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Where to Locate? A Project-Based Learning Activity for a Graduate-Level Course on Operations Management*

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Location decisions represent an integral part of firms' strategic planning process. Because these decisions have a significant impact on the organization, location analysis is a recurrent topic on operations management courses. In this study, we posit that students enrolled on such courses should experience location decisions actively. To this end, this paper proposes an activity that adopts a student-centred approach. The main purpose is for students to acquire the required technical skills to deal with location decisions. Furthermore, the activity is designed in such a way that it also helps students develop some of the soft skills that operation managers should possess, such as teamwork and digital skills. The activity mimics a real-life situation, with students asked to decide where to locate a specific new public service in the city of Barcelona, Spain. This activity was part of a course on operations management, included in the master's degree in engineering management and production systems taught at the Universitat Internacional de Catalunya. The results suggest that the proposed project-based activity helps students to improve relevant skills needed by project managers. By providing students with the opportunity to take part in a location decision that simulates a real-life situation, the activity enhances students' experience-based learning.

Keywords: Project-based learning; technical skills; soft skills; operations management; location selection

1. Introduction

The pedagogical culture that supported the foundation of the European Higher Education Area (EHEA) has generated a paradigm shift in training education, prompted by what industry expects higher education institutions to provide: subject-specific knowledge and the appropriate skills and attitudes. In this sense, organizations expect the higher education system to provide lifelong learning [1, 2]. Students are also required to grasp new scientific ideas, to identify and solve problems, to think and express their thoughts critically and to develop teamwork capabilities [3]. All these demands presuppose significant changes in the traditional way universities operate, affecting not only faculty members in their capacity to act as education drivers and designers of all types of learning but also students, who are the active recipients of learning [4, 5]. To respond to all these challenges, universities have adapted in a number of ways: moving from traditional passive teaching methodologies towards active student-centred learning [6]; helping students acquire transversal skills; encouraging project-based activities and increasing team cooperation that deploys creativity and social skills [7].

The present study proposes an active learning method in the form of a project-based activity to enhance both technical skills (specific skills that relate to a certain field of knowledge) and soft skills (attributes, personality characteristics and behaviours) among students. This activity was included in a course on operations management taught as part of the master's degree in engineering management and production systems offered at the Universitat Internacional de Catalunya, Spain. Master's students have either an engineering or a management background. The activity presents students with a location problem.

Because location decisions have a significant impact on the organization and many factors influence and interact in this process, location analysis is a recurring topic on operation management courses and similar programs. Accordingly, in this study we posit that students enrolled on such courses should learn of the importance of location analysis by experiencing it actively. This paper describes a team activity that, by adopting a student-centred approach and using new technology, allows students to get involved in location decisions. In particular, the activity mimics a real-life situation in which a management team has to decide where to locate a specific new public service in a given city. Based on the final reports, we can conclude that students applied the techniques and methodologies explained in the theoretical lessons and that they acquired new knowledge about location decisions through this process. Students' opinions were collected and the surveys indicate that they evaluated this activity positively.

The paper is structured as follows. First, we briefly outline the appropriateness of developing technical and soft skills simultaneously. Section 2

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describes the importance of location decisions (technical skill), while section 3 deals with the development of soft skills (teamwork and digital skills). Section 4 sets out the teaching methodology used. The activity is described in detail in section 5 and the results are shown in section 6. The implications are discussed in section 7 and the conclusions appear in section 8.

2. Location decisions

Location decisions represent an integral part of any organization's strategic planning process. Organizations become involved in location decisions for a variety of reasons. For instance, entrepreneurial firms can move to specific innovation hubs to benefit from knowledge spillover; freelancers choose from among different co-working spaces depending on the distance to their potential clients, the price and their co-workers' characteristics, among other factors. Other examples are low-cost textile industries moving their production facilities to developing countries; IT service industries transferring some of their operations to Asia; retail chains planning their expansion and deciding on new locations to be closer to clients; logistics operators building new warehouses to facilitate the delivery of products; and companies moving to another location because of a growth in the demand that cannot be satisfied by expanding at their current location [8]. Location decisions are common management decisions in all types of industries due to changes in market characteristics, operational efficiency or cost reductions.

