

An experiment for a quality education using business materials tailored to learning profiles

Un experimento para una educación de calidad utilizando materiales empresariales adaptados a perfiles de aprendizaje

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ABSTRACT

With innovation serving as the primary driver, higher education institutions are essential to fulfilling the Sustainable Development Goal of quality education. Innovating in teaching means constantly adapting to new learning environments and changing audiences, but the advantage is that diversity remains constant. Making resources accessible in a variety of formats promotes inclusiveness, quality and flexibility to different learning preferences and styles, which supports a culture of lifelong learning. In a resource-constrained environment, lecturers often do not have evidence of how this variety of materials benefits the learner. A teaching innovation project is proposed to find out the diversity in learning styles in the classroom as well as the preferences and evaluations of students about three types of materials provided by lecturers of a given lesson, presented through text, graphics and audio. The results have given us a better understanding of the teaching-learning process and the needs of students.

Keywords. Learning styles, learning strategies, teaching innovation, learning preferences, quality education

RESUMEN

Las Instituciones de Enseñanza Superior son actores clave en la consecución del Objetivo de Desarrollo Sostenible de Educación de Calidad, con la innovación como principal catalizador. Innovar en la enseñanza significa adaptarse constantemente a nuevos entornos de aprendizaje y a públicos cambiantes, pero la ventaja es que la diversidad se mantiene constante. Proporcionar los materiales de la asignatura en distintos formatos fomenta la inclusión, la calidad y la adaptación a las distintas preferencias y estilos de aprendizaje, lo que responde a un entorno de aprendizaje permanente. En un entorno de recursos limitados, los docentes no suelen tener pruebas de cómo esta variedad de materiales beneficia al estudiantado. Se propone un proyecto de innovación docente para conocer la diversidad de estilos de aprendizaje en el aula, así como las preferencias y valoraciones de los estudiantes sobre tres tipos de materiales proporcionados por los docentes de un determinado tema, presentados mediante texto, gráficos y audio. Los resultados han permitido comprender mejor el proceso de enseñanza-aprendizaje y las necesidades de los estudiantes.

Palabras clave. Estilos de aprendizaje, estrategias de aprendizaje, innovación docente, preferencias de aprendizaje, educación de calidad

INTRODUCTION

Higher Education Institutions are increasingly catering to a diverse range of learners, including mature audiences engaged in lifelong learning programs, as evidenced by the availability of senior programs. Furthermore, these institutions welcome students who are already employed and seek career advancement or managers aiming to update their knowledge and skills, thereby facing time constraints. To address the evolving professional demands, both public and private universities and educational institutions offer a wide array of undergraduate and postgraduate degrees and courses, aligning with the global commitment to SDG4 on quality education. Moreover, lecturers often encounter additional requests from the student guidance service, which provides information, guidance, training and support to students, prompting them to adapt their teaching materials and methods on the go to meet specific educational requirements.

With the emergence of Covid-19 pandemic, university teaching staff had to quickly adapt to new learning environments, including distance and semi-distance formats. In these new environments,

lecturers had to rely on technology and adapt the materials and the organization of classes and assessments, all in a short period. One specific case illustrating this adaptation is the course Introduction to Business Administration in the first year of the Business Administration Degree at the University of Cantabria. Lecturers created during the pandemic new materials in text, graphics/video, and audio to facilitate distance learning for students, requiring significant additional effort and time. The idea behind these fortunately less and less novel systems is to adapt to the needs and preferences of the target audience. At present, lecturers have decided to keep this range of materials in the course, adding load in terms of reviewing and updating. Considering the high number of students in the course, a teaching innovation project is proposed to learn more about the use that students make of these different materials, and the effect (if any) on their learning outcomes. The existence of different learning profiles in the classroom can make the offer of various materials pertinent. In fact, academic literature agrees that recognizing the student's learning style allows for more effective teaching modalities (Alarcón, 2023). However, despite of the belief that such diversity of materials is useful for students, lecturers have no evidence of it.

This paper contributes to improving knowledge of the diversity of learning profiles in the classroom, as well as obtaining feedback in terms of the use, perception, and effectiveness of the materials used by students. The structure of the paper first includes a conceptual framework about learning styles, learning preferences, and learning outcomes, as well as a reflection of the context of quality education. Subsequently, the project carried out in the classroom is detailed. Finally, the results are described, as well as the preliminary conclusions of the project.

LITERATURE REVIEW

The implementation of university teaching constitutes the most dynamic element of the teaching process and is materialized in practice with the application of different elements: teaching-learning modalities and teaching methods (De Miguel, 2006). Teaching-learning modalities or teaching or didactic modalities are the different ways of organizing and carrying out the teaching-learning processes (De Miguel, 2006) and are related to the different scenarios in which the activities take place, differentiated according to the purposes of the didactic action, the tasks to be performed and the resources necessary for their execution. The teaching-learning modalities include theoretical classes, seminars or workshops, practical classes, external internships, tutorials, group work/study, and autonomous/individual work/study (De Miguel, 2006).

