REVIEW ARTICLE

Pedagogical Contribution of Challenge-Based Learning to the Training of Business Managers: A Systematic Review of The Literature (2019-2023).

Aporte pedagógico del Aprendizaje Basado en Desafíos a la formación de los administradores de empresas: una revisión sistemática de la literatura (2019-2023).

Contribuição pedagógica da Aprendizagem Baseada em Desafios para a formação de administradores de empresas: uma revisão sistemática da literatura (2019-2023).

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ABSTRACT

Education in the knowledge society faces enormous challenges that must be faced under the perspective of pedagogical and didactic innovation. In this time of change, Challenge-Based Learning (CBL) stands as a timely orientation for the improvement of teaching and learning practices, particularly in business administration programs offered in higher education institutions. Although CBL is a methodology that in recent years has been developed in different areas of knowledge, in the economic and administrative sciences the full potential that this approach has to offer to university education is still unknown. This being so, this article presents a systematic review of the literature on the pedagogical contribution of Challenge-Based Learning to the training of new business administrators in higher education, so that they can respond to the needs of present and future organizations. A descriptive study is conducted by analyzing research published from 2019 to 2023, following the Prisma guidelines. Eighty-two articles were reviewed using a qualitative thematic matrix. The results describe the benefits of integrating challenge-based learning into the pedagogical structure of business administration programs. This research contributes to the state of the art of a relevant aspect that is making its way into higher education in Latin America.

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RESUMEN

La educación en la sociedad del conocimiento se enfrenta a enormes retos que deben ser afrontados bajo la perspectiva de la innovación pedagógica y didáctica. En esta época de cambios el Aprendizaje Basado en Desafíos se erige como una orientación oportuna para el mejoramiento de las prácticas de enseñanza y aprendizaje, particularmente en los programas de administración de empresas ofertados en instituciones de educación superior. Si bien el CBL es una metodología que en los últimos años se ha venido desarrollando en distintas áreas del conocimiento, en las ciencias económicas y administrativas aún se desconoce todo el potencial que este enfoque tiene para ofrecer a la formación universitaria. Siendo esto así, este artículo presenta una revisión sistemática de la literatura sobre el aporte pedagógico del Challenge-Based Learning a la formación de nuevos administradores de empresas en la educación superior, de tal forma que puedan responder a las necesidades de las organizaciones del presente y del futuro. Se realiza un estudio descriptivo analizando las investigaciones publicadas desde el año 2019 hasta el 2023, siguiendo las directrices Prisma. Se revisaron 82 artículos utilizando una matriz temática cualitativa. Los resultados describen los beneficios de la integración del aprendizaje basado en desafíos en la estructura pedagógica de los programas de administración de empresas. Con esta investigación se aporta al estado del arte de un aspecto relevante que se abre paso en la educación superior en América Latina.

RESUMO

A educação na sociedade do conhecimento enfrenta enormes desafios que devem ser enfrentados sob a perspectiva da inovação pedagógica e didática. Neste período de mudanças, a Aprendizagem Baseada em Desafios se destaca como uma orientação oportuna para a melhoria das práticas de ensino e aprendizagem, especialmente nos programas de administração de empresas oferecidos em instituições de ensino superior. Embora a Aprendizagem Baseada em Desafios seja uma metodologia que tem sido desenvolvida nos últimos anos em diversas áreas do conhecimento, nas ciências econômicas e administrativas ainda é desconhecido todo o potencial que essa abordagem tem a oferecer para a formação universitária. Dessa forma, este artigo apresenta uma revisão sistemática da literatura sobre a contribuição pedagógica da Aprendizagem Baseada em Desafios para a formação de novos administradores de empresas no ensino superior, de modo que possam atender às necessidades das organizações do presente e do futuro.

Realizou-se um estudo descritivo analisando as pesquisas publicadas de 2019 a 2023, seguindo as diretrizes Prisma. Foram revisados 82 artigos usando uma matriz temática qualitativa. Os resultados descrevem os benefícios da integração da aprendizagem baseada em desafios na estrutura pedagógica dos programas de administração de empresas. Esta pesquisa contribui para o estado da arte de um aspecto relevante que está ganhando destaque no ensino superior na América Latina.