A typical location decision involves both qualitative and quantitative inputs, and these tend to vary from situation to situation depending on the particular needs involved. In this sense, organizations need to consider not only costs relating to taxes, transport and labour but also potential gains [9]. These potential benefits will be determined by local factors such as the competence of the workforce, the concentration of industries, consumer proximity, the suitability of the infrastructure, and access to financial, human or natural resources. Thus, the theory of industrial location is based on the relative profitability of activities in different locations and this depends on the costs and benefits, some of which can be measured quantitatively while others can be assessed only qualitatively [10]. According to MacCarthy and Atthirawong [11], factors influencing location decisions can be classified into five main categories: costs, infrastructure, labour characteristics, government and political factors, and economic factors. All of these should be taken into account when evaluating different location options.

The empirical analysis of location decisions has been a fruitful research area in recent years. This growth has been especially motivated by the increased availability of and accessibility to urban and regional business location data, coupled with advancements in the specification and estimation of econometric models aimed at facilitating location decision making [9]. In this line, Weber and Chapman [12] develop and evaluate a model to support business location-based decisions, basing their study on data available for the city of London. More recently, Tavakkoli-Moghaddam et al. [13] also present a model aimed at facilitating location decision making. These authors have designed a multiobjective model for a facility location problem with congestion and pricing policies.

Another large group of studies concentrates on research into factors that determine location decisions. In this sense, MacCarthy and Atthirawong [11] investigate factors affecting international location decisions. Chen and Moore [14] analyse location selections in heterogeneous multinational firms, trying to determine how differences in productivity can lead to different choices of foreign production locations. Curran et al. [15] explore the factors that influence the business location decisions of start-ups, focusing in particular on the role of personal factors. The study of Ferreira et al. [16] follows this line as the authors analyse entrepreneur location decisions, specifically whether such decisions differ across industries, and they identify the factors determining the choice of location between rural and urban environments. Figueiredo et al. [17] also focus on location decisions in an entrepreneurial setting. These authors explore the distinction between home-based and nonhome-based location decisions in Portugal. Furthermore, Deichmann et al. [10] survey the evidence on the factors determining industrial location in developing countries using data from India and Indonesia. As a whole, these empirical studies tend to agree that costs, agglomeration forces (economies of scale), market access, and infrastructure provision are determining factors for location selection.

In addition, in decision-making research, several methods are proposed for dealing with this type of decision: decisions where multiple criteria have to be taken into account, where quantitative and qualitative factors coexist and where no single option is clearly the best. Multicriteria decision-making methodologies have been developed to help decision makers organize, simplify and assess different options in order to make a rational and informed decision. Nowadays many different multicriteria decision-making methods exist. Some of the most popular are: the Simple Multi-Attribute Rating Technique (SMART), Even Swaps, the Analytic Hierarchy Process (AHP) [18], MIVES [19],

Pareto optimality, desirability functions, overlay plots, utility functions and PROMETHEE [20]. They differ in how they value each of the factors that affect the decision and the way those factors are averaged and compared among the different options. For the present paper, students were encouraged to use SMART, as the authors consider it to be one of the simplest and clearest multicriteria decision-making methods, suitable for students at this stage of their degree. In addition, understanding and managing SMART can definitely help later on by enabling a better understanding of more complex multicriteria decision-making methods.

SMART has been applied widely because of its relative simplicity and transparency, which means that different decision makers with heterogeneous backgrounds can apply the method and interpret its results easily. The main stages of this particular multicriteria decision-making method are as follows. First and foremost, and in common with all decision-making methodologies, the decision maker must be identified. In the in-class project-based activity proposed, each student team acts as a decision maker, as if it were a management team in a company. Second, the alternative courses of action should be identified—in this case, the potential available locations. Third, the attributes that are relevant for the decision should be identified. These factors should be relevant for the decision maker and, in a location decision, they usually include attributes such as the rent cost, the size or access to clients. Fourth, for each attribute, values need to be assigned to measure the performance of each alternative for each attribute. Values can be assigned directly if possible, as in the case of rent cost, or they have to be assigned using a value function or a weight assignment for factors such as the comfort or visibility of the new location. Fifth, as some attributes are more important than others, the decision maker needs to assign weights to each attribute. Sixth, for each location, a weighted average is calculated and finally, based on this average, a provisional decision can be made. It is recommended that a sensitivity analysis be done, slightly modifying the weights to check the robustness of the decision.