Teaching methods, on the other hand, refer to “how teachers proceed to develop their teaching activity” (De Miguel, 2006) so that students learn knowledge, skills, and attitudes, that is, they develop competencies (Fernández, 2006). Teaching methods include expository method/lecture, case studies (acquisition of learning through the analysis of real or simulated cases), exercise and problem-solving (exercising, testing, and putting into practice previous knowledge), problem-based learning (developing active learning through problem-solving), project-oriented learning (carrying out a project to solve a problem, applying acquired skills and knowledge), cooperative learning (cooperatively developing active and significant learning), learning contract (developing autonomous learning). These teaching methods can be approached as blended learning, also considered as hybrid or mixed, which “combines online with face-to-face teaching activities, giving room for student self-regulated learning with selected teaching materials combined with in-person discussion and activities” (Bigné et al., 2019). In fact, blended learning helps to overcome barriers of time and space with students, and many educational systems are being taken to the other extreme, solely virtual, such as Massive Open Online Courses (MOOCs) or Small Private Online Courses (SPOCs).

The combination of teaching-learning modalities and teaching methods selected by the lecturers will create the right learning environment so that students “can mobilize their cognitive and behavioral capacities in the learning process” (Barbosa da Silva et al. 2019). As these authors

argue, learning is an activity that the learner carries out for him/herself in a proactive way. Thus, it is not a reactive behavior that occurs as a response to a learning situation. Although there are different approaches and related concepts in the literature related to learning (learning styles, strategies, process, habit, habitus, approach, practice), it can be said that each student has (and develops) a learning style that is based on his or her learning preferences. The main problem is that in many cases, the student is often unaware of how he or she learns best and especially the strategies associated with his or her preferred learning style. This is not entirely surprising since the physiological bases by which a brain learns have not been identified to date (Egaña et al., 2022).

The construct “learning style” was first coined by Gibson (1969) and it was considered “how a person prefers to be presented with information to carry out learning” (Egaña et al., 2022). Kolb (1984) described learning strategies as “the way students prefer to process new information including strategies that are consistently adopted to learn”. From the point of view of psychology, a learning style is considered to be the learning approach preferred by students, however, more recent definitions consider that they are “the cognitive, affective and physiological traits that serve as relatively stable indicators of how students perceive interactions and respond to their learning environments” (Alonso, 1997, cited by Monteagudo and Vidal, 2016). Learning styles are usually stable but students need to be aware that they evolve and are conditioned by personality, career, tasks, environment, or the proposed topic (Alarcón, 2023).

There are different conceptual models of learning styles, such as Kolb's learning model, Felder and Soloman's model or VARK (Egaña et al., 2022; Alarcón, 2023) (Table 1).

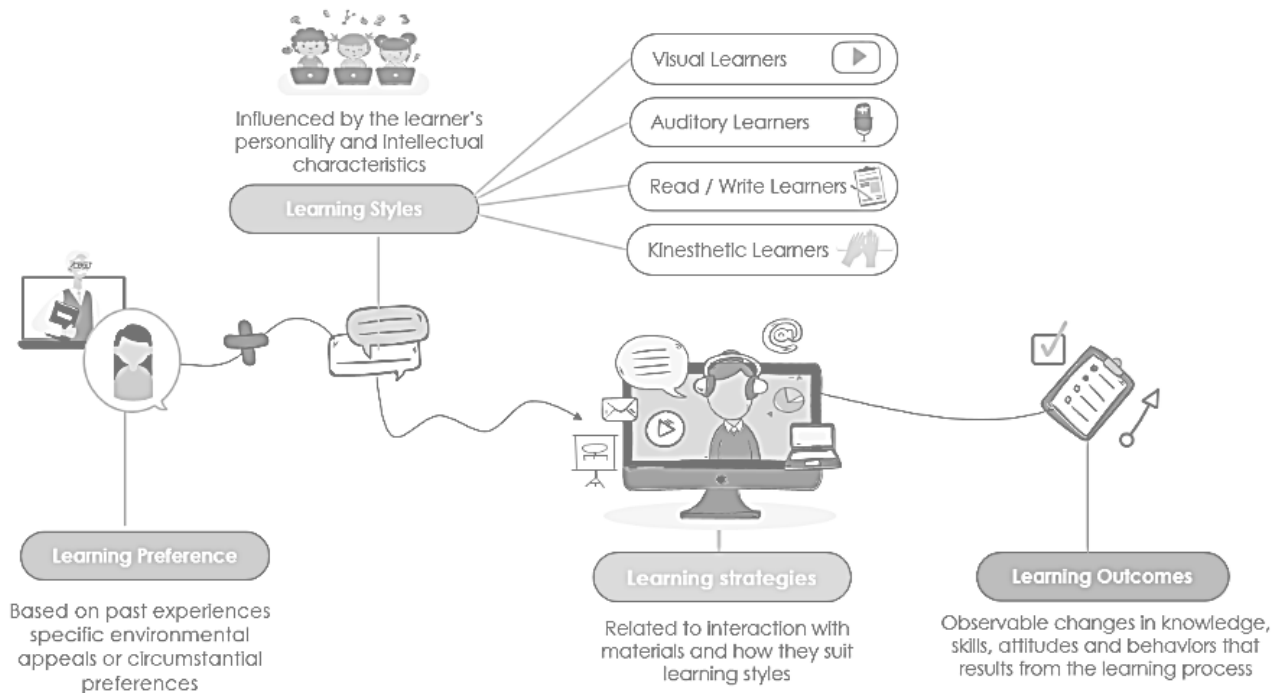
Table 1. Conceptual models of learning styles