Introduction

The historical moment we are living in is characterized by a series of changes and transitions that affect ways of living and thinking in society. We are witnessing the Fourth Industrial Revolution and the evolution of the so-called Knowledge Society, realities that are having a powerful influence on the worldviews of individuals and communities, as well as on the new ways of understanding economic, political and organizational processes. Particularly, in the business sphere, the change that has taken place in the last thirty years in the way of understanding administrative management as a consequence of phenomena such as globalization, the appearance of new technologies and the geopolitical conditions that affect productivity and business projections is notorious. These elements mentioned here invite us to think about the need to rethink the teaching and learning processes that mark the educational and formative activities of the new students of the economic and administrative sciences programs, an aspect that has not been sufficiently addressed in various educational contexts.

Bearing in mind this background of ideas, we can say that higher education in administrative areas has focused on theoretical schemes in which the transmission of knowledge has been its central focus, without associating the curricular approaches with the environment of the organizations, resulting in students acquiring a series of specialized knowledge that, on many occasions, is not adequately related to the demands and requirements of the professional world, and of the different contexts in which individuals develop in the companies.

In this same line of reflection, the teaching practice has also focused on these traditional methodological designs, offering students a series of instructions for understanding administrative phenomena, but often disconnected from the socio-economic reality in which organizations are immersed. This aspect is recurrent, and even historical, the articulation between theory and practice is not an easy exercise, for this reason prominent pedagogues such as John Dewey, in the last century, insisted on "teaching based on the real problems of society, on the development of reflective thinking and on learning democratic participation" (Yáñez de Aldecoa, 2022, p. 2).

Faced with this situation, different pedagogical options have been developed in higher education that "focus on relevant real-life challenges, authentic and open to trigger learning" (Van den Beemt, 2022, p. 29), taking into account the different contexts that need effective solutions, as well as a reconfiguration of teaching that, from an experiential practice, generates the necessary competencies demanded by the rapid social and technological changes of the 21st century.

In this highly changing social and educational environment, Challenge-Based Learning (CBL), understood as:

> An inductive method of learning with real challenges, which provides conditions and motivation to introduce new concepts and reinforce those already known. In which the problems are designed in such a way that, in order to be solved, students should be exposed to new course materials (IFE Observatory, 2015, p. 10).

In this way, an efficient and effective pedagogical mediation is presented, which places the student face to face with reality, with problems and situations that affect companies in their daily life, while deriving a contextualized and situated learning with an innovative character for the education of the present time.

Based on these inputs, some universities have found in this methodology a possible path that offers new formative perspectives for managers. This challenge methodology was initially proposed by Apple in 2008, as an experiential learning perspective, in which students participate in immersive experiences where they apply solutions and learn from real situations (Leijon, 2022). Based on these approaches to experiential learning, institutions in Latin America such as the Tecnológico de Monterrey have been pioneers in developing a challenge-based learning proposal, assuming this methodology as "a pedagogical approach that has been incorporated in areas of study such as science and engineering, which demands a real-world perspective because it suggests that learning involves the student's doing or acting with respect to a subject of study" (Observatorio IFE, 2015, p. 7) .

Experiences such as that of the Instituto Tecnológico de Monterrey have become educational models for the area of administrative sciences that generate great interest and impact, and open perspectives for other faculties of administration that wish to be at the forefront in the processes of pedagogical innovation. The ultimate objective of these reflections and experiences is to achieve a pertinent, efficient and effective education that will allow the graduate of these programs to be adequately positioned in those organizations or enterprises that require their services, contributing significantly to the achievement of the objectives, goals and strategies of the companies in their specific contexts.

Accordingly, the purpose of this review article is to present the pedagogical contributions of challenge-based learning to the training of business administrators, making a literature review in a time window between 2019 and 2023, in articles found in the bibliographic databases Scopus and ScienceDirect. It is a research that is justified considering the novelty of the methodology and its impact on the training of future managers, an aspect still little examined in certain contexts such as the Colombian education. This research by its nature contributes to the state of the art in an area of knowledge quite relevant for the education of the XXI century, as well as opens the discussion on the contributions of this innovative educational approach.

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The main research questions for this systematic review are: What have been the pedagogical contributions of challenge-based learning to the training of new business managers? Y
What results have been obtained in those educational experiences that have applied challenge-based learning?