Given the impact of location decisions on organizations, there have been many attempts in advanced business and management-related disciplines to teach and train students in location-based strategy formulation. In this sense, Kazaz and Moskowitz [21] present the results of an active learning exercise designed to build skills in decision making and the execution of operational plans. As part of this activity, students were asked to consider the impact of their decisions on location selection, competition and collaboration, and customer service. Students considered the activity a good simulation of real-world practices and believed it improved the desired skills. In this line, Tucker and Armstrong [22] describe an active learning methodology in the form of a game-based activity aimed at increasing students' interest and participation in learning about location factors. The activity designed by these authors provided students with an opportunity to find out about dynamic differences between cultures and thus it served to introduce factors affecting location decisions. Prause et al. [8] also highlight the importance of introducing games for educational purposes in the field of location-based strategies at university level. Specifically, these authors describe a business simulation game that, by concentrating on location decisions, allowed students to optimize resource allocation in a competitive risk-free setting. In order to improve students' technical and soft skills for project management, Geithner and Menzel [23] propose a simulation game that gets students to decide on a location and new factory set-up in China. The results suggest that the activity helped students to develop soft skills such as teamwork and to increase their knowledge of project management. To conclude, we argue that all the experiences described in this section highlight the usefulness of introducing active learning methodologies into university classes to train students in location decision making.

3. Skill development

One of the pillars of the EHEA is the development of soft skills that are indispensable to satisfy industry's demands and that students should acquire in their university education. In order to prepare learners for the labour market, higher education should provide them with soft skills that can be transferred to other fields, such as the ability to cooperate, communicate or solve problems [1, 24]. Soft skills are not taught as easily as technical skills, although they are very much needed too [25]. Over the past few years, interest in soft skills on higher education programs has grown significantly. In engineering-related disciplines, the main focus has been on aspects such as presentation skills, effective report writing, digital skills, teamwork and project management [26]. For the purpose of this study, the activity designed concentrates on two of the above-mentioned soft skill types: teamwork and digital skills.

Teamwork itself is considered one of the essential skills that universities should provide as an industry requirement, especially for engineers [27, 28]. Students are likely to learn more with others than they are alone because of the process of achieving a shared understanding of the project and developing

it [29]. Given the diverse experiences and backgrounds of the team members, it is of the utmost importance to have a clear division of tasks and continuous dialogue, coordination, negotiation and cooperation, in order to reach a common goal [7, 25, 30, 31]. In this way, teamwork becomes a positive learning experience that enables the team members to achieve better results than they would by working alone [32]. Collaboration among students provides them with opportunities to talk, sharing ideas and knowledge, asking and answering questions, and thus to extend their thinking and understanding [3, 29, 33]. Furthermore, the collaboration and transmission of knowledge that characterize teamwork development can also be strengthened by computer-aided training [27, 29].

Concerning the development of digital skills, the European Commission has made several calls for more widespread and better use of new technology in higher education [34–36]. Technology-enhanced learning is proven to improve students' technological skills [37, 38]. For the purpose of this activity, digital skills are linked to the ability to find suitable information for the development of a project. According to Porta et al. [39], students acquire knowledge and skills by using technological support (e.g., the internet). In this case, the main goal is not to learn the technology itself but to use it smartly and effectively [40]. In addition, the use of technology can help keep students motivated and enhance their creativity by making them more interested and putting a large volume of information at their disposal [41, 42]. Moreover, it facilitates teamwork and peer interaction as well as knowledge sharing [32]. The use of computing and communication technologies in the development of a project makes the environment more real for the students [3] since they develop the ability to find and select information, which is a basic requirement in the labour market. In this way, the internet can serve as a link to the world outside the classroom, breaking spatial and time barriers [27, 43].

