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Joint Faculty Approach To Active Learning In Master Classes Of Food Technology And Engineering

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A cooperative approach in the faculty members of the Department of Industrial Engineering at the University of Salerno (Italy) was adopted to produce valuable documentation and material for applications of active learning methodology in the master course in Food Processing and Innovation developed within the FOODI project, an Erasmus+ project financed in 2018 in the action KA2 – Cooperation for innovation and the exchange of good practices – Capacity Building in the field of Higher Education. A dedicated form was developed as a key tool in both recording the teaching/learning needs and transferring the work results in terms of examples and activities. Web seminars were provided to illustrate the examples.

1. Introduction

During the past decades there has been a major move from a teacher-centered lecture environment to a student-centered learning environment in engineering education (Fink, 1999; Wayne Bequette et al., 2000; Ghidoni et al., 2019). Engagement of students with the so called “active learning” approach includes the involvement in the teaching process of critical thinking, discussion with the lecturer and peers, observation experience as well as learning by doing with “hands-on” activities (Fink, 1999). The effectiveness of active learning in STEM (Science, Technology, Engineering, Math) disciplines has been debated since long (Prince, 2004), but several experiences indicate a certain increase in the student interest (von Blottnitz, 2006) and motivation in courses adopting class interaction (Liberatore, 2013), multiple engagement methods (Rodríguez et al., 2019) and web-based technologies (Koretsky and Brooks, 2012). A number of proofs of the efficacy of active learning can be found elsewhere (Froyd, 2008). The number of methods and tools available to engage students is wide and requires an experimental approach based on the instructor evaluation. In this respect, a cooperative approach among Faculty/Department members based on peer observation principles turned out useful to overcome difficulties and provided a faster spread of successful solutions (Ghidoni et al., 2019).
This paper reports on a group experience carried out at the University of Salerno (Italy) in the development of support material for active learning in a new master course in Food Processing and Innovation developed within an Erasmus+ project (FOODI, 2019), to be deployed in three southeast Asian countries (i.e., Cambodia, Malaysia and Thailand).

2. The Foodi project

FOODI (MSc course in Food Processing and Innovation) is an Erasmus+ project financed in 2018 in the frame of the action KA2 – Cooperation for innovation and the exchange of good practices – Capacity Building in the field of Higher Education. One of the main project aims is the development of a Master Course in Food technology and food processing, with special attention to the development of innovation and entrepreneurial skills in the attending students. The developed master course is to be deployed in Malaysia, Cambodia, and

Table 1 Institutions involved in the FOODI project

Organisation	Country	Area
Universiti Teknologi Malaysia-UTM	Malaysia	Business
University of Malaya	Malaysia	Physics
Universiti Teknologi Mara (UITM)	Malaysia	Agrotech., Business, Statistics, Chemistry, Islamic studies
Universiti Kuala Lumpur (UNIKL)	Malaysia	Food technology
University of Heng Samrin Thbongkhmum	Cambodia	Agronomy
University of Battambang	Cambodia	Human Sciences, Agronomy
Svay Rieng University	Cambodia	Agricultural Economics
Institute of Technology of Cambodia	Cambodia	Electrical engineering, Chemical and Food Engineering
Ministry of Education	Cambodia	Education
Asian Institute of Technology	Thailand	Food technology
Prince of Songkla University	Thailand	Food technology
University of The Aegean	Greece	Business
University College Dublin	Ireland	Food technology
University of Salerno	Italy	Food Engineering
Research Innovation and Development Lab Pc	Greece	ICT
Metropolitan College Sa	Greece	ICT

Thailand. The leading institution is the Universiti Teknologi Malaysia-UTM. Institutions from three different European countries (i.e., Greece, Ireland and Italy) are involved in the project to help the course design and to generate material, lectures and online courses for training of southeast Asian instructors. The complete list of the institutions involved in the project is reported in Table 1.

The project, articulated in 7 work packages, encompasses the complete process of set up of a master-level course, including definition of the learning outcomes (WP1), design of the project master course (WP2), training of instructors (WP3), deployment of the course (WP4), quality assurance (WP5), dissemination of the project outcomes (WP6) according to the call objectives, and the project Management (WP7).