Background: Recognizing Challenge-Based Learning.

Education has been overcoming the stages of traditional learning and in recent decades has turned towards experiential models. In continuity with the above, in recent years, technology-mediated educational environments have been gaining strength, an aspect that has led to consider that the methods, didactic strategies and pedagogical approaches that were useful to generate critical people, may now require restructuring in view of the positioning of the world that young people are building. In this context, learning centered on the solution of challenges emerges, initially based on Kolb's Model proposed in 1984, where the experiential approach becomes relevant (Romero, 2010). CBL (Challenge-Based Learning), following the STAR Legacy cycle, provides a scenario that allows students to engage collaboratively in the resolution of a problem or challenge relevant to them, while giving them the opportunity for self-assessment.

This way of approaching learning has its origin in an experiential education derived from real-world activities, i.e. as a praxis that emerges from reality, but these experiences go beyond that, they build interdisciplinary scenarios that pose challenges that must be addressed by educational communities in a comprehensive manner, which often compete with their various groups or actors, who must provide practical and concrete solutions.

Challenge-based learning is approached in three phases, Engage, Investigate and Act:

> In the first, students move from an essential idea to a concrete and achievable challenge; in the next, students plan and participate in a journey that builds the foundation for solutions and addresses the necessary academic requirements; and, in the Act phase, evidence-based solutions are developed, and implemented under the supervision of the companies and communities involved. Then, based on the results, the quality of solution to the challenge is evaluated (Nichols M. C., 2016, pp. 11-13).

It is worth highlighting the encouragement of the use of technologies by students in the process and in the presentation of solutions, always being aware that there is no single answer to the solution of the challenge.

Below are some cases in the global environment that illustrate the scope of this methodology. It is the case of seven European universities in the so-called Arqus Alliance (De Stefani, 2022, p. 3), a partnership between the universities of Granada, Bergen, Graz, Leipzig, Lyon, Padua and Vilnius, supported by the European Commission under the European Universities initiative for the years 2019-2022 in which they developed challenges involving more than 40 students from all parts of Europe, whose aim was to create networks across the European Union so that students could obtain a combined degree from studies in several countries of the Union and contribute to the international competitiveness of universities. The challenges commonly set were aimed at developing Arqus Collaborative Challenges, with themes on climate change and the role of institutions and citizens in the face of these risks, which required the collaboration of students, governments, companies and communities benefiting from the projects.

Among other experiences, the one developed by the Universitat Oberta de Catalunya in association with Grupo Financiero Banorte stands out, which "provide tailor-made solutions for the company in terms of training, communication, development and competitiveness. That is why 60 short-term itineraries were designed aimed at solving specific business challenges" (Reyes, 2018, p. 12).

In Colombia in 2017, among the various proposals, the Interacpedia platform was developed, included as one of the ten best education startups in the world by EnlightED. It is an "initiative from Medellin that connects universities and students with the entrepreneurial ecosystem through a digital co-creation platform that allows transforming academic proposals into innovative projects. In this way, Interacpedia helps them to provide a real use to their theoretical approaches" (Dinero, 2017), this led them to be one of the winners of the Everis Global award, and one of those selected by MIT as well as being included in the Innovation Challenge in Latin America.

In its time Interacpedia managed to achieve interaction between universities and organizations, which allowed student projects to generate value while solving real challenges. This project began operations in January 2016, with 17,000 students and 70 universities in 20 cities in 5 countries. Today they are in Colombia, Spain, Mexico, South Korea and Taiwan, although they will soon reach 7 more countries in an internationalization plan that has signed up the markets of Canada, United States, Chile, Argentina, Costa Rica and Peru.(Observatorio de la Universidad Colombiana, 2018).

Methodology

The methodology chosen for this research corresponds to systematic literature review studies. This type of analysis differs from the traditional narrative review because it is less prone to bias, is more objective and detailed, while being more rigorous and explicit in the inclusion and exclusion criteria: "the final PRISMA-P 2015 checklist contains 17 numbered items; the items are classified into three main sections: administrative information, introduction, and methods"(Estarli et al., 2016, p. 6).