Because of everything described above, technology-enhanced learning has changed the way universities provide education, lecturers teach and students learn [44]. Ruizacárate Varela et al. [27] recommend combining both online and traditional learning in order to achieve better results in problem solving and keeping students motivated. The objective of the proposed activity is not confined to the development of soft skills such as teamwork and digital skills but it also encompasses the development of technical skills. Technical skills are not only necessary but also expected by employers. Students need to finish their degree with a high level of technical and specific skills that makes them competent and able to solve technical challenges [45].

In the case under analysis, we consider those technical skills related to the location problem, also known as location analysis or the facility location problem. The location problem is a branch of operations research concerned with the optimal placement of facilities to minimize transportation costs while considering other, more qualitative factors such as avoiding placing hazardous materials near housing. It is a complex problem that involves the evaluation and analysis of quantitative and qualitative information, prioritization and decision making.

4. Teaching method

The demand for new teaching methods that facilitate skill development while ensuring the acquisition of basic knowledge (theories and methods that form the basis of science) presupposes important changes in the traditional role of university lecturers and the preparation of teaching material. Indeed, the quality and usefulness of educational practices are key to producing highly skilled, competent and successful professionals. Recent studies addressing this need support the interest in this topic [46–49]. Pedagogy based on the development of skills provides students with lifelong learning, since they acquire generic skills through practice and formative assessment [50].

Active learning consists of having students engaged in the learning process: carrying out activities and thinking about what they are doing, and reflecting on their ideas and how they are using them [51, 52]. Students learn by doing—they acquire and retain knowledge by applying it while they participate in or contribute to activities, improving their performance not only during the activity but also after it [29, 53]. Active learning places the learners in the centre of the process, making them more independent and responsible. At the same time, educators change their role and become guides, tutors or facilitators instead of expert authorities [40, 43]. In general terms, traditional learning can be considered as that which teaches fundamental theory and provides exercises for 'knowing what', while active learning focuses on guiding students to develop a 'knowing-why' point of view [31]. Following Kirschner [5] and Prince [52], a balance between active and traditional learning is the best option, promoting learners' engagement and incorporating activities with disciplinary and interdisciplinary objectives into the lecture. Lecturers need to develop activities where students can apply the concepts learned in class, thus combining the subject-specific and transferable knowledge that industry demands. If an active learning strategy is implemented correctly, it can make students more

motivated to learn, enable them to retain knowledge for longer, and give them a deeper understanding of the subject and positive attitudes [29].

According to Pulko and Parikh [26], in engineering education, soft skills are developed on engineering courses but, more specifically, during project work. In this way, the emphasis on the content and the teaching methodology at universities with engineering programs has to shift from a focus on content to pay attention also to process [50]. It is important to encourage students not only to be able to select the skills that they need to complete a task but also to learn the context where these skills can be applied in the work environment [7]. It is in this context where project-based methodology plays a key role. According to Friedman [54], project-based learning is one of the most relevant active learning methods. It can be defined as a comprehensive perspective designed to engage students in investigation to solve real problems by using multiple cognitive instruments and various sources of information, while working in a social context. Since project-based learning encourages students to find solutions for problems in an authentic situation, it can serve as a link between classroom experiences and real-life events [41].

Within engineering education, previous studies have revealed that, compared to the use of conventional approaches, the introduction of project-based activities increases instructor-student and student-student interactions and enhances not only students' knowledge acquisition [55, 56] but also the development of teamwork and communication skills [57]. In this field, some studies concluded that project-based learning seems to be more effective than traditional lectures [43, 58]. In general terms, project-based learning is shown to be a motivational tool that can increase students' interest by involving them in solving real problems, working in teams and finding authentic solutions. Lecturers emerge as key figures in the design of project-based activities, since they are responsible for motivating the students through the selection of interesting projects with attainable resolutions, taking into account students' previous knowledge and the means available to them [41]. To develop the project successfully, students need to organize and do the assigned work, they need to collaborate with others and follow the tutor's instructions, they have to collect and manage information, and they need to communicate and debate their ideas and findings [59]. In doing so, they acquire invaluable experience that makes them more autonomous and responsible for their learning [60] and provides them with a sense of pride at having accomplished the designated task [61].

