

PROBLEM BASED LEARNING AS A WAY TO PROMOTE ACADEMIC SUCCESS AND STUDENT'S ENGAGEMENT: CASE STUDY OF SYLLABUS "FOOD PRODUCTION MANAGEMENT"

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Abstract - The present work describes the pedagogic strategies based on problem solving and practical application of knowledge and competences used in the ambit of the syllabus "Food Production Management", of the 2nd year of the Higher Specialization Course (CTESP – Curso Técnico Superior Especializado) of Gastronomy, Tourism and Well-Being ministered in the Department of Food Industry of the Agrarian School at the Polytechnic University of Viseu. The students were asked to develop a project built around culinary preparations. The theme chosen was recipes including chestnut, considering that it is one nut with a high relevance in Portugal, and belonging to the tradition of culinary in the country. The project, comprised two parts, developed in parallel. One part involved a collection of existing recipes using chestnut, and the other consisted in the development of an innovative thematic menu, composed of original recipes containing chestnut. All tasks were developed in groups of students, who had to conjugate collaborative learning with project based problem solving. The results obtained were very encouraging, with all students showing successful realisation of the proposed tasks, and achieving a good academic performance at this syllabus, with high classifications, resulting from the involvement, motivation and desire to achieve success of all students.

Keywords - Academic Performance, Collaborative Learning, Problem Based Learning.

I. INTRODUCTION

Collaborative Learning comprises a set of teaching and learning methods in which students are encouraged to work in integration to fulfil a common learning objective. This approach has been adopted across a wide variety of subjects, curricula, school settings, teaching approaches or age groups (Guiné, 2020b). Considering that collaborative learning has assumed an increasingly important role in learning and educational approaches, a high number of studies have been devoted to its investigation and application [2], [3]. Collaborative learning includes, on the one hand, cognitive benefits such as improved learning performance and motivation, as well as enriched social skills essential for future professional success [2]–[4]. Collaborating with peers can promote students' knowledge building. However, it also requires them to discuss, coordinate, and integrate peers' sometimes conflicting ideas about what and how to learn [5]. Dealing with the cognitive or motivational difficulties that often arise in the group when students try to reach a shared understanding, requires the activation of regulation strategies by multiple group members, who collectively engage in the control and regulation of group learning [6]. Collaborative learning is strongly associated with the fact that knowledge is a social construction. The four principles of collaborative activities are [2], [3]: 1. The student is the main focus of instruction; 2. Interaction and "doing" are of fundamental importance; 3. Working in groups facilitates learning; and 4. There is a focus on

developing solutions to real-life problems.

Problem-based learning and case study-based learning comprise similar approaches to the teaching-learning process. Both focus on the learning experience in real life situations or as close as possible to real situations, which are carried out by small groups of students under the guidance of a teacher or tutor. The Case Study method dates back to 1870 and was first referred to at Harvard University Law School, while Problem Solving Based Learning was formally introduced about a century later as a derivation of the case-study method [7], [8]. Problem solving based learning is a student-centered learning approach, but it makes use of collaborative learning techniques, where students learn about a subject by working in groups to solve an open-ended problem. It is an unquestionable fact that dynamic and interactive learning is highly influenced by motivational and emotional constraints, since group work experiences and individual socio-emotional aspects are fundamental to determine, on the one hand, the learning process and, on the other hand, the cognitive regulation of the group [7], [8]. Strategies that involve students in working together to solve a problem include: a) Inquiry-based learning; b) Authentic learning; and c) Learning by discovery. On the other hand, the implementation of the methodology covers the following steps: 1. Present a problem to the students; 2. Provide some structure or guidance for solving the problem; and finally, 3. Achieving a final result or solution, that aims to fulfil the group's objectives and the achievement of learning with success demonstrated by the practical result of the

work carried out [7], [8].

One other relevant concept is Integrative Learning, which is an approach where the student brings together previous knowledge and experience to support new knowledge and experience. In doing so, students take their skills and apply them to new experiences and at a more complex level. The concept behind integrative learning is for students to take ownership of their own learning, becoming critical inquirers who are able to make meaningful connections across different disciplines and utilize critical thinking for real-life problem solving [9]. Investigating how functions communicate effectively with each other and across project teams is critical to integration and continuous improvement goals [10]. Integrated project learning presupposes pedagogical methods and strategies to integrate theoretical knowledge based on a curriculum specially designed to solve real-world problems. This learning methodology allows students to test their knowledge in different ways, such as through internships, which contribute to increased learning [11], [12]. Furthermore, it can also be seen as a strategy that focuses on knowledge exchange and knowledge development [13], [14].

