



# **Curriculum Development for Sustainable Seafood and Nutrition Security (SSNS)**

Report: Study Trip to NTNU

Trondheim, Norway

Nov 5-9, 2018



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# Curriculum Development for Sustainable Seafood and Nutrition Security (SSNS)

## Report of the Study Trip to NTNU, Norway

### Background

A weeklong study tour was hosted and organized by Norwegian University of Science and Technology (NTNU) during November 5 – 9, 2018 as a part of Workpackage 2 of the Curriculum Development for Sustainable Seafood and Nutrition Security (SSNS) funded by the European Union under Erasmus+ programme. The main objectives of the event were to learn about the courses and innovative teaching and learning methods practised at NTNU, observe laboratory facilities, equipment, and teaching-learning environments. This was in concurrent to a Chinese proverb 'I hear and I forget. I see and I remember. I do and I understand'. 27 lecturers and 2 staffs from EuroTraining from Asia and Europe participated in the event. More than 10 instructors of NTNU and a sub-contracted VLE (virtual learning environment) instructor gave their presentations enriched with ideas of innovative teaching-learning methods. Activities were also organized to visit laboratories and field stations including a salmon farm and a processing factory. This report covers the day-to-day activities of the whole 5 days at NTNU, Norway:

### Day 1 (Nov 5, 2018):

Dr Jorgen Lerfall and his team welcomed the participants (Fig. 1). He also introduced The NTNU that has the main campus at Trondheim and contact offices in Brussels as well as in Tokyo. The university has about 40,000 students, out of which 9% are international students. There are over 7,000 staff. There are about 10,000 students enrolled in technology area, while the remaining are at the department of social science and engineering. More interestingly, NTNU is engaged with substantial 92 Horizon 2020 projects. Department of Biotechnology and Food Science also have about 110 students, out of which 50 are MSc and 10 Ph.D. levels. The central focus has been the aquatic food production, food safety and security and seafood quality. After the introductory presentation, a series of other presentations were held that are briefly illustrated here.



**Fig. 1** Jorgen presenting about NTNU (left) and participants (right)

### Presentation 1: Food Safety by Dr Anita N. Jacobsen (Fig. 2)

Part I was about “Investigating a foodborne outbreak”. A teaching module was developed in collaboration with Norwegian Food Safety Authority (NFSA) consisting of Lectures – 1, 3, 8 (infection etc.). Epi-Play (one day) was developed and used as role-play. Altogether, 14 tasks were given to the students. Descriptive analysis and cohort analysis were performed.

The part II was about “Emergency response exercise” in which a theory was given, as background then a role-play was included. An example of a paper factory that drained water to a municipal canal was used for the emergency response role-play exercise. The module consisted 7 hours in 4 days to solve the problem. Action cards were water works, laboratory, food plant, article journals etc.

Discussion: Food poisoning in Thailand is a big issue – it should be included in curricula. For food poisoning, traceability is very important which should be a part of it.



**Fig. 2** Anita presenting overall framework of teaching-learning and a curricula of food technology program.

**Presentation 2: Dr Alireza Ashrafian presented on the course TMMT5002:**

The course is about Production Management, Innovation and Product Development. Major highlights of the course were motivation, the structure of the course, Model, Lean Food Manufacturing, discussion and sharing. Motivation is needed from the industry, food technology engineers who are not only engineer the products but also understand the manufacturing process, automation, innovation, digitization and so on. Business management is done from Engineering point of view. It was developed with the industry partner: Seafood producers e.g. Hitramat producing crabs which was very happy to cooperate. Students are asked to bring their own problem.

Another module was developed namely - Lean Food Manufacturing. The motto is “Work smart not too hard”. Lean refers to continuous improvement, problem solving, teamwork, measure productivity, eliminate waste, 5SA3, SMED, etc. The total production is related with total quality management. They believe in standardize material, as well as visual and daily management. Conventional wisdom has it that learning is best by doing, where presenter literally indicates to bring the factory in the class for the best industrial learning.

During the discussion or Q&A, participants from Indonesia raised a question that if there are many students in the class up to 100, how it can be managed? The answer was by splitting into a few groups. It was reaffirmed that the involvement of industry needs win-win situation. In some cases industry may not be open for the involvement. The fish processing courses existed at JFU and Gadjahmada Univ.). They work in village, encourage some product development applying technologies. Suranari Institute of Technology in Thailand has courses with similar modules/course. The main point in this course is that students work with the company. It was developed as a module to bring more real-world problems.