In the first phase of the research, the search databases were decided and the search process was executed according to the PRISMA guidelines for systematic reviews. The studies included in this review were the result of their selection through two search channels: one in the main collection database of Scopus and in the ScienceDirect database of Elsevier; the range of years consulted was from 2019 to 2023, the consultation was performed during the months of January, February and March 2023, the date of the last search performed was March 23, 2023.

Electronic Search Strategy

With the keywords denoted in Table 1, several iterations of the search were performed, analyzing the results and their relevance to the research questions of the systematic review. The following equation shows the search used in Scopus: TITLE-ABS-KEY ((("challenge based learning") AND (management) AND (higher AND education)) AND (EXCLUDE (DOCTYPE , "cp") OR EXCLUDE (DOCTYPE , "cr")). Then we proceed to the search in ScienceDirect with the following equation: (challenge based learning) AND (Management) AND (higher education)

The combination of words entered in the search option of each database was performed in a field, selecting in all cases TITLE-ABS-KEY, "challenge based learning" was typed in, which yielded a total of 464 results corresponding to 397 studies in SCOPUS and 67 studies in ScienceDirect. The set was then refined by applying the Subject area filter in the categories Business, Management and Accounting, Economics, Econometrics and Finance and Social Science. This procedure excluded 296 results. With the research and review articles filter, 81 articles were excluded. Finally, duplicate articles were excluded resulting in a total of 82 items for review. In addition, the reference lists of the key literature were reviewed to locate additional publications, which could not be identified by previous search strategies, finally Google Scholar was used to search for gray literature to avoid the possibility of publication bias.

Scope of the Review and Types of Publications Analyzed.

Once the process of excluding articles was completed, the title, abstract and keywords of 82 records were read, according to the following inclusion criteria: I) The terms "Challenge based learning" appearing in the title, abstract or keywords. II) Studies that refer to challenge-based learning in the field of higher education. III) Articles that go deeper into the methodology, providing conclusions on the pedagogical contribution of challenge-based learning to training in administrative sciences, economics and engineering, particularly in the professional fields in which these sciences interact with administrative processes.

In the application of criterion II, 46 records not related to higher education were excluded. This phase was carried out with particular care to ensure the reliability of the data. In this regard, the entire text of those articles that raised doubts was read. In the third and final part of the review, 14 of the 36 selected articles were removed after identifying the absence of clear or precise conclusions in accordance with the object of study.

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In order to clarify the procedure followed in this systematic review, Figure 1 shows the PRISMA flow chart generated, which summarizes the results of the phases applied.