| Author/s | Model | Profiles |
|--|--------------------------------|---|
| Kolb (1984) | Learning Style Inventory (LSI) | Active experimentation Concrete experience Abstract conceptualisation Reflective observation |
| Felder and Soloman (1997) | Index of Learning Styles (ILS) | Active – Reflective Visual – Verbal Sensing – Intuitive Sequential - Global |
| VARK learning styles (Robertson et al., 2011, p. 37) | | Visual. Preference for using visual resources such as diagrams, pictures or videos. Auditory. Need to talk about situations and ideas with a range of people; enjoy hearing stories from others Reader/writer. Prolific note-taker; textbooks are important Kinaesthetic. Preference for hands on experience within a 'real' setting and for global learning |

Most models of learning styles include cognitive traits, and intellectual and personality characteristics (Freiber et al., 2017). However, when the learner response and interaction come into play, the consensus in the literature is to speak of learning preferences, although as we have said, in many cases these boundaries are more than blurred. In fact, VARK is not consider a learning style by Flemming himself (Fleming, 2012), but “the identification of modalities that they might prefer when learning” (Fleming, 2012). Egaña et al. (2022) also highlight this when they consider that learning styles are “a preference for receiving, collecting, processing and interpreting information”. This implies that there may be a distinction between a learner’s preference (they may

prefer or be attracted to a particular format or strategy that perhaps works for them in another context), but they may not be good at it, which is related to their competencies or skills. Finally, Freiber et al. (2017) consider learning styles and learning strategies to be two sides of the same coin, so that learning strategies correspond to the techniques used in solving specific tasks and performed by the learner during the learning situation.

Figure 1. Student journey in the learning process



Source: Authors (with platform SlidesGo)

Materials in different formats available to students can interact with each learner's learning style and learning strategies, as learners select the format and manipulate the subsequent information, adapting it to achieve a learning objective in a given context (Stover et al. 2015). The concept of learning strategies is therefore the link between learning styles and learning preferences, so that learners will try to carry out learning strategies that are in line with their learning styles and preferences.

Quality education and teaching innovation

The crucial role that quality education plays in shaping a sustainable and inclusive society reflects the importance of any educational initiatives aimed at increasing innovation and student learning capacity. Sustainable Development Goal 4 (SDG4) aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all (Global Goals, 2023) and recognized "all types of learning and diversification of learning opportunities and modalities to allow all youth and adults to develop knowledge, skills and competencies for decent work and life" (Ghanem, 2020). SDG4 sub-targets cover the different aspects that can be acted upon and reflect the diversity of starting points at a global level (4.1. Free primary and secondary education, 4.2. Equal access to quality pre-primary education, 4.3. Equal access to affordable technical, vocational and higher education, 4.4. Increase the number of people with relevant skills for financial success, 4.5. Eliminate all discrimination in education, 4.6. Universal literacy and numeracy, 4.7. Education for sustainable development and global citizenship, 4.8. Build and upgrade inclusive and safe

schools, 4.9. Expand higher education scholarships for developing countries, 4.A. Increase the supply of qualified teachers in developing countries). Of all of them, the proposed teaching innovation project focuses on sub-targets 4.5 and 4.8, focusing on overcoming discrimination in education by providing the right environment for all students to develop their learning potential.

In this sense, developing innovative teaching projects promotes inclusion and equality by bringing in diverse perspectives, ensuring that learning is relevant for any student regardless of their background. At the same time, increasing autonomy in learning through innovative teaching projects encourages students to change from a passive mindset to learner mindset. In this way, they work on individual competences that allow them to explore, adapt and innovate in the idea of lifelong learning, preparing them for an ever-changing world and empowering them to contribute to society.

DESCRIPTION OF THE PROJECT

Background of the course

The course Introduction to Business Administration is a core course with a load of 6 ECTS credits, materialized in 150 hours dedicated by each student (67.5 face-to-face hours and 82.5 non-face-to-face hours). The responsibility, planning, and teaching are carried out within the Area of Business Organization of the Department of Business Administration of the Faculty of Economics and Business Administration of the University of Cantabria. The course has been offered during the first semester of the academic year 2022/2023 to 365 students of the following degrees: Degree in Business Administration and Management (205 students), Double Degree in Business Administration and Management and Economics (10 students), Double Degree in Business Administration and Management and Labor Relations (25 students), Double Degree in Law and Business Administration and Management (25 students) and Degree in Labor Relations (87 students, with the name Fundamentals of Business Administration).