The present work describes the pedagogic strategies based on problem solving and practical application of knowledge and competences used in the ambit of the syllabus "Food Production Management", of the 2nd year of the Higher Specialization Course (CTESP – Curso Técnico Superior Especializado) of Gastronomy, Tourism and Well-Being ministered in the Department of Food Industry of the Agrarian School at the Polytechnic University of Viseu.

II. CASE STUDY

A. Contextualization

The role of project management involves the efficient utilization of men, machines and money. For this, several computational methods are available, that use logic and production theories as with older manual methods, but that are concretized through computer programs rather than manually. Notwithstanding, for small businesses and small scale enterprises, manual methodologies are still a viable solution. The disciplines considered in project management include:

- Engineering design;
- Process planning;
- Master production planning;
- Material requirement/Resource planning;
- Capacity planning;
- Shop floor control;
- Inventory management and control [15].

The syllabus "Food Production Management" (FPM) focuses on the techniques used to better organize tasks in food production, either at industrial level or simply applied to any kitchen, restaurants included, to manage the necessary tasks required to fulfil all orders successfully (Figure 1). The syllabus contents are very diversified and the evaluation procedure is rather difficult having in mind the high amount of subject contents allied to the complexity of correctly assessing knowledge as well as acquired competences and skills.

Additionally, the students tend to find the topics relatively uninteresting, losing focus along the semester, which will make it more difficult to easily engage in conventional evaluation methodologies, like written exams.

Based on this evidence, and considering the perception that the students might benefit from a more applied conceptualization of the objectives, in the 1st semester of curricular year 2022-2023 the students frequenting the syllabus FPM were challenged to engage in an innovative program aimed at showing, in a more practical way, the application of the concepts intended to be transmitted during the functioning of this curricular unit.

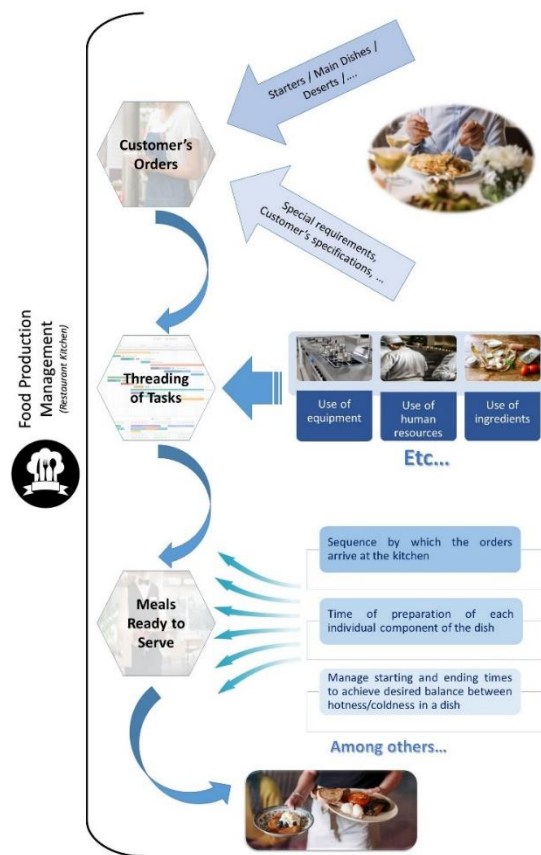


Figure 1. Development of the syllabus Food Production Management.

B. Problem Stating

Zlatkin-Troitschanskaia et al. [16] discuss the advantages as well as the challenges of Assessing the learning performance in higher education students. The assessments mimic real-life situations in which multidimensional aptitudes, such as critical thinking, essential for meeting specific academic demands and future professional skills are measured. However, performance assessments in higher education pose numerous challenges. One of such much used tools is self-assessment, which allows augmenting student's engagement [17]. Several studies reported that practical application based assessment has proven a

valuable tool to assess student's performance, in various domains, like pharmacy [18], [19], nursing [20], medicine [21], sports [22], foreign languages [23], [24], mathematics [25] or engineering [26], [27]. Evaluating students is a permanent challenge, trying to balance between a correct assessment of the absorption of the explicit information transmitted and the competences/skills developed based on that knowledge (Figure 2). A good result in assessing answers to theoretical questions about a certain type of information, corresponding eventually to a high classification, may not necessarily correspond to an optimal development of skills to apply that knowledge in solving practical problems in a context of real life situations. Hence, it was aimed to find an alternative way to assess the performance of the students along the semester and in the final completion of the syllabus, while also motivating the students to develop a collaborative applied project whose results would be physical rather than theoretical.

