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Analysis for implementing an inductive learning in a MSc course

Patrizia Buldo

Department of Food Science
University of Copenhagen

Introduction

The present project focuses on the analysis for implementing a new practical work for the MSc course "Dairy Product Technology" (DPT) (http://kurser.ku.dk/course/llek10243u/). DPT is a compulsory course of the MSc program in **Dairy Science and Technology at the University of Copenhagen**, scheduled in the 4th block of the academic year. The work load is equal to 206 work hours and the students obtain 7.5 ECTS. The course includes a theoretical part, which accounts for 25 hours of face-to-face lectures, a practical part that includes a project (64 hours), and excursions to dairy companies (24 hours). Self-study, hence preparation for the exam, is estimated to 66 hours. In addition, 12 hours of supervision are offered. The project work focuses on a theoretical exercise and on three practical work exercises. The aim of the theoretical exercise is to discuss a current topic in dairy research suggested by the course responsible. Students work in groups and a short report based on existing literature is delivered. The three practical works focus on topics covered by the theoretical part. Also in this case students work in groups and deliver a report based on the obtained results. The main objective of the project work is: *"to provide students with in-depth knowledge of research within a self-chosen subject related to dairy technology"*. The intended learning outcomes (ILOs; http://kurser.ku.dk/course/llek10243u/) are well designed to be highly operational and functional, and it emerges that the main objective of the course is to be able to convert knowledge and skills in competences. In my opinion the proposed objective and ILOs are not fully achieved by the current practi-

cal work. I believe that the current practical work does not fully provide students with *"in-depth knowledge of research"*, *"ability to reflect on how the final product quality, hence the colloidal interactions occurring in dairy-based systems, is affected by the technology behind manufacture"*, *"ability to apply the principle of colloidal science to processing of dairy products"*, and to *"interact with professionals in the dairy industry and associated organizations"* (ILOs). If the students need to be able to convert knowledge and skills in competences, I believe that a more applied project, as inductive learning (Dewey, 1981) should be implemented. Inductive learning is a method of teaching and learning, which awards students with knowledge, skills and competences relevant for their professional working life. Inductive learning can be described as a tool to link theory and practice (Krogh & Wiberg, 2015).

Objective

The present work aims to perform an analysis for implementing inductive learning in an MSc course. The focus is on the analysis of the resources needed, on the objectives´ alignment among the teachers, and on the student's situation. A possible approach is hereby suggested

Analysis and expected challenges

The utmost aspect to consider before applying the change should be the investment in **resources**, such as availability for teaching/learning environments, and for supervisors. When evaluating the *teaching/learning environments* care should be taken for availability of laboratories and technical instruments for all the students. The work environment should be suitable for a large number of students as the number of students is dramatically increasing (from 20 students in 2014 to 40 in 2015). In addition, laboratories as well as technical instruments are often shared with other students and researchers. Therefore it should be taken in consideration that the period to perform the practical project should not interfere with the on-going research of the department. Another import resource needed is the availability of *supervisors* and *technicians*. The role of the supervisors should be first to plan the project accordingly to the objective and ILOs

of the course, which should be highly relevant and motivating for the students. Supervisors and/or technicians should be available to introduce and instruct the students to the different analytical methods, and for assistance during the practical period. The supervisors should also be available for the final assessment. Consequently, a considerable investment in time and on different resources, as supervisors, laboratories, technical instruments and materials, should be expected. In order to have a positive engagement from the supervisors, it is important that the time spent on the planning and on the performance of the project should be beneficial to them. This could be achieved by involving PhD, Postdoc and researchers and rewarding the time spent on it either as ECTS for PhD students, and as teaching activities hours for Postdoc and researchers (as it is already done in most of the cases). In addition, the project work could be designed as screening project to evaluate the potential of the topic for further investigations.

Another important aspect to consider before implementing the practical work is the **objectives´ alignment** among the teachers involved in the course. The course responsible and the teachers involved in the course should agree on the benefits that this change will bring to the students and to the course. It is important to have all management on board, and clarify the task and responsibilities of the different people involved. The latter can be a crucial point for a successful course, especially the first time that the practical work will be implemented. A lack in objectives´ alignment can result in students´ frustration.

The **student's situation** should also be carefully evaluated. The level of expectation for the course is going to be raised; therefore a good communication plan should be implemented. The *communication plan* should be formulated in order that a clear goal and structure of the changes in the course need to be presented, including the benefits for the students. This part of the course should be emphasized in the course description. A project based on inductive learning can be *more demanding* than the current practical work, therefore it is expected a higher amount of working hours. Increasing the amount of ECTS cannot be considered as a feasible solution. However, the hour's distribution can be revised, and more hours can be allocated to the project work; e.g. excursions' hour can be used to visit the companies willing to support and supervise the projects, and a presentation and a preliminary discussion of the problem can already take place; supervisions' hours can also be used during the project. The student situation is also reflected in the *engagement required* from the students. Generally, students prefer practical and active learning activities; and students who are

familiar with inductive learning describe it as *"more interesting, motivating and rewarding than traditional teaching approach"* (Krogh, Stentoft, Emmersen, & Musaeus, 2013). However, some students are used to have a role as passive acceptor, and in order to avoid confusion and frustration they should be introduced and encourage in performing a project based on inductive learning, therefore change their role to *"active learner"* (Krogh et al., 2013). By changing the focus from a theoretical to a practical exercise I would expect higher students´ motivation, moreover it promotes skills and knowledge as student do not just observe but actively participate in the learning, and their attention is higher than in a face-to-face lecture (P. S. Jørgensen, 2015). Students familiar with inductive learning have higher ability to "know-how", and to use a holistic approach in their future work career for solving work related problems. In addition, they also develop communicative, teamwork and project management competence (Krogh et al., 2013; S. Jørgensen, 2015).