The general objective of the course Introduction to Business Administration is to offer students a first global vision of the company, so that its contents are the base for what they will incorporate in successive courses, having the necessary preparation for their study with this initial knowledge. The course is therefore the first contact of the student with the business world, which conditions the didactic objectives. The integration in the same course of descriptive and analytical teaching materials is required, trying not to fall into an excess of abstraction and formalism that distances the student from reality or, on the contrary, into an excess of description that lacks interpretative capacity. In short, the need arises to facilitate the description of a reality that is unknown (the company), with a general and introductory character that allows understanding the interconnections between the different subsystems that compose it. This global purpose can be broken down, in turn, into two main types of objectives: 1) based on the learning of the fundamental contents of the subject; and 2) focused on the development of skills and competencies on the part of the students.

Table 2. Objectives and competencies of the course

| | Objectives |
|----------------------|---|
| Based on the context | 1- To reach a general knowledge of the problems implicit in the management and direction of a company. 2- Introduce the elementary and basic concepts related to the company. 3- To understand the nature and functions of companies as a way of organizing economic activity. 4- To know the different functional areas of the company and the necessary knowledge to develop the professional work in them, so that the student identifies the need of the |

Based on the development of skills and competencies

subjects of the degree. This knowledge will serve as a guide when choosing electives and additional training

5- General knowledge and interpretation (with a high degree of aggregation) of the information generated by the company.

Basic competencies

- a. Possession and understanding of knowledge in an area of study that builds on the foundation of general secondary education
- b. Ability to gather and interpret relevant data (usually within their area of study) to make judgments that include reflection on relevant social, scientific, or ethical issues.
- c. Students are able to convey information, ideas, problems, and solutions to both specialized and non-specialized audiences

Generic competencies

- a. Organize-Plan. Capacity for organization and planning. It consists of acquiring skills to observe, evaluate and make proposals to establish organizational guidelines and plan future actions according to pre-established criteria.
- b. Cooperate. Ability to work in a team. The student must know how to integrate and collaborate actively in the achievement of common objectives with other people beyond individual achievements, thinking globally for the good of the organization to which he/she belongs.
- c. Solve. Ability to solve problems. It is understood as the identification, analysis and definition of the significant elements that constitute a problem or aspect to improve in order to solve it with criteria and in an effective way.
- d. Use software. Ability to use computer tools. The student must achieve skills in the use of the necessary software as a means for the realization and completion of the necessary tasks in each subject and in the daily work life.
- e. Negotiate. Conflict management and negotiation. Aptitude consisting of foreseeing, dealing with and solving conflicts that occur in the work world, as well as the use of adequate techniques to mediate and have an impact on the decisions to be taken when dealing with people and groups.
- f. Internationalize. Working in an international context. This competence consists of knowing how to understand and adapt to the social and business culture of different countries, which is of great interest for any company or organization with international projection.

Specific competencies

- a. Lead, manage. To direct and manage a company or organization and/or its functional areas. The degree in Business Management must possess the necessary skills to coordinate and direct towards the objectives set in an area of the organization or the organization as a whole.
- b. Advise. Ability to advise on technical-organizational aspects. This competency refers to the ability to offer advice to company and organization managers on everything that is useful to achieve the company's achievements and improve its competitiveness.
- c. Entrepreneurship. Initiative and entrepreneurial spirit. Ability to possess sufficient drive to propose initiatives and implement business projects.
- d. To lead the management. Ability to lead the management of any functional area of the company. The student will be able to integrate into any functional area of a company or organization to perform and lead the tasks carried out therein.
- e. Manage people. To manage people and work groups in a company. The student will analyze the behavior of people in organizations in order to be able to manage individuals and work groups in the field of human resources.

Source: University of Cantabria (2023)

Of all the ways of executing teaching, the subject is taught through the master class, cooperative learning, project-oriented learning, exercise and problem solving, gamification, virtual teaching and tutorials.

Teaching project objectives

The characteristics of the course, with many students coming from different degrees with little previous contact with management and business organization, made the lecturers face the post-pandemic course from a different perspective. This included the possibility of returning to teaching all classes in a virtual environment. Therefore, materials in various formats (text materials, video pills, H5P interactive activities, and audios...) were created against the clock so that they could be consumed by the students through the Moodle virtual classroom. During the last two academic courses, we observed that different students showed preferences for a certain typology of materials to study the contents of the course, but we lacked evidence about the student's use of these materials and also its perceived usefulness and its valuation. The characteristics of Generation Z students have already been analyzed in other projects (Bigné et al., 2019): the widespread use of technologies and openness to new cultures and social trends. This new educational landscape includes changing the learning processes, which implies a deeper understanding of the students.

For these reasons, a teaching innovation project was proposed to find out the declared learning preferences of the students in the course and the use and evaluation of the different materials provided by the lecturers on the virtual classroom. Specifically, the objectives of the project are detailed below.

In relation to the students:

- To increase students' awareness of their own learning styles.
- To favor active learning of students through a portfolio of learning tools.
- Increase student responsibility for their own learning.