5. Description of the project

5.1 Main purpose

In a student-centred approach, students were asked to get involved in a location decision mimicking a real-life situation in which a manager had to decide where to locate a new outlet for a specific public service (such as a language school, library or youth hostel) in the city of Barcelona. Students were expected to work in groups and use new technology (as a way to obtain information) in order to find the optimal solution. The project activity is thus designed in such a way that both technical skills (location decisions) and soft skills (teamwork and digital skills) can be enhanced simultaneously.

5.2 Sample

This project is included in a course on operations management taught as part of the master's degree in engineering management and production systems taught at the Universitat Internacional de Catalunya. The activity took place in November 2014, with a class of 24 students working in groups of four. The master's degree students taking part in the course came from different countries and had different educational backgrounds, mainly in the areas of management and engineering. To enhance the discussion and facilitate analysis from multiple perspectives, students with heterogeneous profiles were grouped together. Also, because this project required some knowledge of the city of Barcelona, each group contained at least one local student.

5.3 Detailed description

Location decisions followed a two-step decision process [62]: first, the region was selected; second, the exact site within the region was chosen. With the aim of replicating a real-life situation, this activity also considered these two levels of decision making. Therefore, for the case being studied, in the first stage, students were asked to select the district of Barcelona where the new outlet should be located and, in the second stage, they had to determine the precise location (for example, street name and number).

Table 1 shows the different subtasks into which the project was organized. Throughout the whole activity, the lecturer acted as a facilitator and spurred students on to reach a solution. When starting the activity, the lecturer presented the problem statement and explained to the whole class not only the academic requirements of the work to be delivered at the end of the activity but also the methodology the students should follow. A final presentation was scheduled at the end of this activity, where each group would present its project

orally and explain how the students in the group had reached a solution. Students were also told that, after finishing the project, they would be asked to fill out a survey to provide feedback and their impressions of the usefulness and design of the activity.

Once all the instructions had been given, students were organized into groups of four, with the professor making recommendations on how to form groups. First, as previously explained, each group had to have at least one local student. Second, it was preferable to encourage students to form a group with other students with whom they did not usually work. In real-life situations, professionals do not tend to choose who will be part of their team. Therefore, we recommend getting students to work with unfamiliar classmates.

As shown in Table 1, the activity considered several milestones that acted as checkpoints (M1, M2 and M3), with an expected length of no longer than 10 minutes per group. During this time, each group explained to the professor the early ideas emerging from the team discussion meetings (TD1, TD2 and TD3). While the professor was working with one team, the other groups moved forward with the project.

The first team discussion (TD1) was about becoming familiar with the project topic. Students had to examine the need for a new outlet for the service and determine who the target audience would be. They were expected to search specific websites to find out about the current provision of the service. The second team discussion (TD2) consisted of determining which district would be best so the new outlet would complement the existing ones without overlapping. To do this, students were encouraged to generate a value tree with the most critical attributes. The value tree could differ for each team as different teams might value different characteristics in a location. The emphasis here was on the coherence between company objectives and location characteristics. For instance, if a new youth hostel was to open, it would make sense to take into account the number of major tourist sites, transportation facilities and the entertainment on offer in the district, among other aspects. The attributes would be different if, instead of a youth hostel, a hairdresser's shop had to decide on its location. Using the SMART methodology that was introduced briefly to students at this point, students had to decide how to measure each attribute. In this step, students relied heavily on statistics that were publicly available on the city council website and the specific websites of the public service. Then students had to assign a weight to each attribute, depending on its relative importance. Weights allowed students to determine how each district was performing for each of the standards chosen. Later, a weighted average was calculated for each potential location, and each district obtained an overall score.

Once the district had been selected, a second assessment procedure was needed in order to decide the exact location of the new outlet (TD3). This third step might combine the use of qualitative and quantitative approaches. By following a similar procedure as in TD2, qualitative approaches could be used to rank districts and reduce the number of potential sites. When only two or three potential sites remained, quantitative techniques (such as the rectangular distance, the Euclidean distance, the centre of gravity, and isocost curves) could be used to reach the final solution. This final location should be given in terms of the name of the street and street number. It will be positively valued if the location is a feasible solution. As for the use of digital skills, in this stage students were found browsing property websites on the internet and using Google Maps to calculate distances.