Most of the master course design was developed during two study visits carried out by southeast Asian Project lecturer and staff representatives in September 2019 and in November 2019 at the University College Dublin in Ireland and at the University of Salerno (UNISA) in Italy, respectively. The structure of the course designed is described elsewhere in detail (FOODI, 2019). Briefly, it consists of 90 EC credits, deployed in 3 semesters. Most of the learning outcomes are provided in 7 compulsory modules of 6 EC delivering fundamental and applied knowledge, which are complemented by 3 optional modules of 6 EC chosen out of a list of 6. The program also includes a 30-EC module called MIDAS deployed along the whole 3 semester period, mostly aiming at the development of transversal skills. MIDAS stands for ‘Mastering Innovative and Disruptive Approaches for Success’, is designed to foster creative confidence as well as an innovative and entrepreneurial mindset in the students and includes an industry-linked Action Research Project culminating in a presentation of projects at a FOODI Conference with the host industries.

In the project management, it was decided that UNISA would have been in charge of guiding the design and producing the material related to the teaching modules of 1) Research & Investigative Processes, 2) Food Process Design, 3) Processing Effects on Structural & Functional Components of Foods, 4) Food Supply Chain, Traceability & Sustainability, 5) Food Packaging, 6) Halal Regulation & Certification.

During the study visit at the University of Salerno, the active learning approach was discussed among the partners, also with the support of the lecture given by prof. M. Barolo of the University of Padua (Italy) on the adoption of active learning techniques in University courses after the experience gained in Padua (Ghidoni et al., 2019).

The process of producing materials for *training of trainers* was also in charge of UNISA. To this end, a working group was constituted at UNISA by gathering the authors of this paper, on a volunteering basis. The working group established a procedural methodology aimed at matching source information coming from the southeast Asian partners with thinking and developing work, thus generating suitable materials and agreeable products to be returned to the southeast Asian partners as beneficiaries. The procedure is schematized in Figure 1.

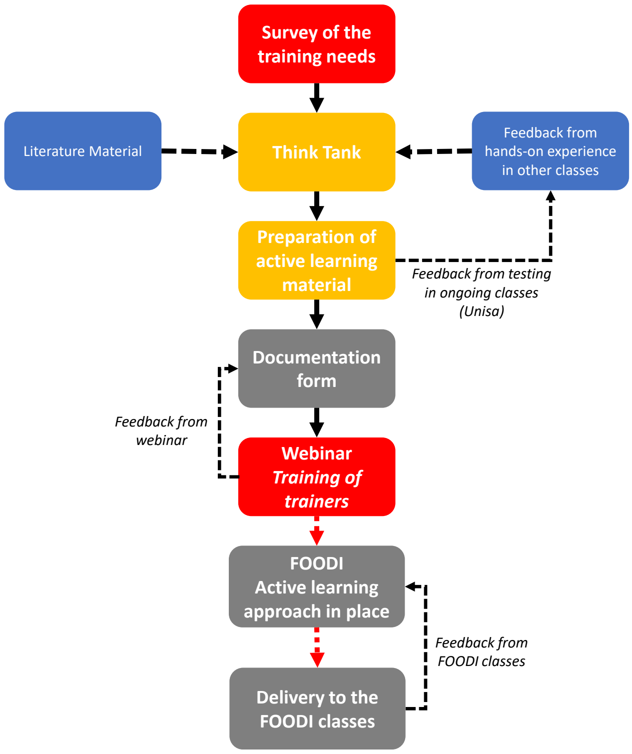

Figure 1. Block diagram of the procedure set up for producing and delivering active learning in FOODI.

As a first step of such a procedural methodology, an initial survey was carried out by the working group at UNISA to identify the training needs of the Asian partners. This survey revealed that most of the Asian partners were strongly interested in receiving formation and materials in "active learning". Therefore, it was decided that all three European institutions would have moved their focus and produced an effort in this direction, each institution with a particular attention to the courses assigned in the design step of the project.
As a second step, the UNISA team started a "think tank" phase about the generation process of materials and examples of active learning, to be applied to specific lectures of the above-mentioned courses, on the basis of literature data and the feedback from hands-on experience in other classes (both in presence and online).