**Presentation 3:** Dr Eirin Bar discussed on the course TMMT - Sustainable food production. There is a consensus among scientists that 60% more calories need to produce to feed the world by 20150. Norwegian Environment Agency estimated that 930 million plastic bags were used in the country in 2014 that is equivalent of 180 plastic bags per person. Recently, to counteract the environmental wreckage caused by the plastic, Norway government is supporting the initiative of implementing fee on plastic bags. Alternatively, environment friendly cotton bags are alternatives to the plastic bags. There is massive information available often which turns out to be fake. The question is how to filter the information that is appropriate for particular contexts.

**Presentation 4:** The presentation by Dr Eva Falch involved in facilitating knowledge transfer between students and important actors of the food value chain. The seafood value chain was well discussed. Regular webinars on European food framework are organized by EU parliament. External actors, internal actors, and students themselves can play the mentors. The knowledge transfer also involves external network where different students meet and share knowledge.

**Presentation 5:** Experts in Teamwork (EiT). In the afternoon of Day 1, Bjorn (head of EiT) and his team presented an interesting topic - 'Experts in Teamwork'. The course was first developed in 2001 in response to the demand from business for a sociology department. Since then, it has grown and the university has made it compulsory to all the students of several departments. Annually 2,500-3,000 MS students (also PhD) from all the fields need to take this course. A handbook for teachers, which tells how they should organize this course, was distributed to the participants that should be useful to them if they want to develop similar courses. In this course, students are grouped into various topics and they are called as "Villages" which consists of 20-30 students from various fields e.g. agriculture, aquaculture, and engineering and from a different culture, background, and nationalities. The group is "Expert Inter-disciplinary Team" similar to a project, which requires several experts to launch. Normally, 4<sup>th</sup>-year students are enrolled after they have theoretical knowledge in their field and are ready to apply in the real field situation working in a team. Each village has a team of facilitators which requires:

- LL – Learning Leader i.e. supervisor or professor (1/village)
- LA – Learning Assistants (2/village) trained to facilitate the group

The two students are trained as team leaders who organize each team and are paid for their work during the period. The purpose is that the students need to learn from a specific situation, authentic problems of the society and work life outside the universities to serve to the people and the communities e.g. companies, or official govt. etc. It is based on concrete experience => reflective observation => abstract concentration => Active experimentation.

Each group produces two reports - one about the project and the other on teamwork. However, participants doubted that some students might not participate actively. Reports should be individual even though they work in-group so that evaluation can be done based on their respective report.

More information can be found at: [www.ntnu.no/eit](http://www.ntnu.no/eit)

The next speaker emphasized that EiT is mainly based on the industry and community cooperation. Interdisciplinary team of students works in a group for a project based on the problems of the community. Interdisciplinary members cooperate with external partners who can serve to augment the quality of the project with good inputs, skills, ideas, or solutions. The questions can be made to the students that reflect the value to the society. Again, the big question is about its sustainability.

The speaker discussed about change maker skills and entrepreneurial skills. According to them, we have to seek opportunities, creating value for others. Some other interesting skills to acquire are:

- Take action
- Finding resources to make things happen
- Collaborative leadership
- Creativity
- Determination
- Empathy and thoughtfulness

The speaker highlighted the followings that students learn from this teaching:

- Deeper understanding of challenges for society
- Utilize interdisciplinary professionalism of the group
- Apply knowledge, solutions, and ability to carry out the project efficiently and effectively.
- External partners make the work more realistic

The industry also gets benefits such as diverse people, new ideas, or solutions, involvement of academia. EiT Theme covers wide range of disciplines. Some of the thematic areas are:

- Digital medicine
- Innovation in health care
- Energy transition – thinking green
- Biofuels – a solution or problem
- Sustainable aquaculture in future food production
- Aqua tech on the premise of biology
- Marine technology

Themes are chosen/given by teachers or can be made available online. Then students choose the topics as per their interest. The outputs consists of two reports either a group work or individual report. Meetings are held every Wednesday during spring to update everyone.

### **Laboratory visits:**

The participants were divided into two groups while visiting two labs (Fig. 3, left). Mass Spectrometry (MS) Lab dealt with Instrumental Analysis of various samples. Students/researchers prepare samples and give to the lab for analysis. Lab reports or compositions are made available via email or online.

Nuclear magnetic resonance spectroscopy (NMR) Lab, which is a National Laboratory consisted of heavy equipment to analyze the structure of proteins especially cancer cells to see how they are affected. Smallest machine was of 400 MHz, and others were 600 and 800 MHz. Machines are imported from Switzerland.