In relation to teachers:

- To improve teaching through the materials delivered, which favors planning and homogenization in courses with a high number of students and several teachers.
- To favor the integration and adaptation to the learning of different learning styles.

Defining the project

The project was carried out at the Faculty of Economics and Business Administration and at the Faculty of Law of the University of Cantabria following a structured methodology: design of the materials, design of the experience, implementation of the experience and evaluation of results. The participants of the study are students of the courses Introduction to Business Administration and Fundamentals of Business Administration. Of 352 students enrolled in the courses, 254 valid responses were obtained (72.1%).

First stage. Design of the materials

The first phase of the study consisted of selecting the content to be delivered in three ways: through graphics, through audio and through text. Taking into account the syllabus of the course, the selection of contents took into account the script, the functional design, the graphic design and the possibility of adapting the information to the three types of materials. Lesson 6 of the course includes the Activity Indicators in the Organization. The selected content to be taught was a profitability analysis, in which return on assets (ROA), return on equity (ROE), Weighted Average Cost of Capital (WACC), cost of equity capital, and their interpretation and comparison are explained.

To explain these concepts, lecturers created three kinds of materials in which they include the same information, but are required different skills to understand them: 1) Textual material (in which

you should read the information), 2) Visual material (in which you should observe the information) and 3) Audio material (to listen the information).

The text material includes 5 pages in a pdf document with a final glossary summarizing all concepts (see extract in Figure 2). The visual material consists of a video of 5 minutes 27 seconds in which graphs, tables and images are used in a presentation made with Prezi (see extract in Figure 3). The audio of the visual material is a music track. The audio material is a scripted reading of the text-type materials (podcast style), in a track of 11 minutes 17 seconds.

All materials were produced in Spanish and made available to students through the Moodle platform, the virtual classroom of the course.

Figure 2. Extract of materials in text

Análisis de rentabilidad
El análisis de rentabilidad se estructura en tres apartados con el fin de responder a las siguientes fórmulas:

- 1 **¿Es rentable la actividad de la empresa?**
- 2 **¿Es rentable para sus accionistas o propietarios?**
- 3 **¿Es sostenible la actividad de la empresa?**

Para analizar este aspecto se han de calcular dos ratios: la rentabilidad económica y el coste de capital. Posteriormente tendremos que compararlos.

Rentabilidad económica (RE)
La rentabilidad económica (RE) se determina a partir de los datos de los activos y, en concreto, de los datos (BAIT) y los activos operativos (AT) y los activos operativos para determinar las inversiones realizadas en activos corrientes y no corrientes. La rentabilidad económica es la generada por los activos de la empresa independientemente de los recursos de su financiación.

$$RE = \frac{BAIT}{AT} \cdot 100$$

BAIT: Beneficio antes de intereses e impuestos, o resultado operativo, económico o bruto, es decir, el beneficio generado por los activos de la empresa antes de gastos financieros (FI) e impuestos e intereses (I). En inglés se conoce como *Before Interest and Taxes (BIT)*.

AT: Activo Total de la empresa. Incluye los recursos en efectivo, no corrientes, (NC), como los activos corrientes, (CC).

Coste de Capital (CC)
Se obtiene como una media ponderada del coste de los diferentes fuentes o recursos financieros de que la empresa hace uso, utilizando como pesos o ponderaciones la importancia (cantidad) de cada fuente de financiación con relación al valor total del patrimonio neto más pasivo. Por consiguiente, el coste de capital medio ponderado será el dato por:

| Fuente de financiación | Cantidad | Coste |
|------------------------|----------|-------|
| Financ. Propia | FP | FP |
| Financ. 1 | F1 | F1 |
| Financ. 2 | F2 | F2 |
| Financ. 3 | F3 | F3 |
| Financ. 4 | F4 | F4 |
| Financ. 5 | F5 | F5 |
| Financ. 6 | F6 | F6 |
| Financ. 7 | F7 | F7 |
| Financ. 8 | F8 | F8 |
| Financ. 9 | F9 | F9 |
| Financ. 10 | F10 | F10 |

$$CC = \frac{FP \cdot FP + \sum_{i=1}^{10} F_i \cdot F_i}{FP + \sum_{i=1}^{10} F_i} \cdot 100$$

El coste de los recursos financieros es muy importante cuando se pondera con la estructura económica de la empresa (activo) se define una determinada rentabilidad (RE). La empresa solo podrá subsistir en el tiempo, si el activo es mayor que el coste de capital. Por tanto, el coste de capital, entendido como el coste efectivo que la empresa debe pagar por la utilización de sus recursos financieros, es una exigencia mínima de rentabilidad que debe cubrir la empresa con su negocio.