3. A documentation tool

As a third step, the UNISA team developed the active learning material, combining the literature material available mainly in the field of Engineering (Felder and Brent, 2003; Prince and Felder, 2006; Baeten et al., 2010; Mason et al., 2013; Daly et al., 2014; Wang and Tahir, 2020) with the hands-on experience developed in the classes taught by the volunteering lecturers of the University of Salerno. The process was further strengthened by the ongoing Covid-19 pandemics, which caused most of the University classes in spring and fall semesters of 2020 to be taught online. Therefore, the volunteers participating in the development of the active learning material had the chance to directly test the proposed approach in the difficult environment of the online classes, especially for what concerns student engagement. As a matter of fact, one of the most critical issues deriving from the shift from in-presence to online teaching was avoiding to turn the lectures in Powerpoint shows and failing to provide variety in instruction (Felder and Brent, 2021). However, active learning in physically distanced classrooms still remains a formidable challenge (Bruff, 2020), which required considerable efforts in introducing novel tools, for example, for live polling (Wang and Tahir, 2020), collaborative notetaking and group work. Therefore, the most recent tools for online teaching were also revised.
The most important aspect in designing the active learning material, however, was considered to correctly identify the learning outcomes of the lecture and the teaching challenges, and based on those, to use the most adequate approach to pursue them. The most frequently-identified teaching challenges, especially with reference to the topic of the lectures, were: (1) Effective understanding of the concepts of the lecture; (2) Ability to identify the main criteria used to select a specific food transformation process, also in comparison with conventional processes; (3) Ability to evaluate the energy and mass flow rates involved in food processes; (4)

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ACTIVE LEARNING DOCUMENTATION FORM

DESCRIPTION OF THE UNIT	
Unit type *(lecture, workshop …)*:	
Unit title:	
Expected unit duration *(hours)* *	
Summary of lecture contents	
(Make a list or a short description of the lecture contents)	
Learning outcomes of the unit	
(list the main learning outcomes of the lecture)	
Teaching challenges of the unit	
(Identify the main teaching challenges of the lecture that deserve alternative teaching)	
Kind of active learning activities adopted (chose as many as necessary)	
Check of background knowledge	
First approach to a new subject	
Learn by doing	
Assessment of learning	
Assessment for learning	
Development of a case study	

*by no means, this number is intended to be prescriptive, but it is intended as an indication to understand the lecture contents

(The next table should be repeated for each of the active learning activity designed for the lecture)

a)

DESCRIPTION OF THE ACTIVE LEARNING ACTIVITY		
Number *(in time order)*:		
Expected duration of the activity *(minutes)*		
Collocation of the activity in the lecture:		
(Clarify the collocation of the activity in the lecture connecting it to the specific lecture content)		
Teaching challenges addressed:		
(Link the teaching activity with the specific teaching challenge(s) identified above)		
Kind of active learning activities adopted (choose at least one):		
Check of background knowledge		
First approach to a new subject		
Learn by doing		
Assessment of learning		
Assessment for learning		
Development of a case study		
Strategy:		
(Explain the strategy adopted to overcome the specific teaching challenge(s))		
Method (choose at least one):		
Involvement	Graded	Not graded
Individual home assignment		
Individual work in classroom		
Collaborative home assignment		
Collaborative work in classroom		
Description of the activity:		
(Describe the activity also using examples of material provided (tests, questions…)		
Attachments & links		
(List any material or link that can help the understanding of the activity)		

b)

Figure 2. FOODI active learning documentation form.

Ability to think critically and be able to select the appropriate non-thermal process for a particular manufacturing process; (5) Enhancing the participation of the students during the lecture; (6) Keeping the attention of audience high; (7) Making audience aware of the critical review importance. Six main types of the most common active learning modes were used, namely: 1) Check of background knowledge; 2) First approach to a new subject; 3) Learn by doing; 4) Assessment of learning; 5) Assessment for learning; 6) Development of a case study.