After visiting the labs, Jorgen and his colleague showed facilities around the building including chemical labs, library and students' study rooms. Clearly, it was felt that facilities for individual and group learning was superior to the facilities acquired by students in Asian countries. Asian students are more guided by teachers and self-learning environment is still unrecognized method in many parts of Asia.



**Fig. 3** Visits to laboratory (left) and the salmon farm (right)

### **Day 2 (Nov 6, 2018):**

After exciting 1st day, the following day was planned for a visit to Atlantic Salmon production site (Fig. 3, right) to gain some real fish farming experience. We started off at 08:30 from Hotel in Akrrinn and arrived at Hitra after about 2.5 hrs. long journey. Participants were divided into three groups to take boat to Cage culture site, which was about 2 min away by speedboat. Salmon cage culture consisted of 50 m diameter and 28 m deep. Therefore, the perimeter of the cage was 170 m ( $2\pi r$ ) and volume 64,093 m<sup>3</sup> ( $\pi r^2 h$ ). The total number of fish stocked was 170,000 (i.e. 2.65 fish/m<sup>3</sup>). The fish stocking size in the culture was 100g (nursed in land based hatchery). The maximum biomass reached at 25 kg/m<sup>3</sup>. The harvest size was five kg after 14 months of grow-out period. Considering 90% survival rate, the total biomass harvest was 765 ton/cage (5 kg x 170,000 x 90% survival). A single cage culture generated total revenue of 6.12 millions Euro (765 ton x 8 Euro/kg). There were 200 similar cages in total that generated total revenue of 200 x 1.224 billion Euros per cycle. The Feed conversion ratio (FCR) was maintained at 1.2. The expenditures were feed cost and cage i.e. 765 ton x 1.2 FCR = 918 ton x 9 Kroner/kg = 8,262 kroner = 865,131 Euro/cage. The gross margin over feed cost was maintained at 6.12 – 0.865 = 5.2 million Euros.

The hatchery was located at different place where eggs are produced using 9<sup>th</sup> or 10<sup>th</sup> generation captive broodstock undergoing a series of genetic improvement (e.g. GenoMar, Akvaforsk companies). There are about 200 families for this. The growth from egg to 100g size takes about 9 months and requires fresh water. Participants also had a chance to see feed monitoring control room. Feeding was somewhat automatic that was done by machine and it spread all over slowly. This was monitored by under-water camera and controlled by computer operators in office to see how fishes were responding to the feed. Feeding is done until they eat actively (ad libitum) and stopped when they are not eating and feeds are going down to the bottom. Fishmeal constituted about 20-30% of the diet.

The major health problem faced by the fish was Sea lice. In the past, they had to use chemicals to kill but now they have found alternative natural method such as use of cleaner fish (e.g. lump fish) inside providing a shelter of artificial seaweed to let them eat lice, and also cover around cages by a sheet of polyethelene up to 5 m depth where sea lice can harbor. Sometimes, they use mechanical method to remove them, and bath salmon in freshwater for about 7-8 hours to kill lice.

**Visit to Salmon slaughtering house (Leroy)** – processing factory was another exciting place to see and learn. After having lunch bus arrived at Leroy centre at about 2 pm. Participants were divided into two groups to observe the production line. According to the staff, the centre receives 3-5 kg salmon by boat. The killing is done by electric shock, and

then passed to chilled water (1-1.5 °C) tank. Cleaning, de-gutting, de-heading, de-skinning, filleting and packing (12 kg in plastics) are done during the process. The fish processing capacity is remarkably 300 ton per shift and two shifts could be run a day. The factory is brand new and has five production lines. The machines are made in Denmark and Iceland. A boat can carry about 500 ton fish at a time.

A presentation was made by Sven Amund Fjeldsævi, CEO, Leroy Midt AS (public company). The company is 2<sup>nd</sup> largest in Norway after Marine Harvest. It harbours about 45,000 tons of live fish in cages with 550 employs actively working. The processed fillets are transported to Denmark within 24-34 hours of processing. The 80% electricity power supply is from common cables / line and remaining by generators where there is no line. The company also produces Trouts and accounts for about 60-70% of the total production in Norway. It was claimed that there are no environmental issues such as escapees and genetic mixup with wild salmon or pollution. They are against GMOs. The vaccinations are done against 7-8 types of diseases when fish are about 50-60 g in size. The major traits to consider for genetic improvement are color, disease resistant and rapid growth. Questions were taken in from the participants and had short intriguing discussion on specific information about Salmon farming over the exquisite dinner.

### **Day 3 (Nov 7 2018):**

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Third day started at 09:00 hrs with presentation of the review of activities of the Day 1 and Day 2 by Ram C. Bhujel, the Coordinator of SSNS in a hall of Hotell Froya.