Figure 1. PRISMA flowchart

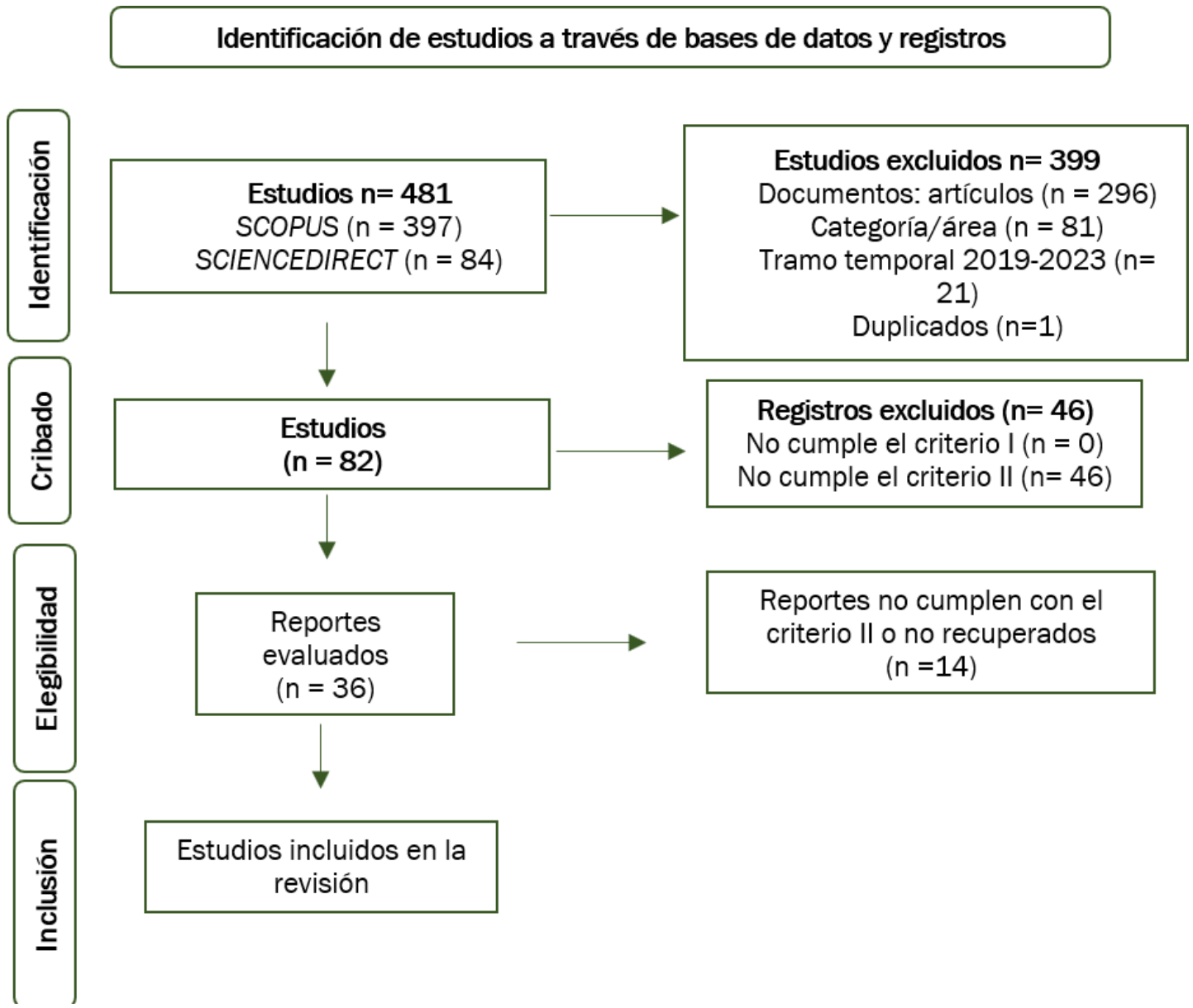

Figure 1: PRISMA flow chart. Source: Own elaboration.

Data Analysis

A total of 82 studies were analyzed for this research, all corresponded to peer-reviewed journal articles, three of them were literature reviews. The countries where there were more related publications was Mexico as shown in Figure 2. The following countries, which only have one publication in the databases analyzed were: Andorra; Belgium; Brazil; Canada; Chile; Cuba; Denmark; Ecuador; France; Germany; Greece; Peru; South Korea; Tanzania, Uruguay. This information places Colombia as a country interested in the concept of challenge-based learning for higher education programs.

Figure 2. Documents by country.

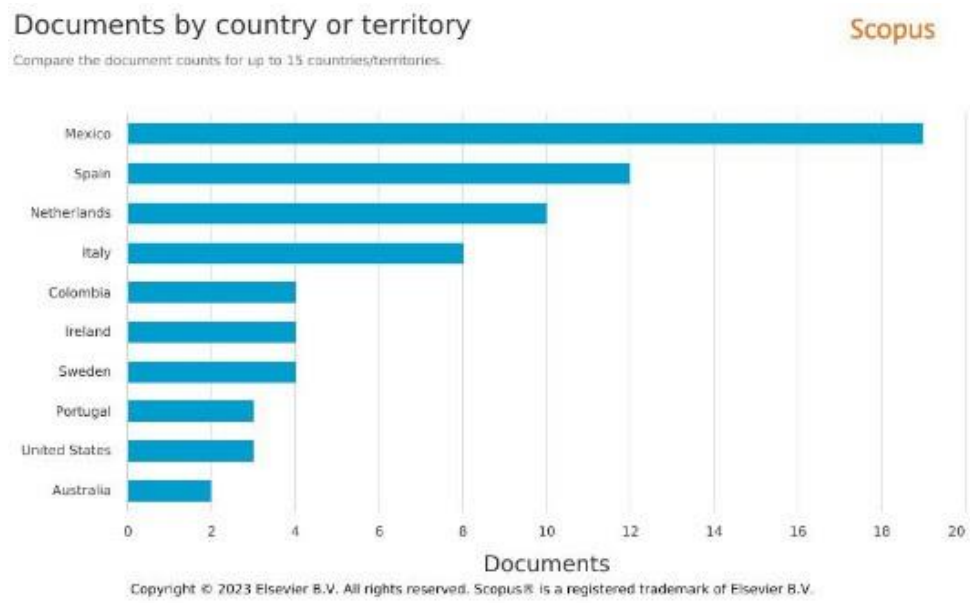

Figure 2: Overview of publications on challenge-based learning.