Glosario
Rentabilidad Económica: Ratio de relación entre los resultados brutos obtenidos (BAIT) y los activos operativos para determinar los recursos invertidos en activos corrientes y no corrientes.
Rentabilidad Financiera: Ratio de relación entre los resultados netos obtenidos (RF) los recursos propios financieros y los recursos de los fondos propios de la empresa (aportaciones de los socios, capital social, beneficios no distribuidos, reservas, y demás posibles fuentes de financiación propia).
Rentabilidad Bruta: Beneficio generado por los activos de la empresa antes de gastos financieros (FI) e impuestos e intereses (I).
Activos Totales: Representa el total de los recursos de la empresa, tanto las inversiones en activos no corrientes (ATC) como en activos corrientes (AC).
Coste de capital: Media ponderada del coste de los diferentes fuentes o recursos financieros de que la empresa hace uso, utilizando como pesos o ponderaciones la importancia (cantidad) de cada fuente de financiación con relación al valor total del patrimonio neto más pasivo.
Sostenibilidad: Diferencia en el valor del valor de la empresa y su coste respecto a la media del mercado. Representa el riesgo de la empresa.

Sources: Authors

Figure 3. Extract of materials in video

APRENDIENDO A ANALIZAR LA RENTABILIDAD

¿ES RENTABLE LA ACTIVIDAD? ¿ES SOSTENIBLE LA RENTABILIDAD? ¿CREA LA EMPRESA VALOR?

Objetivos, Rentabilidad, Sostenibilidad, Recursos, Estructura Económica, Estructura Financiera.

Pon en práctica la Rentabilidad Económica

Considera el siguiente negocio:
"Compras un sello por 100 € y lo vendes al día siguiente por 110 €"

ACTIVO: Sello (100 €)
INTERVENCIÓN: 100 €

¿Cuál es el beneficio de la operación? 10 € (110 - 100)

¿Cuál es la rentabilidad de la operación (RE)?
 $RE = \frac{BAIT}{AT} \cdot 100 = \frac{10}{100} \cdot 100 = 10\%$

Se calcula como el beneficio generado dividido por el activo utilizado.

¿Cuándo es sostenible la rentabilidad?

ESTRUCTURA ECONÓMICA: ¿Cuál es la actividad de la empresa? ¿Cuál es el activo de la empresa? ¿Cuál es el coste de capital?

ESTRUCTURA FINANCIERA: ¿Cuáles son los recursos financieros? ¿Cuál es el coste de capital?

RENTABILIDAD ECONÓMICA (RE o ROA): $RE = \frac{BAIT}{AT} \cdot 100$

COSTE DE CAPITAL (CC o WACC): $CC = \frac{FP \cdot FP + \sum_{i=1}^{10} F_i \cdot F_i}{FP + \sum_{i=1}^{10} F_i} \cdot 100$

Si RE > CC, la actividad es sosteniblemente rentable
Si RE < CC, la actividad NO es sosteniblemente rentable

¡No te olvides!

¿Rentabilidad Sostenible? $RE > CC$
¿Crea valor para los propietarios? $RE > FC$
¿Estructura financiera? $RF > RC$
¿Actividad rentable? $RE > D$

Sources: Authors

Second stage. Design and structure of the experience

The second phase consisted of the design and structure of the experience. First, students were asked their preferences when learning, as well as their perception of different learning styles.

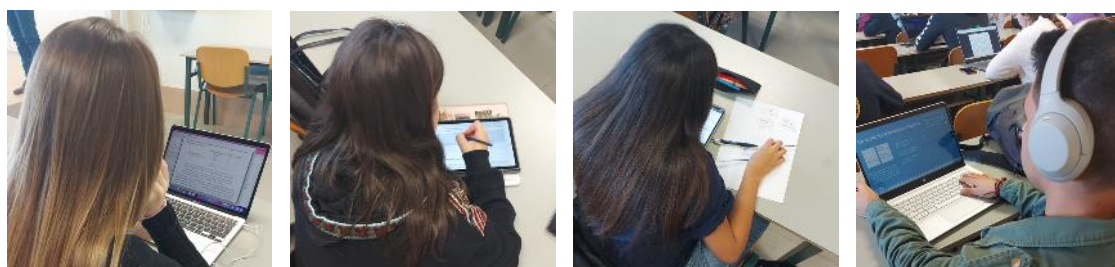
In this sense, first we explained the concept of learning preference based on VARK learning preferences and what each of them consisted of: visual (different formats, graphs, charts, tables, diagrams, maps, plans, flow charts, posters, different colors...); aural (listening, discussing, talking, asking questions, remembering...); read/write (lists, notes, text, glossaries, definitions, textual notes, manuals...); and kinesthetic (practical exercises, trial and error, field trips, visits, applications, exhibitions, recipes...). This provided us with the students' declared learning preference.