**Presentation 1:** BSc and MSc thesis research models practiced in NTNU were presented by Jorgen. Three models are as follows:

**Model #1:** Project/problem/challenge is given by the industry while the supervisor is appointed from a university. Work is done at the factory or at the university according to choice. The advantage of this model is – high employability, gain of industrial experience, real research experience, build network, and higher job opportunity. On the other hand, the disadvantages of this model are – supervision can be challenging, problem of secrecy (privacy?), publication problem (authorship). He elaborated with an example of Brown crab (*Cancer pagurus*) production company. The shelf life extension of fresh production of Brown crab (*Cancer pagurus*) was a problem. The company had a problem of an item to keep for long because it was spoilt quickly, and wanted to increase the shelf life. <https://hitramat.no/producter/page/2/>

**Model #2:** Project given by the R&D project. The example for this model was Marine Harvest funded project and Norwegian funding agency. The good thing about this model is having research and results for publication in journals.

**Model #3:** Cooperation among industry partner, a contract research partner, and university. However, the problem with this model was data right for publication as it included various partners. For example, NOFIMA and SINTEF funded NTNU.

Alim of Indonesia mentioned that most of the thesis are part of the R&D funded by the government. An industrial research program involved teams from various stakeholders e.g. industry, government sectors, and 50 students. In Vietnam, there were objections from community. In addition, proposal submission, getting funds from government, and being involve in research was a problem. Over 50% students are working with industry in Europe whereas in Asia it is limited.

### **Presentation by Anita on - Embed employability in teaching.**

The presentation was focused on quality culture. She emphasized on contribution from everyone to the education. The NTNU Teaching excellence is attributed to the source from funding. The student environment for excellent learning has to be appropriate. The DIKU student gets opportunity of internship activities, guest lectures from expertise, excursion to various sites, well-equipped practical labs, and BS thesis. The students are focused on projects related to working in the industry level. She also highlighted on active teaching methods. She emphasized that the employability is not just getting job but also to generate jobs. It involves generic skills and provides active learning for the students by engaging students in students oriented programs. It can be through flip classroom and using digital tools. The aim of the project was to produce digital learning materials at industry level. The process technology can be arduous task due to many calculations involved. In such case, use of multidisciplinary and relevant films, interviews, or photos can be effective in learning.

The use of visualize central principal of process, learning through lectures, guided discussions, self-learning, exercises, examination has proven to be more effective. She emphasized on the importance of internship. The internship period aims to reduce the gap between the knowledge achieved at NTNU and during the internship, it reflects the student learning.

A photo story on theme of work place design was presented. The story displayed how work place design can be a challenging experience for students' performance. The proper sitting posture, height of table is some of the factors. Adjustable table according to the student's comfortableness should be provided. Some students may not want to join digital meeting such as via Skype due to their timid nature. Due to higher use of technology and ease, the digital material becomes more accessible than in a paper report.

Food Microbiology can be illustrated by bone model and flip classroom, short presentation and creating videos. This has to be supervised by group leader. For testing of its practicality, concept inventory can be developed. This may include a survey to find key concepts, make a series of multiple-choice questions. Conducting student evaluation on related courses also provides the effectiveness of the course and learning outcome by the students.

**Presentation 3:** It was about the development of education for the aquaculture industry. The presenter introduced Blu Competence Centre (BLAT Kompetansesenter). This was originally designed for high school students 16-18 years. It is notable that 1 out of 4 approved centralized project form the EU – 2016 and is ranked as the second best project.

VET Courses are proposed on 12 countries. The Action plan is developed for EU VET innovation and the harmonization of qualifications.

The Spin off project – Optimize training, innovative methods and tools for acceptance of prior learning in qualifications and workplace training (OPTIMAL). This project aims to:

- Promote efficient VET training taking into account the employees accumulated experience and recognize prior learning.
- Pilot new methods and tools for RPL in effective learning.

The project will conclude in September 2019 and are now in the process of piloting methodology and tools of ordinary VET courses in Trondelag Country Authority. The project partners are FEAP, Teachers union of Ireland.

### **Training for Higher education:**

This video link shows the Industry's engagement in training at the workplace.

<https://vimeo.com/281400656>

Higher education and training in seafood sector is required due to increasing specialized complex and the market demand. It is time for a leap towards high tech industry such as salmon fish farming. However, it has problems such as complex issues, need for cooperation, systems thinking.