Suggested approaches

Once that the above mentioned challenges have been analyzed, and the teachers agree on the implementation of a project based on inductive learning, the *subjects* of the projects should be carefully selected. I believe that the key point to have a successful outcome is to identify project topics with high impact on student motivations and engagement. In addition, it is important to guide the students with specific research questions, as the limited time available can lead to students' frustration and confusion on the purpose of the activity. Therefore, limit the scope of the project is critically necessary. Involve *external teachers/supervisors* can also be attractive for the students. In order to have both students and supervisors involved in the practical projects, I suggest involving PhD, Postdoc, and Researchers from both academia and companies to propose and supervise their own project. I believe that this approach should get the students involved and supervisors attached to each project.

Figure 9.1 proposes the different phases of an inductive learning projects. The order of the different phases can change based on the topic of the project and on the students´ approach, as they often work simultaneously with two or more phases, e.g. identification and solution of the problem. The supervisor should follow the students in all phases and he/she should make sure that the student understand the concept of "solution of the prob-

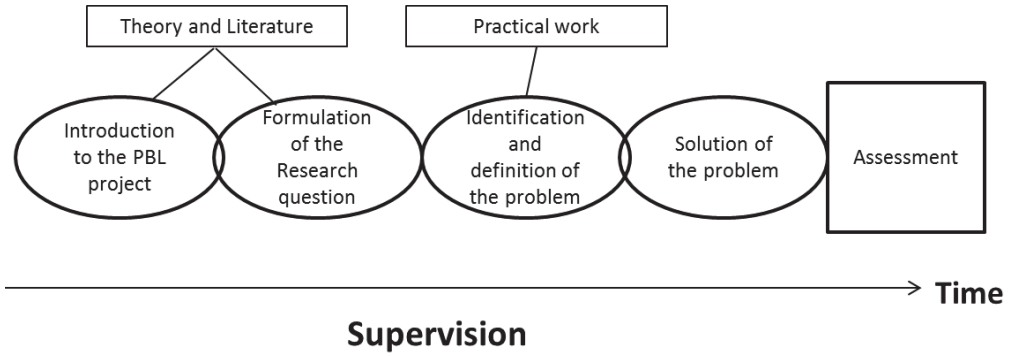

Fig. 9.1: Different phases for inductive learning projects (modified by Krogh and Wiberg (2015)).

lem", as it should be intend as to elaborate and define a problem rather than finding the final solution (Krogh & Wiberg, 2015). The overall aim should be to define the research questions initially formulated by developing one or more solution if needed.

The role of the supervisors should be seen as a *facilitator* of student´s work (Krogh et al., 2013). The supervisor should make sure that the formulated research question, the theory and the approach to solve the problem are according to the ILOs of the course. Whereas, the students' role is to identify and solve the problem, by applying skills and knowledge via competences (Figure 9.2). Theory and literature must be at the base of a project, as it is needed by the student to analyze and further identify and solve the research question (Figure 9.1-9.2).

Conclusions

Based on a preliminary analysis hereby presented, I would strongly recommend implementing inductive learning to the MSc course in DPT. In order to succeed with the implementation and performance of the practical work, the most important initial point, after evaluating the resources, should be the positive engagement from all the people involved. If expectations and ILOs are aligned among the teachers, the implementation can be considered successful.

I believe that the main contribution for implementing inductive learning project is that the students will learn to acquire knowledge and skills in a holistic approach which will contribute to stimulate their creativity. In addi-

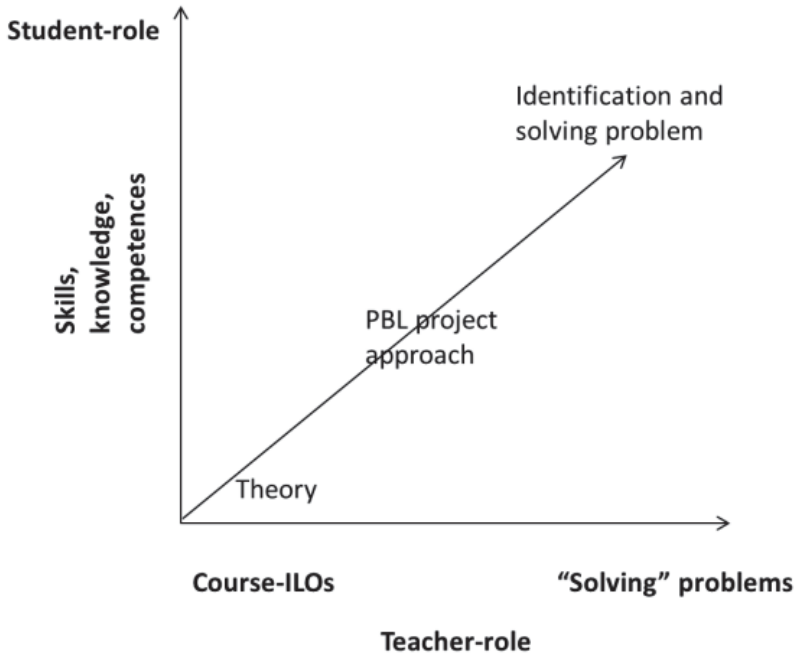

Fig. 9.2: Theacher and student role during inductive learning based project (modified from Krogh, Stentoft, Emmersen, and Musaeus (2013))

tion, it will create graduates who are able to solve and to deal with problem-solving task during their future work career. This is highly reflected in the proposed objective and ILOs of the course, as the project work and the ILOs are better aligned.

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