes similar to international CDIO principles for the study programs related to student competences and engineering abilities according to Blooms taxonomy.

Student evaluations of all courses at DTU FOOD are good and the community work continuous the development of knowledge based sharing and practices for student activation and evaluation. Measurement of student learning are ongoing and increasing in number.

Entrepreneurship and innovation has been integrated in courses both at the B.Eng. and M.Sc. and progression have been visualized by the wheel of innovation. Student participation in these innovations courses is gradually increasing.

Activities during biannual seminars at DTU FOOD and internal at DTU Teaching and learning conferences illustrate the extended willingness to discuss teaching and learning and share experiences from teaching at DTU FOOD. At the same time the DTU FOOD Director refers to teaching at her quarterly summaries and acknowledged teachers efforts and student satisfactory on courses and projects at the yearly summary. TEACH FOOD is developing and future perspectives are inclusion of other employees than faculty at DTU FOOD.

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