Higher Education is necessary to deal with the complementary challenges. Ironically, we have to solve current challenges e.g. sea lice and educate the tomorrow's (future) leaders. A model known as 'Bridgehead aquaculture' has been introduced. It is a model for knowledge building in the aquaculture sector through collaboration with university and higher secondary education. A noteworthy company is AkerBla – (Knowledge based Marine Health). They served with 17 people at the beginning. Later, it expanded and has spread all over Europe in 70 countries. Many delegates visit there. A group of veterinarians from Ghana had visited some time ago. This has been a place for a capacity building.

They have a unique regional capacity building and collaboration program. Thirty students attended a conference while 70 had applied. Furthermore, 15 professors also joined along with industry leaders.

NTNU acts as a bridge between OCEANS and Aquaculture. They have a webpage where they can post their news, updates, announcements etc. The regional development is based on real engagement of people from various stakeholders.

A one-day meeting is organized focusing on obtaining work experience, while another day for meeting with experts ([www.ntnu.no/brohode-havbruk](http://www.ntnu.no/brohode-havbruk))

The participants visited the Blu Competence Centre (BLATT KOMPETANSESENTER) that housed various company offices (Director's offices). They rent office spaces. The names of companies include Marine Harvest AS (largest salmon company), SalMar ASA, Hitra-Froya lokalavis AS, BioMar, SINTEF og NTNU, Leroy Midt AS, Ernst & Young AS, Aquatic Concept Group, etc. They also facilitated a High School at the ground floor. Training for high school children was also conducted at this place. In addition of having hands-on training and experts talk, interested people can also get advice and support on business development planning, acquiring necessary funding, project planning, data acquisition, data analysis, manuscript writing and publication.

#### **Day 4 (Nov 8, 2018):**

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A visit to MarineTek/SINTEF was scheduled on this day. Oyvind Hellan, VP Research of SINTEF Ocean gave a talk on SINTEF – the largest Scandinavian research organization. There are 2,000 employees from 70 nationals and provides services to 3,800 customers. It records revenues of NOK3.2 Billion, and NOK 500 m international sales. The Norwegian grant constitutes 8% and 92% from other grants such as EU. By size it ranks 4<sup>th</sup> after Fraunhofer, TNO, VIT etc. It is an independent and non-profit organization. Its major activities are contract research, national lab, innovation ventures, sustainable development, and social mission, renewable energy, health and welfare, ocean, etc.

SINTEF has partnership with NTNU since 1950. It has strategic cooperation regarding joint use of lab and equipment, and research project. The knowledge of interdisciplinary team is shared into business ventures.

The distinguished lab is the largest marine technology research and education center in the world. The students reside on the ground floor, while university professors in the middle and institute occupies on top of the building. There are 120-140 MSc, and 15-20 PhD students graduating per year that approximates size of a university. It has two centres of excellence

and four successive centres namely MARINTEK+, SINTEF Fisheries and Aqua +, SINTEF ENV TECH, SINTEF OCEAN.

They first test advanced model then develop software and study, analysis & verify before dissemination. One of the software developed was 40 year old which is used in Marine Cybernetics Lab. Recent ongoing model development are Offshore cage culture - shore technology and Floating bridges design especially for aquaculture.

Next presentation was by Hans Bjelland titled 'Offshore-exposed aquaculture: Progress and perspective'. This presentation pointed out the challenges faced by exposed aquaculture. The challenges are growth limitation, development permits, shifts. Hans elaborated the five challenges:

1. Fish farming represents a demanding work environment and takes a lot of stress.
2. Management and daily operations/inspections, need to develop robust technology, decision support.
3. Vessels operations – transport of live fish, fish crowd towards the surface. The unpredictable environment poses threat to operating vessels.
4. Fish welfare and rough handling – stress.
5. Fish escape - 400,000 wild fish in Norway but each year about 150,000 salmon escape, although all of them may not survive.

**Way Forward:** The future concerns are the fundamental shifts of industry leaving familiar grounds and increase more unique farms. It is expected to increase fish populations in each unit upto 1 million per cage. Currently, the maximum number of fishes holding capacity is 200,000 per cage. The cage design under water has to be improved that will facilitate collection of wastes and feeding. Automated laser system will be developed for sea lice killing.

Kirsti Greiff, Research Manager of SINTEF, delivered interesting presentation on automation in seafood industry. The automated processing system involves killing of fishes, size grading using robot. The uniform quality is maintained as robot detects the melanin pigment on fish skin and cuts using 3-D model technique. The robot sorts out high and low meat content crab. It can also be trained to pick up certain fish or fruit etc. The cost of robot is decreasing which will be easier to promote its uses in the future industry minimizing the labour cost.