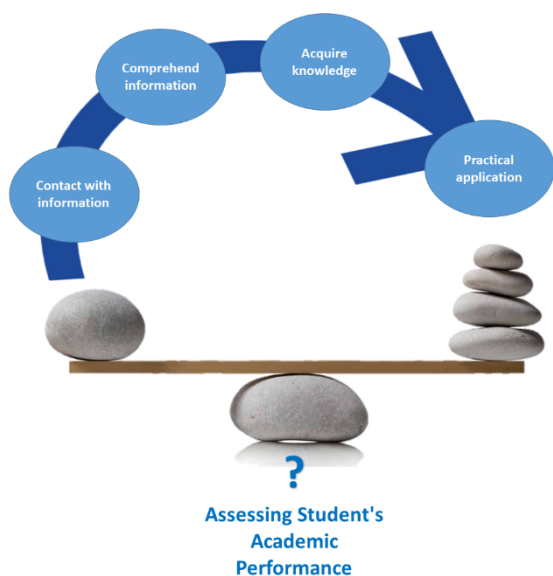


Figure 2. Duality between information and practical application of knowledge.

An innovative approach was used to attempt implementing this major objective, not used previously in the institution, much less in that syllabus or the course it belongs to. Also, this idea was original, never described before in the literature, although it utilizes principals of collaborative learning, problem based learning, and other pedagogical instruments widely disseminated in many areas of education, from technological to scientific or even in the domain of the social sciences.

C. Proposed Project

Considering that the principles of the production management are transversal regardless of the practical application, for example, the same techniques apply generally to managing the production of a food industry plant than a restaurant kitchen, with necessary

adaptations, naturally; and having in mind that one of the strong components of the course is gastronomy; and also that the students, after being graduated in Gastronomy, Tourism and Well-Being, will certainly have the catering as one of the major employment areas, the proposed project was built around recipes, i.e., culinary preparations, and all that they involve.

For the development of the project, and considering that the world of recipes is nearly infinite, a specific theme was chosen for this year's project, and, in case the delineated approach resulted, in following years different themes would be selected, although applying similar methodologies.

The theme chosen was recipes including chestnut, attending to the relevance that this dried fruit has in Portugal, at many levels, and because in the Department of Food Industry several research projects have been developed focusing on nuts, and chestnuts in particular.

Figure 3 depicts the development of the project.

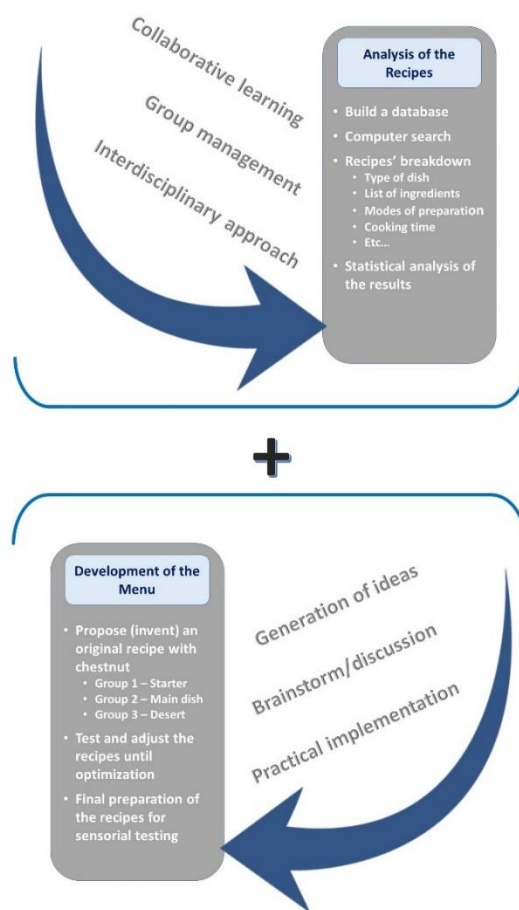


Figure 3. Proposed project and pedagogical tools.

As illustrated in Figure 3, the development of the project comprised two complementing approaches, developed in parallel: a) A collection of existing recipes using chestnut, regardless of the type of food preparation they comprised, and b) The development of an innovative thematic menu, composed of original recipes containing chestnut. All tasks were developed

in groups of students, who had to conjugate collaborative learning with project-based problem solving. Moreover, the use of different learning tools in the kitchen and diversified software applications, would also be a way to add value to the acquisition of knowledge in the ambit of the FPM syllabus.