At this point, it is worth mentioning how SMART proved useful as an approach to evaluate and compare location alternatives. Multicriteria decision-making methods such as SMART enable

Table 1. Detailed description of the activity

Order	Subtask	Duration
1	The lecturer sets out the project and describes the rules	20 minutes
2	Group formation and distribution of the public services to be located	5 minutes
3	Team discussion (TD1): Familiarization with the service. Initial brainstorming	40 minutes
4	First milestone (M1)	10 minutes/group
5	Team discussion (TD2): Decide the weights and criteria for choosing the district. Assign weights indicating the relative importance of each factor and establish a scale for each factor	1 hour
6	Second milestone (M2)	10 minutes/group
7	Team discussion (TD3): Define the factors that are relevant for selecting the exact location, assign weights, and decide a common scale for all factors	1 hour
8	Third milestone (M3)	10 minutes/group
9	Drawing up the final report	1 hour
10	Oral presentation	10 minutes/group

decision makers (in our case, students) to incorporate their personal opinions as well as quantitative information into the decision process, mixing qualitative and quantitative data. By establishing a composite value for each alternative that summarizes all related attributes, it was possible to rank alternatives and choose a final location.

Using active learning methodology, during the whole project the lecturer acted as a facilitator. Specifically, his or her role consisted of assisting students when necessary, and ensuring that the project would reach a conclusion within the given time. It is important to note that, prior to starting the activity, students had been working on location decisions for two hours, during which time a general introduction was given and several examples discussed.

5.4 Assessment of the activity

The acquisition of technical skills was assessed by means of a report and an oral presentation. The report needed to cover the following content: (1) description of the current service provision, (2) factors (and weights) to be considered for deciding on a location, (3) analysis, (4) final decision, and (5) list of references. A rubric for the oral presentation was designed so that students knew exactly how they were going to be evaluated (see Table 2).

Location analysis is a relevant module on the operations and production management course as students usually had little or no previous knowledge of this topic. Therefore, several activities were designed throughout the term to ensure that students would finish the course with the expected knowledge. Specifically, several in-class exercises were conducted, introducing the main concepts. The project-based activity described in this study was conducted next. The last chance to test students' progress prior to the final exam was an individual assignment. We believe it is a good strategy to have

Table 2. Rubric for the oral presentation (scale from 4 down to 1)

Criterion	Advanced (4)	Adequate (3)	Minimal (2)	Inadequate (1)
Content				
Structure	The presentation is organized as follows: initial considerations of the service to be located, current provision, first-level analysis (criteria and weights), second-level analysis (criteria and weights), final decision, and conclusions.	The presentation omits one of the required sections (initial considerations of the service to be located, current provision, first-level analysis, second-level analysis, final decision, and conclusions), or it uses a different order.	The presentation is incomplete, omitting important sections (initial considerations of the service to be located, current provision, first-level analysis, second-level analysis, final decision, and conclusions), or it uses a different order.	The presentation is structured in a chaotic way, and the required sections (initial considerations of the service to be located, current provision, first-level analysis, second-level analysis, final decision, and conclusions) are not clear at all.
Organization	The presentation is organized clearly. The ideas in it can be discerned easily.	The presentation is organized.	The organization of the presentation is mixed up and random. The listener must make some assumptions about the sequence and the relationship of ideas.	The presentation is so disorganized that the listener cannot understand most of it.
Comprehension				
Subject knowledge	Students demonstrate full knowledge by answering all class questions with explanations and elaboration.	Students are at ease giving answers to all expected questions but fail to elaborate.	Students are uncomfortable with the information and are able to answer only rudimentary questions.	Students have no grasp of the information and are unable to answer the questions accurately.
Style				
Creativity	Very original presentation of material, which captures the audience's attention.	Some originality apparent. Good variety and blending of materials and media.	Little or no variation. Material presented with little originality or interpretation.	Repetitive, with little or no variety. Insufficient use of materials and media.
Text: font choice and formatting	Font formats (such as colour, bold and italics) have been planned carefully to enhance readability and content.	Font formats have been planned carefully to enhance readability.	Font formatting has been planned carefully to complement the content but the text may be a little hard to read.	Font formatting makes it very difficult to read the material.
Length of presentation	Within two minutes of the allotted time.	Within four minutes of the allotted time.	Within five minutes of the allotted time.	Six minutes or more longer or shorter than the allotted time.

students work altogether as a class first, next to ask them to work in teams (the project-based activity), and later to do an individual exercise. By operating like this, students first have the opportunity to share their knowledge and clarify potential doubts as a class or in teams and, once they feel confident, each student can solve a problem individually.