**Afternoon session:** Participants were divided into 3 groups, discussed various topics.

**Group 1** discussed about the employability of students, barriers of active student learning, and use of aid tools to enhance learning. The student learning is impaired due to lack of skill, ideas, and experienced teachers. One of the ways to solve this problem is by providing adequate training to them. Provision of reward and incentives will encourage students learning. It is also essential to develop motivation and interest in students. A regular seminar and discussion session has to be organized. The well-equipped classrooms, internet and modern technology, and necessary funds has to be made available for the use. The promotion of digital tools such as flip classroom will boost the students learning capacity.

**Group 2** suggested in developing teachers guide. They provided methods of teaching with examples. They explained on how to develop a good syllabus. They also emphasized on improving teaching materials and learning environment.

**Group 3** highlighted the need and importance of labs. They had visited various labs. Asian universities are in dire situation of well-equipped laboratory facilities namely microbiology, chemistry lab, and dairy lab.

Outcomes of the group discussion were presented by Jorgen (Teachers guidebook) and Anita (employability of students and various other questions about barriers etc.).

At the end, a review of day 3 and 4 was presented by the Project Coordinator, and discussed about possible use of techniques and responsibilities.

### **Final Day, Day 5 (Nov 9, 2018)**

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A presentation followed by discussion session was led by Anne Feren, Kari Helgetun Langfoss and Kristin Belsaas from department of biotechnology and food science on topic revolving around Internship program. The intern host has to meet certain criteria such as the intern host must have at least 20 employees and the work has to be relevant to the food and agro-processing. The estimated duration of internship is 5 months in a year constituting 2, 30 credits. The potential intern hosts are food industry, research institutes, analytical lab, or Norwegian food safety authority. A contact person from those institutes has to be appointed to share detail information.

The intern will work aligned with the company goals. The internship company will have extra benefit and costs no charge. This will provide an opportunity of having a contact with future employee and getting familiar with academic environment. Several companies including Loroy, SalMar, NOFIMA, Sea Food (Tromsø), etc. are potential intern hosting company. A company can host 1 or 2 students. The intern can be associated with writing reports, while the analytical results and quality control needs to be done by staff in the lab or under strict supervision. However, language can be barrier for foreigner.

The progress report has to be sent to the university on timely basis such as every month. A prospective evaluation is warranted on either pass or fail basis. The MSc level work requirement is 12 weeks. Grading criteria should be developed in suitable format. If a student fails the exam, one more attempt is provided to obtain satisfactory grading.

Second presentation introduced **eLearning/virtual classroom**. Aquatic Food Production learning module can be provided through e-learning and virtual classroom for convenience of students and teachers as a whole. The link for the lecture files, question and answer session shall be made available on e-learning environment. This course requires a commitment of 45 minutes a week for two lectures and a project work. The lectures are also made available on podcasts. Conversely, the students might be much more shy to talk in virtual environment than in the classrooms. Another disadvantage is the practical aspect that needs to be arranged separately. Currently, the department has two such courses running effectively.

Nicholas talked about VLE on his presentation. He introduced Moodle 3.5 version that is DGPR compliance and operates in 200 countries. It is customizable, easy to run and anyone can have the access to the website. It can be logged in as an administrator, trainer, teacher, and trainee, students or as a guest. The authorized users can enroll and assign work as well as get other features such as define roles, manage account. The General Data Protection Requirements (GDPR) feature enables privacy and policies of the data. The language can be switched to the preferred one. It lets the trainer work with script and preparation before hand. It is user interface friendly allowing direct learning paths and easy group management through sharing materials in groups. It also makes the peer and self-assessment possible by RUBRIC. A grade book is provided to track the progress of students and integrates badges to motivate/reward students accordingly.



**Fig. 4.** Presentation about VLE/Moodle by Nicholas.

The students can register through their account. Students can personalize their dashboard according to their taste and desire. They have additional features such as collaborative tools and activities, calendar, and share files under file management tools. A Moodle system allows to record videos directly, edit and send to others. It is also available on smart phone version.

The course design is divided into topics (Topic 1, 2, 3, 4 etc.) and weeks format (by week 1, 2, 3 etc.). The discussion forums will provide discussion threads between the involved members. The recommended course is designed based on the format of the course outlines and learning outcomes. A detailed summary of grading is provided for the submitted assignments, quizzes. Feedbacks on activity module can be requested through quick questionnaire survey. The badges can be provided to show stepping to higher levels. The contact person for this system are [nmicha@csd.auth.gr](mailto:nmicha@csd.auth.gr), [nikos.michailidis@gmail.com](mailto:nikos.michailidis@gmail.com). The EuroTraining are taking responsibility of setting up VLE system to the project partners.