The subject areas of the published literature give us a clear idea about the application of challenge-based learning and those disciplines of knowledge that use this methodology prominently: social sciences, engineering, computer science, business, management and accounting, energy, environmental sciences, psychology, health professions, arts and humanities, medicine, nursing and mathematics. See figure (3)

Figure 3. Documents by area of knowledge

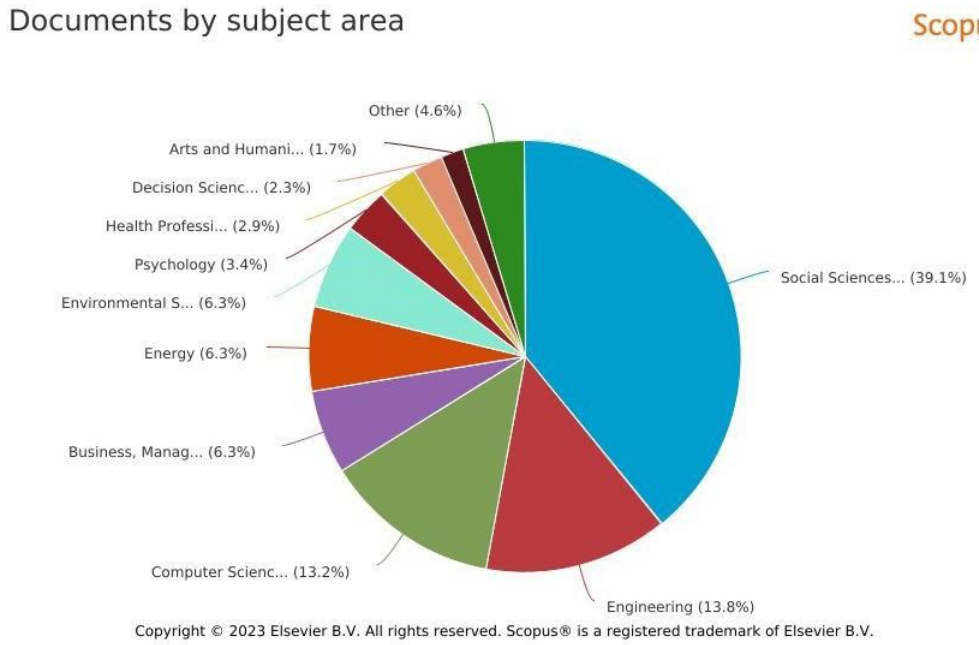

Figure 3: Description of areas of application of challenge-based learning

Keywords used

Exploring the keywords in the literature gives an idea of what relevant topics are being researched and which disciplines are using challenge-based learning. The keywords used for each article were analyzed with the VOSviewer program (van Eck & Waltman, 2010). This system allows the detection of co-occurrence which identifies the number of papers in which the keywords were used together (see Figure 4.).

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The execution of VOSviewer showed that the most important keywords were: challenge based learning, higher education, students, learning, interdisciplinarity, sustainability, experiential learning, educational innovation, training, technology, entrepreneurial skills, socially oriented education. The visualization shows that challenge-based learning has focused on engineering and computer science, and the concept is also linked to different branches of study such as psychology and human sciences.

Figure 4. Key words within the literature reviewed.