The process described in Figure 1 was documented through a dedicated form, set up after collecting inputs from the different partners and staff members and designed to describe the proposed activities to the instructors of the Asian partners in an orderly and effective way. Figure 2 illustrates the form used, which consists of two main sections. The first section is dedicated to the description of the lecture intended as a module unit developing a whole topic. Each of the units was intended to last from one to a few hours. The objective of the section is to highlight the design approach in the adoption of specific learning activity. Therefore, beside the lecture contents, it includes the expected learning outcome of the lectures and the clearly identified challenges in the teaching process. The form also includes a summary of the kind of teaching approaches adopted to overcome or mitigate the difficulties foreseen for the teaching process. The second part of the form is in a tabular form and describes the active learning tasks, with as many tables as learning activities envisaged for the lecture under consideration. The table has to be filled by clarifying, first, in which part of the lecture the reported activity is placed, and then explaining its motivation by identifying the specific teaching challenges addressed, finally the kind of the learning activity adopted. Next, the strategy adopted to overcome the faced challenges is documented and, afterwards, the description of the activity conceived is detailed. In the table it is also required to specify if the student involvement is individual or collaborative, if class and/or home student activity is required and if it is used for grading. The table also includes a space to add eventual references to the educational resources used.

4. The operating method and the current results

As a fourth step, the UNISA team decided to effectively develop materials for the assigned modules (as specified in Section 2) using a distributed, but cooperative approach. Hence, the task to produce a draft of the active learning activities for a given module was attributed to one or two staff members of the UNISA group. The whole group met in weekly meetings of 1-–2 hours in which some activity proposals were cooperatively discussed and possibly amended. Sometimes the activity proposals were discussed twice in order to reach consensus. The work for such a step lasted a whole semester, during which a total of 54 proposed learning activities were developed in 84 lecture hours for 14 units in the 6 teaching modules (as specified in Section 2). An example of “filled” form for active learning tasks linked to a given lecture is reported in Figure 3.