Subsequently, students took the VARK questionnaire on the VARK official website (<https://vark-learn.com/>) and the Felder test. Felder's model classifies styles based on five dimensions that refer to (Monteagudo i Vidal, 2016): "the type of information that students prefer, the modality that students perceive as most effective, the type of organization with which they prefer to work, information processing and learning progression". These two results provide us with learning preferences (VARK) and learning styles (Felder). With this information, we classified students into groups and then provided them with the materials in different styles. To classify the students, we used the information from VARK questionnaire, so that students with a clear preference (majority of V, majority of A, majority of R) were provided with the corresponding associated material (graphics, audio, text, respectively). The remaining students were randomly assigned 1) one type of material, 2) the combination of two materials or 3) three materials at the same time. Another group freely chose the type(s) of material they wanted to use. In any case, we finally obtained two groups of students: first, if students received the type of material that they stated as preferred in their learning style, they were considered to be in the "congruent" group and second, students who received a different type of material than the one considered as preferred for learning were considered to be in the "incongruent" group.

Third stage. Activity day

The third phase consisted of the implementation of the experiment. Students were notified through the virtual classroom Moodle that they would be carrying out an activity in the classroom as part of their continuous assessment and that they had to bring an electronic device (laptop, tablet, smartphone) and headphones (for audiovisual materials). The session was structured in two distinct parts. First, a period of time was dedicated to carry out the activity, visualizing the materials assigned to them. To do this, minutes before the session they received an email with individual information: the folder they had to access on Moodle and the access code. Students who did not complete the previous learning profile surveys were assigned at that time. After a period of 45-50 minutes, the students had time to answer the evaluation test, in order to assess the acquisition of knowledge according to the material used, and the satisfaction survey.

Figure 4. Use of electronic devices during the experiment





Note: Students granted permission to be photographed during the session
Sources: Authors

Fourth stage. Analysis and interpretation of results

Last stage in the methodology is the analysis and interpretation of results. Analysing learning outcomes according to the materials used and declared learning profiles will allow us to know whether it is effective to continue adapting the portfolio of materials in our courses.

RESULTS

The demographic profile of the participants is shown in Table 4. Forty-one percent of the participants were men and fifty-eight percent were women. Most of participants (55.7%) were enrolled in the Degree of Business Economics and Management in the University of Cantabria. 23.7% were enrolled in the Degree of Labor Relations and 20.1% were enrolled in Double Degrees.

Table 4. Demographic characteristics of participants

| Description | Frequency | Percentage (%) |
|----------------------|-----------|----------------|
| Gender | | |
| Female | 148 | 58.5% |
| Male | 105 | 41.5% |
| Degree | | |
| Double Degree BE/LAW | 23 | 9.0% |
| Double Degree E/BE | 9 | 3.5% |
| Double Degree BE/LR | 20 | 7.9% |
| BE | 141 | 55.7% |
| LR | 60 | 23.7% |

Note. DD BE/LAW: Double Degree in Law and Business Economics and Management, DD E/BE: Double Degree in Business Economics and Management and Economics, DD BE/LR: Double Degree in Labor Relations and Business Economics and Management, BE: Degree in Business Economics and Management

Results of the learning preferences and styles

The results obtained from the learning preferences and learning styles provided a picture of the classroom. The students declared themselves that they preferred to learn with visual or graphic strategies (32%) and text-bases strategies (30.4%), followed by kinesthetic strategies (16.2%) and

auditory strategies (12.2%). Only 23 students could not or would not (or were not able to) declare how they learned best (see Table 5).

Table 5. Classification of students by declared profiles

| Declared profiles | Total |
|-------------------|------------|
| Visual | 81 (32.0%) |
| Aural | 31 (12.2%) |
| Read/write | 77 (30.4%) |
| Kinesthetic | 41 (16.2%) |
| ND | 23 (9.1%) |

The average student in the classroom has a mild preference for being reflective, tending to think about any piece of information first. Felder and Soloman (1993) refer that balance is the most appropriate, in accordance with what happens in our classroom. Our average student presents a moderate preference for intuition, so that there is a preference of discovering relationships and innovation. Being more intuitive, as appears in our classroom, implies to miss important details (Felder and Soloman, 1993). Our average student is strongly characterized as a verbal learner, who should take better advantage of both written and spoken explanations, improving their learning by working in groups internalizing each other's explanations. Finally, our average student has a mild preference for being global, slightly tending to show poorer comprehension if they do not have the complete puzzle (Table 6).

Table 6. Distribution of students among learning styles and strategies

| | Strong preference | Moderate preference | Balance | Balance | Moderate preference | Strong preference | |
|------------|-------------------|---------------------|---------|---------|---------------------|-------------------|-----------|
| Active | 3 | 22 | 72 | 100 | 51 | 4 | Reflexive |
| Sensing | 11 | 29 | 27 | 66 | 66 | 52 | Intuitive |
| Visual | 17 | 23 | 36 | 53 | 61 | 61 | Verbal |
| Sequential | 3 | 24 | 65 | 105 | 51 | 4 | Global |

After the time devoted to self-study of the materials, students completed a 20-question evaluation test. The average score for the group was 7.392 out of 10. Students who had access to visual materials scored higher on the test, followed by students who had access to text materials, then to audio materials and finally, and contrary to what might be expected, students who had access to all materials scored lower (Table 7).