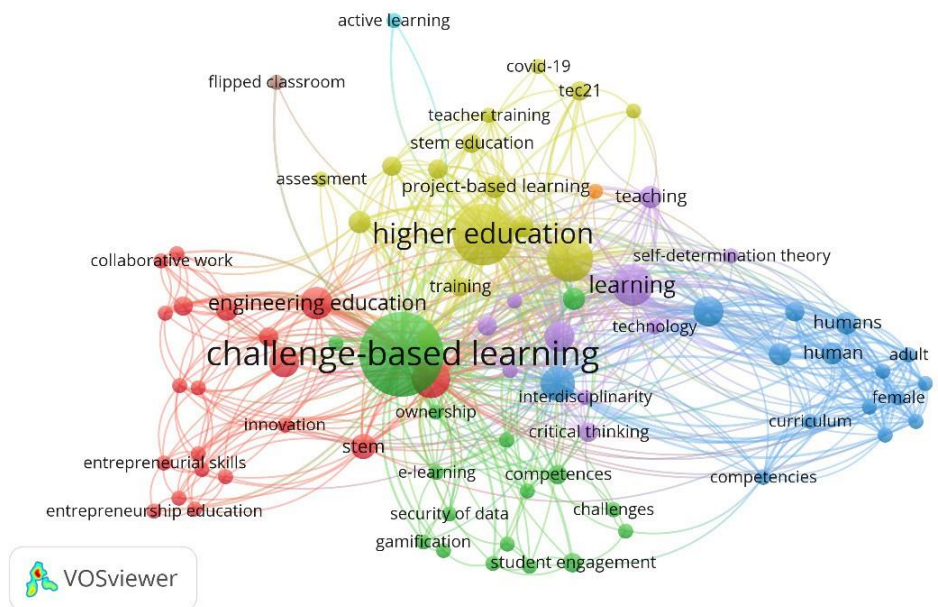

Figure 4: VOSviewer visualization of keywords within the literature of the reviewed SCOPUS database.

Additionally, Design Thinking appeared as a derivation of management disciplines that use challenge-based learning.

Figure 5. VOSviewer visualization, timeline keywords

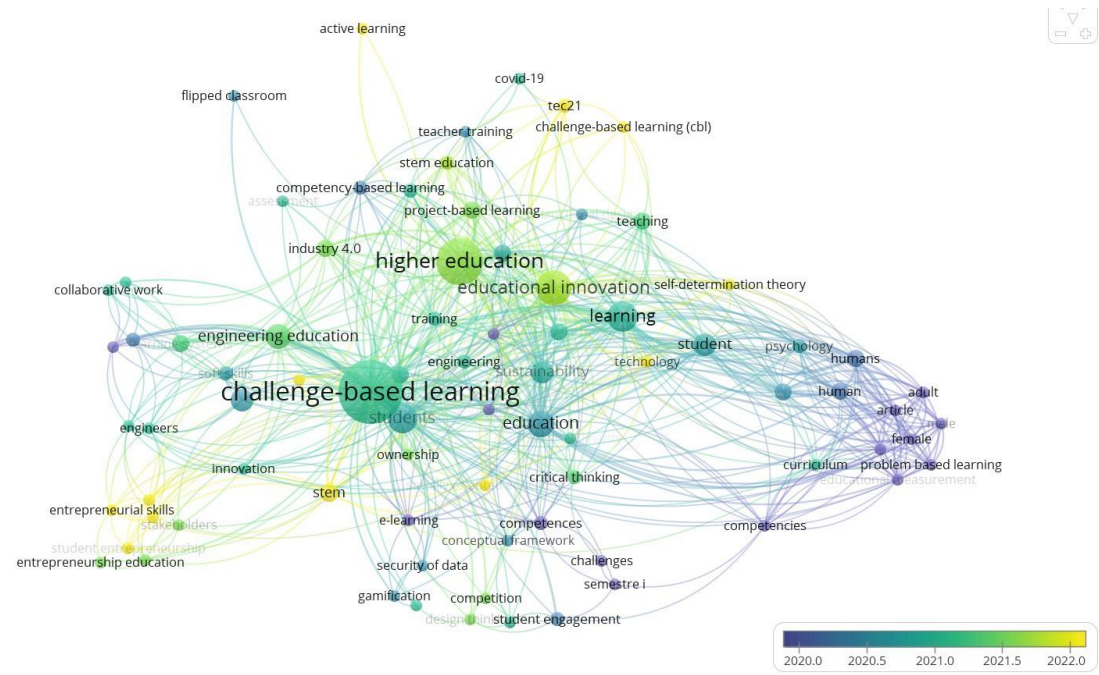

Figure 5: VOSviewer visualization of keywords within the literature of the SCOPUS database reviewed.