Concerning the evaluation of soft skills, teamwork was assessed using a survey of four questions (using a scale of 1 to 5) to find out students' opinions of the class exercises and the project-based activity described here. Although the class exercises were discussed in pairs, we posit that the project-based activity was the activity that made the biggest contribution to improving this skill.

As for the development of digital skills, we argue that the activity could have been designed without the use of new technology. Nevertheless, we posit that universities should challenge their students in the use of new technology. Although today's students were born in the digital age, they do not necessarily possess the digital literacy skills to obtain and select data when millions of items of data are available. Therefore, with this activity, we aimed to help students become competent digital citizens.

6. Results

Results were evaluated in terms of academic performance and student satisfaction. Regarding the academic results, grades were given based on the final report and the oral presentation. Both the reports and the presentations met the required standards specified in the project guideline. Twenty-four students were divided into six groups, each one focusing on a specific public service. Two of these groups obtained the highest score (10), three groups were graded with 9, and one group obtained 8.5. Table 3 shows the average grades. Two additional columns are included. The first one refers to the grades that students scored in the individual assignment dealing with location decision-making problems. The last column contains the grades from the final exam, in which three exercises out of six referred to this topic. For illustrative purposes, in the table we report the average grade obtained in these exercises calculated on the basis of 10 points. As can be observed, students performed very well in both the project-based activity and the individual assignment. The results in the exam were also satisfactory. Accordingly, we can conclude that the strategy followed (first working in teams and later individually) was sound.

Table 3. Students' academic performance

	Project-based activity	Assignment	Exam
Mean	9.26	9.47	8.08
Standard dev.	0.58	0.92	2.85
Minimum	8.50	7.50	0.00
Maximum	10.00	10.00	10.00

Table 4 shows the students' perceptions of different aspects that reflect teamwork performance. As can be inferred from the results, students indicated they felt confident when working in teams. In particular, in their self-evaluations, they gave themselves the highest average score (4.04) for arguing over ideas with their team-mates. The item with the lowest average score (3.70) referred to students' ability to share knowledge.

Regarding students' feedback, a survey was designed aimed at finding out students' impressions. The questions included in the survey, along with the average scores, are shown in Table 5. Each item was evaluated according to a five-point Likert scale,

Table 4. Students' opinions on teamwork skills (scale from 1, "strongly disagree", to 5, "strongly agree")

Propositions	Average score
I took part in the group discussions	3.87
I shared my knowledge and ideas while working	3.70
I asked questions and listened to my classmates when we had different viewpoints	3.83
I expressed my ideas to my classmates and argued for them	4.04

Table 5. Students' feedback (scale from 1, "strongly disagree", to 5, "strongly agree")

Activity	Average score
LEARNING	3.70
I learned things that I consider to be valuable	3.69
I have learned and understood the module on location decisions	3.77
The activity has helped improve my understanding of the subject	3.65
METHODOLOGY	4.23
The activity was intellectually engaging and stimulating	4.32
The lecturer gave clear explanations	4.15
Students were encouraged to discuss and exchange their ideas	4.08
The lecturer was approachable in individual dealings with groups	4.35

where 1 indicates "strongly disagree" and 5 "strongly agree".

The results indicate that what students valued most was the methodology chosen. They considered this activity to be attractive and interesting and found that it helped them understand the main concepts related to location decisions. The lecturer's support was also key to ensure the activity was a success. We can conclude that overall the experience produced encouraging results, which demonstrate that traditional teaching methods should be complemented by more dynamic activities, where students are placed at the centre of the learning process.