Table 7. Learning outcomes by material provided

| Material | Total |
|---------------|--------------|
| Visual | 7,780 |
| Audio | 7,487 |
| Text | 7,730 |
| All materials | 7,392 |
| Group | 7,629 |

Results of the learning preferences and styles

A satisfaction survey was conducted with the students who carried out the experiment. This survey was anonymous. The first part of the survey described the study habits in the students. In that sense, 52% of students only use the written materials provided by teachers and 72% of students use the slides provided on Moodle. 7,3% of students supplement them with books, but

35% of them use web resources (written resources or videos) to clarify concepts. Half of them need to read the materials out loud and 61% create their own materials to facilitate the learning process.

During the experiment, only 14% used the materials only once, and 60% read, watched or listened to the materials more than once. Approximately half of the students made outlines or took notes the first time they read / listened to / watches the materials, a percentage that drops to 25% when used a second time. The majority of students (89%) considered that the materials provided were sufficient to complete the post-experiment test.

If students had been allowed to choose only one type of material, 47.7% would have chosen a material in video, 46.7% would have chosen a material in text and only 5.5% would have chosen a material in audio. The perception of having different types of materials is very satisfactory on the part of the students, as they consider that it improves their autonomy (97%), their learning outcomes (89%), and their knowledge about the topic covered in the activity (83%). Despite not being reflected in the final results, 85% of students would like to have this type of activities in the future and 97% want to have several materials available throughout the courses of their degree (see Table 8).

Table 8. Perceptions of having different types of materials.

| Item | Average |
|---|---------|
| I think that having different types of materials (visual, audio, text) helps to improve my autonomy in learning | 97% |
| I believe that these type of autonomous learning activities improve my learning outcomes | 90% |
| I think that I found the activity conducted in class useful to learn more about the profitability analysis | 91% |
| I think that, after the activity, I know more about profitability analysis than I knew before | 83% |
| I would like to do this type of activity in the future, in this and other courses | 88% |
| I would like to have different formats of materials (visual, audio, text, others) in other courses throughout my degree | 98% |

DISCUSSION

Innovation in the teaching-learning process has been seen as an opportunity to respond to the critical role of HEIs in achieving SDGs (Shallcross and Robinson, 2007; Ferguson and Roofe, 2020). Being aware of the multitude of starting points in the different subtargets of SDG4, with this teaching innovation project we focus on the promotion of inclusive, quality and lifelong learning.

Having a portfolio of learning tools is a challenge for lecturers, especially in a changing environment where our “customers” are renewed every year. However, the diversity is a constant, so working on delivering useful options that respond to the learning preferences of the student body is a demanding option but it also brings benefits. This project has allowed us to have a better understanding of the learning process of our students, their learning styles, their learning preferences and their study habits.

In the first place, we have realized how little knowledge they have of their own learning process and of the strategies that best suit them when it comes to learning. And this knowledge is essential for them to take control of their future learning in a turbulent environment. For this reason, it is interesting that lecturers enable various styles of materials that complement or supplement these processes. Second, we have obtained evidence of the use and perception of the usual types of materials provided in the course (text materials, video pills). Having selected a topic and having created materials in three formats has allowed us to better control the results obtained. Monitoring the individual learning process of a large number of students is a limitation, so that direct relationships cannot be established between the type of material used and the individual learning outcome. In addition, the student is the one who adapts the type of material to their learning style

and learning preference, adopting the appropriate strategies (repetition, notes, drawing diagrams, explaining to another person, telling it out loud, etc.). As it was an activity carried out in the classroom, these types of strategies could not be analyzed individually. However, one of the most interesting results is that the lowest marks in the assessment test were obtained by those students who used all the materials. This is somewhat contrary to our expectations and does not coincide with the perceived usefulness of the informal feedback received in the classroom, prompting us to further investigate to develop the experiment.

The limitations in this project have been diverse. Firstly, as mentioned above, the monitoring of the individual learning process could not be carried out due to the large number of students. This limits the establishment of causal relationships, as external variables such as workload, the student's situation or personal circumstances have also not been taken into account. Although the project was carried out in two groups in two different faculties, it is still a project carried out in a single academic year (and with freshman students) and environment, so the preliminary results cannot be generalized.

Precisely in order to respond to these limitations, future lines of research are proposed. Future research includes replicating the experiment in other subjects and courses (second, third or fourth year or even postgraduate students) to see whether similar results are obtained. In addition, we would like to explore the relationships between learning styles, materials provided and learning outcomes obtained as a group but also by gender and by Degree. Although this will not allow us to know individual differences either, it will be possible to associate the results with the competences traditionally associated with the different degrees, thus favouring adaptation even more.

One of the objectives that we had as lecturers was to assess the reception of having all the materials available in all formats could have, considering the time and effort that this entails. The satisfaction survey has made us see that it is the text-video combination that is most requested by students, being the audio format the least valued. In any case, the activity was valued very positively and in general, they would like to repeat the experience in other courses. These results allow us to assess the creation of new content and formats in this and other courses, having a better understanding of the process.

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DECLARATION OF CONFLICTING INTERESTS

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CRedit AUTHOR STATEMENT

All authors have contributed equally to all parts of the work.