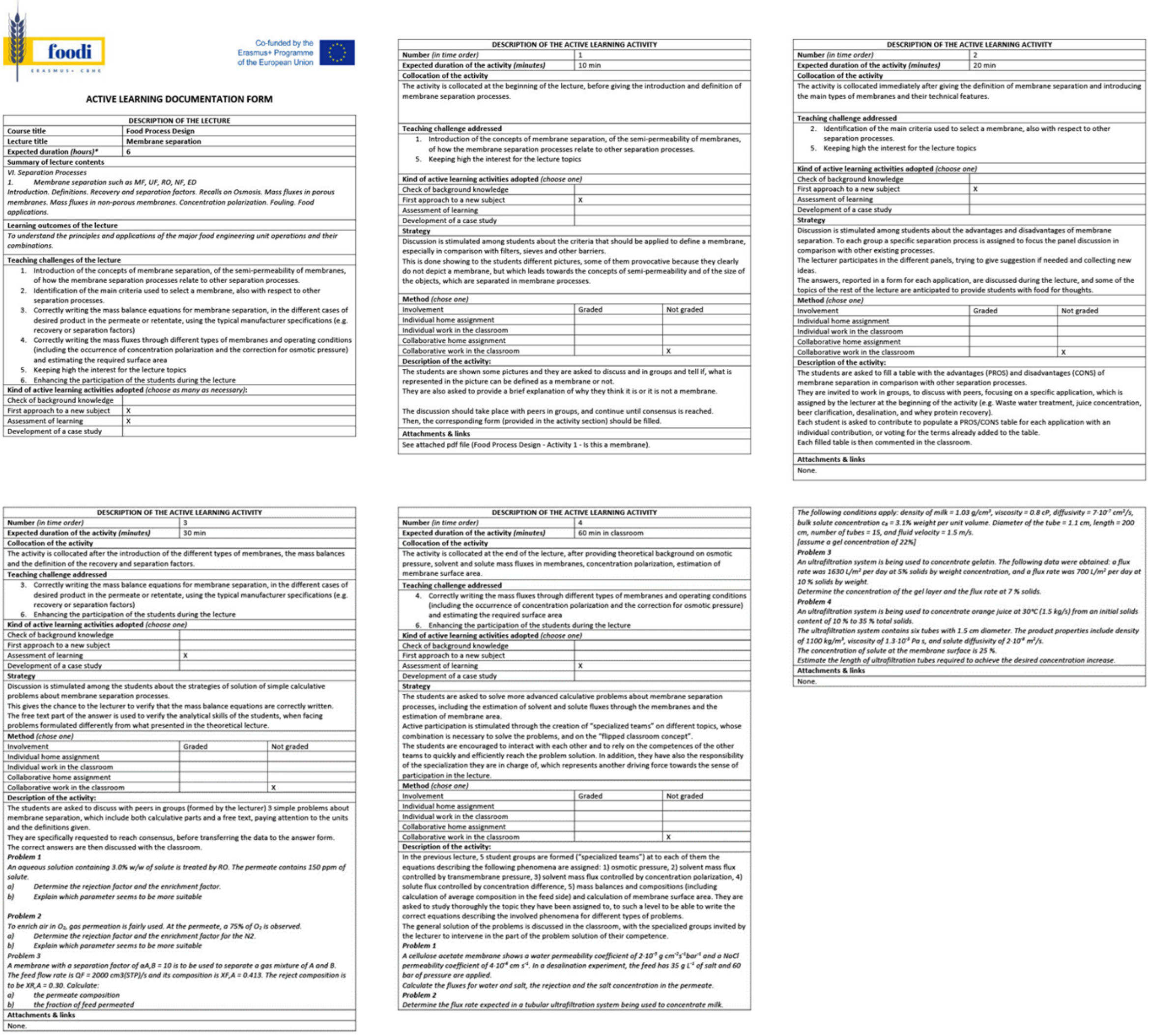

Figure 1. Example of filled active learning documentation form

The project had originally planned 3 staff visits to Cambodia, Thailand and Malaysia in spring-summer 2020, in which the visitors from the European Universities should have met representatives of the master course instructors in each of the countries to present the developed approach and the training materials. Due to the CoViD19 sanitary emergency, travelling was not possible. Therefore, as a fifth and final step, the presentation of the developed approach and of the training materials was switched to on-line webinars. The produced materials were uploaded on a dedicated web server and 6 one-hour interactive lectures were delivered on-line by the UNISA team between 03/08/2020 and 07/08/2020. During these lectures, examples of active learning applied to the assigned courses were provided. The interactive on-line webinars were attended by about 30 lecturers from the Asian partners (Cambodia, Thailand, and Malaysia), who actively participated and provided an individual assessment through a webinar appraisal form. The Asian attendants rated the webinars with an appreciation grade of 85% in the average, generally accepted the proposed approach toward active learning and positively evaluated the methodology transfer with an appreciation grade of 70% in the average. In addition, comments and other suggestions written in the webinar appraisal forms were collected by UNISA staff and used to further improve the active learning documentation supporting the Asian trainers.

The efficiency of the proposed learning activities will be validated only at a later stage, when the master course in Food Processing and Innovation will be delivered. The student surveys implemented in the active learning material will be used by the trainers to consolidate, improve or adjust the developed active learning materials.

5. Conclusions

Examples of learning activities were developed to be applied to six modules of the master course “Food Processing and Innovation” within the frame of the FOODI project. Through a survey, the teaching/learning needs were preliminary collected to drive the approach towards active learning in the teaching process and to tailor its design. The work done was communicated to the users (i.e., the Asian partners of the project, future lecturers of the master course), using a specifically designed form. A constructive peer review process was adopted to verify the material produced and to homogenize its presentation. The examples of active learning tasks, constructively linked and effectively interacting with preselected lecture subjects, were presented in 6 web seminars in August 2020, within the frame of the FOODI project, to an audience of 30 experienced lecturers from Asian countries, who provided a positive feedback in an individual webinar assessment form. The validation of the proposed active learning approach will be given in the next future, when the master course Food Processing and Innovation will be delivered in the different Asian countries (as planned for the academic year 2021-22).

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