7. Discussion

In this article, we have reported the results obtained in a project-based learning activity on location analysis. The results of the first application of this activity are promising. Not only were the academic results satisfactory but so was the students' feedback about the activity. We believe that further practical experiences such as the one suggested here should be designed and implemented on operations management courses. There are several advantages. First, by simulating real-life situations and using a student-centred approach (project-based learning), it is possible to involve all students actively. Moreover, by working on the project, the students not only find a solution but also put their knowledge into practice. Several soft skills are also expected to be improved by carrying out this activity. In our case, two kinds of soft skills are emphasized: the ability to find information using new technology and teamwork. This activity also creates an open and transparent atmosphere where clear goals are set and students have to cooperate actively rather than compete to reach a solution. In this respect, an individual's success or failure in learning is linked to the results of the other group members. Indeed, this situation is very similar to the one that future graduates will find in a company setting.

This was the first time this type of activity took place on the operations management course at master's degree level in the Universitat Internacional de Catalunya. Although we believe that this study provides useful insights for other educators, it is important to note that we identified some limitations, which in turn represent opportunities for future research. First, we acknowledge that the number of students participating in the activity was rather low. Consequently, progress in the students' performance as well as their feedback can be discussed based only on descriptive data analysis. Nevertheless, it is important to note that one of the key factors that helped the activity be highly effective was the small size of the working groups and the continuous attention, dedication and counselling each of the groups received from the lecturer in charge of the activity. This would not have been possible with groups of more than 20 to 30 students. In such cases, two facilitators would be necessary. Another limitation refers to the assessment of soft skills. Unfortunately, we did not have evidence of how skilful students were at teamwork and digital skills before participating in the activity. Consequently, it was not possible to determine the extent to which this activity helped improve the aforementioned soft skills. Lecturers organizing future versions of this activity might consider addressing this issue.

The project can also be expanded by incorporating the development of other soft skills, such as critical thinking, into the activity's objectives. Critical thinking could be incorporated by developing a peer-to-peer evaluation system whereby participants in the activity would evaluate and comment on other groups' work. Another way to broaden the scope of the activity could be to include learning from other areas of knowledge, making the project interdisciplinary. For example, students could be required to include the cost evaluation of the project, which would force students to incorporate knowledge from other disciplines such as accounting and finance.

The project was designed using real information from a particular city—in this case Barcelona, Spain. The idea was to put students into as realistic a situation as possible. This purpose could be enhanced by bringing professionals into the class—for example, someone at the city council with responsibility for service location decisions—and this person could explain at first hand what kind of problems they faced. Another possibility to consider for future versions of this course is to have experts from industry evaluating the final presentations. We believe having real-world input will undoubtedly enrich students' learning experience.

8. Conclusions

In today's fast-changing world, universities are expected to provide students with subject-specific knowledge as well as soft skills that prepare them for the labour market. In this way, higher education needs to go beyond purely transmitting knowledge, as it has to aim to give the individual a well-rounded education. To do so, it is crucial to pass on to learners the importance of acquiring broader knowledge and soft skills. Therefore, universities are responsible for helping students build a solid base on which they can make their future professional competences grow.

In this context, the rapid digital change that our society is experiencing also demands individuals who are highly skilled in the use of new technology. Responding to this need requires integrating new technology into universities and using it effectively. Technology can help students get a deeper understanding, learn more efficiently and creatively, and update their knowledge. When properly implemented, the use of new technology in lectures enriches teaching by improving the learning experience as well as by supporting personalized learning. However, it must be noted that educating students to succeed in a complex and interconnected world represents investment in training lecturers, in suitable infrastructure, and in the development of didactic resources.

Based on the aforementioned considerations, in this study we have reported on an activity that attempts to respond to these new demands. In particular, the activity proposed is a project based on real data that inspires students to adopt the role of a project manager. While conducting this activity, students learn about location decision making. At the same time, two main types of soft skills are expected to be enhanced—namely, teamwork and digital skills. There are multiple possibilities of adapting the activity to other settings, class sizes or learning objectives. We believe that there is an urgent need to provide similar experiences on other more traditional master's courses.

Education today requires the use of flexible and innovative teaching methodologies. Further research to identify best practices in this area is of paramount importance. When surrounded by suitable learning and teaching environments, students are able to develop confidence in their own abilities. It is precisely in such contexts that students grow professionally and personally. Investing in such education practices has an impact not only on students but also on society as a whole. Graduates constitute one of the most effective channels for transferring knowledge from universities to society.

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