The development of the work was achieved in proper facilities, namely part a) in a computer laboratory, equipped with computers, internet access, software installed ready to use, and part b) in the pedagogic kitchen lab, aimed at being used by the gastronomy students.

III. RESULTS AND DISCUSSION

The students were very satisfied with the project because they identified it with their interests, and its implementation exceeded their initial expectations of having a conventional learning, based of expositive classes. The engagement was very strong, and the students, divided into three groups, ware able to collect and fully analyse a total of nearly 300 recipes (n = 274), all with chestnut among the list of ingredients. Although part a) of the project was appreciated as a very positive experience, it was part b) that most satisfied the students. They were very excited in the phase of generating the ideas of the recipes, and more so when they had to prepare the recipes in the kitchen, testing different formulations and combinations of the ingredients to achieve the best result. In the end of the semester, all groups prepared their recipes for the teachers, the full thematic chestnut menu consisting of the starter, main dish and desert. All recipes were much appreciated by the tasters. Figure 4 shows the students of each group, while presenting and explaining their recipe, for evaluation.

Collaborative learning encourages student development, commitment and willingness to join the work team to achieve the overall goal. Research directed towards the impact of collaborative learning or work developed in groups has revealed that educational experiences that are based on active, social, contextual and engaging methodologies for the student allow a more efficient learning process, and and better promotion of the development of competences, not only specific, but also transversal. These methodologies enhance the development of high-level critical thinking, oral communication, self-management and leadership skills, while simultaneously promoting student-faculty interaction and preventing failure or dropout. Additionally, student self-esteem and accountability are enhanced and preparedness for real-life social and employment situations is enhanced through exposure to a greater understanding of different perspectives [7], [28]. Collaborative learning can occur peer to peer or in larger groups. Through the interaction between colleagues, students teach each other and complement the construction of the common project. Collaborative learning based group work can involve a variety of

forms, namely, rapid active learning activities in the classroom or more complex group projects that encompass an interdisciplinary and interaction between several curricular units of the same year/semester or of different years of the course [2], [3].

One of the fundamental principles for promoting education standards is curriculum integration. It appears that these assumptions are still deeply linked to real practice and, therefore, knowledge is interconnected, applied, understood and assimilated based on the knowledge and skills of the different disciplines involved. The Integrated Project (IP) approach can refer to integrated curriculum or multidisciplinary integration. It is about making connections of a diverse nature, including across disciplines, with real-life experiences or even connections based on skills or knowledge [29]–[31].

**Group 1
Starter**



**Group 2
Main Dish**



**Group 3
Desert**



Figure 4. Student's presentation of the final recipes.

The project developed by the students encompasses an interdisciplinary approach and integrated curricula, since the students used to develop their work the skills and competences of other previous syllabuses of the course, like for example: Food Safety and Hygiene, Portuguese and European Gastronomy, Food Processing and Conservation, or Entrepreneurship and Gastronomic Tourism.

When comparing the academic performance of this year's students, with that of last year's students for the

same syllabus, and considering that last year there was a more traditional approach for both, classes and evaluations, an increase in the final classifications was observed (Table 1), representing an increase of 10% in the average score of the whole class in relation to the past year.

Approach to the syllabus functioning and student's assessment	Academic year	Classification	
Conventional approach	2021/22	Min	14.2
		Mean	16.8
		Max	18.2
Innovative problem solving approach	2022/23	Min	16.0
		Mean	18.3
		Max	19.5

Table 1. Student's classifications (scores on a scale between zero and twenty, for which a classification of 10 or higher means approval).

According to Kryshko et al. [32], motivation is a strong factor positively influencing the academic performance of university students. Also Gutiérrez and Tomás [33] report a direct effect of student perceptions of autonomy support on their satisfaction, as well as on academic performance. Perceiving the support of teachers for autonomous work complemented with the sense that their basic needs for autonomy are satisfied, allied to competence and relatedness have been demonstrated as the best predictors of academic success in university students [33].

IV. FINAL CONSIDERATIONS

The strategies implemented to achieve the objectives of the Food Production Management syllabus include collaborative learning, based on a problem-based project simulating a real context of restaurant activity. In parallel, these strategies provided an investigative, motivational and even entrepreneurial spirit. As a conclusion, these have proved to be effective for students' performance and competences development. In this way, the students' academic success was promoted, while contributing to their personal enrichment and to the development of complementary skills. Besides an excellent evaluation rate, and high classifications, the students also acquired other types of transversal skills that will help them to face the challenges of professional life and even at the level of interpersonal relationships both in the ambit of or outside the work environment. In this way, the experience was considered highly positive and will be continued and possibly even improved in the future.

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