### **Final discussion and conclusions**

At the end of the program, participants were asked to express their feelings and experiences about the activities or each component of the trip. All the participants expressed that the program was well organized, informative, and very useful, especially how collaboration has been done with industry for research, internship, or community service and outreach program. Above all, the participants pointed out that the course on “Expert Interdisciplinary Team (EiT)” has a very practical approach and unique way of teaching students exposing to the real time problems and engaging them to solve the social problems. However, it was pointed out that it takes a significant amount of time to develop a perfect program. Even teachers need to be trained doing some role-play. Its real application and success depend on the ability of the teachers, teaching environment and the policy of each institution. Participants also expressed that NTNU focused on student centred learning that shifts traditional lecturing to interactive learning. More emphasis was given on group/team work and discussions. Plenty of small to big rooms for group works were made available. Important to note, students get opportunity to develop skills by doing work in the labs where high tech equipment and facilities are available e.g. MS, NMR equipment. Participants showed interest to have more collaboration with NTNU either in the form of similar project for group to go ahead or even one to one institution and individuals. Consequently, collaborations can be done for specific research and publications between two professors who have the same area of research interest. Project team believe that the SSNS project has provided the opportunity and platform to create networks, which they will share and with institutions and individuals to take maximum benefits.

At the end before closing the programme, Project Coordinator presented the activities completed so far, and the deliverables to work on. The followings were points and deadlines agreed by all the participants:

1. **D2.1 Trip reports** – it was made clear that each participants has to submit the trip report using the format provided earlier along with an official document of trip arrangement in each institution (RTA/RRTA). A page or half to write lessons learned in brief and what and how he/she will apply upon return or while developing new course (MS/VET courses). The deadline agreed was within two weeks i.e. Nov. 23, 2018.

**D2.2 VLE System.** All the teachers agreed to use VLE/Moodle system and actively participate innovative teaching. The course developed for the SSNS project will be uploaded. The Moodle system/platform will be developed within 3 weeks i.e. by the end of November 2018. In order to help teachers a demo with basic functions will be set up by the end of December 2018. Teachers will try and give feed back for improvement. A template for a course will be developed by the end of January 2019. Teachers will start uploading their courses by the end of March 2019.

**D2.3 SSNS MSc Course outlines.** It was agreed that a participating teacher should at least develop a course as a model. A template will be selected and circulated to all the teachers by the end of November 2018. Teachers will select a course name and give to the Coordinator by the end of November 2018, and the first draft of course outline will be submitted by the end of Dec. 2018 which will be finalized by the end of June, 2019.

**D2.4 Teachers guidebook** – participants discussed quite a lot in three groups. Basically, they come up with a draft contents, which will be further, refined. It should at least contain methods of effective teachings. Single guidebook of 20-30 pages will be produced, which should contain two chapters (teaching and thesis research). Stirling University along with NTNU and other European partners are to produce the first draft by the End of March which will be circulated to all teachers for comments, and final version should be ready by the end of May. Asian partners will translate into Thai, Indonesian and Vietnamese languages by the end of June 2019.

Additional information are available at the following social media link:  
<https://www.facebook.com/groups/Sustainableseafood/>

Presentation slides will be available in Dropbox.





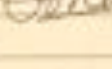
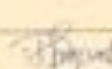

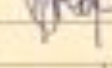

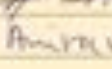
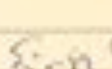
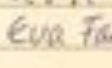

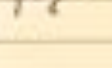
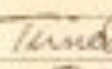
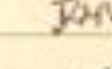
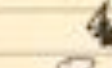
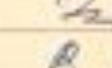
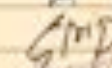
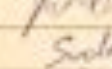
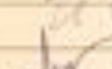






#### **Annexes:**

1. Schedule of activities:
2. Names of the people who presented or attended the Study Tour in Norway.

## Annex 1. Schedule of activities:

			
<b>Program SNSS study visit to NTNU, November 5-9, 2018</b> <b>Organizers:</b> Assoc. Prof Jørgen Lerfall, Assoc. Prof Eirin Bar, Assoc. Prof Anita N. Jakobsen and Prof Turid Rustad			
Date	Time	Activities	Room
4.11.18	-	Arrival Trondheim and NTNU	Akrisen
5.11.18	08:45	Registration	LY54
	09:00	Welcome to Department of Biotechnology and Food Science	LY54
		Student active learning in cooperation with the industry - ex. from NTNU	LY54
	09:15	Foodborne outbreak investigation	
	09:45	Lean food manufacturing	
	10:15	Break/Coffee	
	10:30	Sustainable food production	
	11:00	BSc and MSc thesis in cooperation with the industry	
	11:30	External conditions in the food industry	
	12:00	Lunch at the NTNU canteen	F3 (Gløshaugen)
6.11.18	14:00	Experts in Teamwork	
	15:00	Guided tour at the NTNU campus Gløshaugen and the city center	
	19:00	Dinner at Akrisen	
	08:30	Field Visit: Departure to Hitra and Frøya (from Akrisen)	Hitra
	11:00	Visit to Atlantic salmon production site	
7.11.18	12:30	Lunch at Kafe Sjøsprøy	
	13:30	Study visit to a salmon slaughterhouse (Lerøy)	
	19:00	Accommodation and dinner Hotel Frøya	Frøya
	09:00	Visit to The Blue Competence Centre	
	09:15	Presentation of the center	
	09:45	Presentation of <i>AquaBIA</i> (Knowledge based marine health)	
	10:00	Presentation of the project Brohode Havbruk 2050	
	10:15	Break/Coffee	
	10:45	Presentation of the Erasmus+ project Optimal	
8.11.18	11:00	Presentation of DigMat (educational project, NTNU)	
	12:00	Lunch at The Blue Competence Centre	
	13:00	Workshop - Student active learning	
	14:00	Departure to Trondheim	
	09:00	Visit to MariaTek / SINTEF	
		Presentation of SINTEF Ocean	
9.11.18		Presentation of Offshore Production Technology	
	11:30	Lunch	KRM201 and 202
	12:30	Workshop - Employability + Teachers guide	
		Laboratory work	
	15:00	Break/Coffee	0302
9.11.18	15:30	Summary of the workshop and discussion	0302
		Student active learning - ex. from NTNU	LY35
	09:00	Experience-based learning in Food Science	
	09:30	Experiences with on-line learning (BT3110)	
	10:00	Break/Coffee	
	10:30	Workshop - SNSS progression and deliverables	
	11:30	VLE platform for the Curriculum (EUROTraining)	
	12:30	Lunch	
9.11.18	13:30	Final discussion, closing	LY35

Annex 2. Names of the participants who attended or presented during the Study Visit.

			
List of participants SNSS study visit to NTNU, November 5-9, 2018			
Name	Partner	Country	Signature
Marina Zotaki	EuroTraining	Greece	
Theodora Zotaki	EuroTraining	Greece	
Ioannis Boziaris	UTH	Greece	
Mala Nurilmala	IPB	Indonesia	
Nurjanah	IPB	Indonesia	
Ruddy Suwandi Suwanda	IPB	Indonesia	
Ilham Alimin	JFU	Indonesia	
Niken Dharmayanti	JFU	Indonesia	
Suharyanto	JFU	Indonesia	
Alim Isnansetyo	UGM	Indonesia	
Amir Husni	UGM	Indonesia	
Riza Yuliratno Setiawan	UGM	Indonesia	
Alireza Asharafin	NTNU	Norway	
Anita Nordeng Jakobsen	NTNU	Norway	
Anne Feren	NTNU	Norway	
Eirin Marie Skjendal Bar	NTNU	Norway	
Eva Falch	NTNU	Norway	
Hanne Karlsen	NTNU	Norway	
Jørgen Lerfall	NTNU	Norway	
Kari Helgefoss Langtun	NTNU	Norway	
Sunniva Hoel	NTNU	Norway	
Turid Rustad	NTNU	Norway	
John K.M. Kuwornu	AIT	Thailand	
Ram C. Bhujel	AIT	Thailand	
Salin Krishna	AIT	Thailand	
Bundit Yungsoi	KKU	Thailand	
Pornthep Niamphithak	KKU	Thailand	
Siripavee Charoenwattanasak	KKU	Thailand	
Daracha Thiammueng	MJU	Thailand	
Sudaporn Tongsir	MJU	Thailand	
Thepparath Ungsethaphand	MJU	Thailand	
Tran Minh Phu	CTU	Vietnam	



Co-funded by the  
Erasmus+ Programme  
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Tran Ngoc Hai	CTU	Vietnam	<i>Ngoc Hai</i>
Tran Thi Tuyet Hoa	CTU	Vietnam	<i>Tuyet Hoa</i>
Nguyen Hoang Nam Kha	NLU	Vietnam	<i>Nam Kha</i>
Nguyen Van Trai	NLU	Vietnam	<i>Van Trai</i>
Vu Cam Luong	NLU	Vietnam	<i>Cam Luong</i>
Nguyen Quang Huy	RIA1	Vietnam	<i>Quang Huy</i>
Tran The Muu	RIA1	Vietnam	<i>The Muu</i>