Regarding the analysis of the timeline and evolution of the keywords, Figure 5 allows identifying the new terms involved in the literature and the relationship with challenge-based learning, such as knowledge management, steam, business skills, entrepreneurship and technology.

According to the analysis carried out, the variety of disciplines associated or with a significant relationship with challenge-based learning is evident. In the same vein, the analysis of summaries, introduction and keywords performed with the atlas ti 22 system shows a strong link between challenge-based learning and other learning models, as shown in Figure 7.

On the other hand, the analysis of documents carried out in atlas ti 22 made it possible to elaborate the following figure with the word cloud used in the selected articles. This finding demonstrates the impact that ABL is having on higher education.

Figure 6. Word cloud of the selected literature using Atlas ti22

Figure 6: Word cloud using the keywords of the selected pieces. Elaborated with Atlas ti22

Research Methodologies Used in the Analyzed Literature

The data on methodologies analyzed in the different studies show that the vast majority are qualitative methods, with descriptive case studies standing out. This is due in part to the experiential and experiential element that characterizes challenge-based learning, where individuals are subjected to practices and challenges in business contexts that demand participation.

Table 1: Methodologies used in the analyzed pieces

Methodology	Reviewed literature that applies.
Descriptive case study. Qualitative	(Franco, 2023); (Christensen, 2021); (Pons-Valladares, 2022); (Eraña-Rojas, 2019); (Vázquez-Villegas P. R.-C.-C.-P.-P.-L.-A.-A.-H., 2022); (Colombari R. &., 2022); (Rodríguez-Chueca, 2020); (Pérez-Sán- chez, 2020); (López-Fraile, 2021); (van den Beemt, 2023) (Sidhu, 2021); (Yáñez de Aldecoa, 2022); (Sukackė, 2022); (Mesutoglu, 2022); (Abril-López, 2021); (Román-Calderón, 2021); (Md. Khambari, 2019); (Dieck-Assad, 2021); (Martin, 2021); (Perez-Rodriguez, 2022); (Yoorubsuk, 2022); (Carreno, 2021); (Lozano-Rodriguez, 2020); (Pepin, 2021); (Nguyen, 2023); (Sierra-Diaz, 2021); (Recke, 2021); (Kohn Rådberg, 2020) (Colombari R. D., 2021); (Membrillo-Hernandez, 2021); (Bombaerts, 2021); (Mele, 2022); (Koeper, 2020); (Fernandez Rivas, 2022); (Lopez-Cau-.dana, 2022); (Luna, 2022); (Ma, 2022); (Guitert, 2020); (Rodríguez, 2019); (Jordán-Fisas, 2022);(Gudonienė, 2021); (Campos, 2022); (La Fleur, 2021); (Padova, 2020); (Hendrickx, 2022); (Gutiérrez-Martínez, 2021); (Vargas-Mendoza, 2019); (Kukreti, 2019); (Pornpongtechavanich, 2021); (Högfeldt, 2019); (Vázquez-Villegas P. M.-M.-M.-R.-H., 2023); (Portuguez Castro, 2020); (Vilalta-Per- domo, 2022); (Tang, 2020);
Quantitative	(Colombelli, 2021); (Karagiannis, 2020)
Mixed method	(Lau, 2021); (Lara-Prieto, 2023); (Necchi, 2020)
Literature review	(Leijon, 2022); (Conde, 2021); (Gallagher, 2020)

Table 2: Methodologies used in the analyzed parts

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Analysis of Results

The analysis of the pieces allows us to find that there exists in the literature conceptual approaches and other similar orientations to challenge-based learning, because there is a "wide range of frameworks, hybrid approaches and classroom interventions that use this term to disseminate this approach" (Gallagher, 2020, p. 1). Methodologies such as problem-based learning, design-based learning, activity-based learning, place-based learning, and activity-based learning are some types of recurrent methodologies in the literature reviewed that blend with or are familiar to challenge-based learning.

Challenge-based learning differs from other approaches in that, instead of focusing on a problem to be solved (Van den Beemt, 2022), or a central question predetermined by someone else that needs to be answered (Yáñez de Aldecoa, 2022), it focuses on the innovative resolution of the challenge posed, which, in turn, is determined dynamically among all participants.

Once the scope, methodology and definitions used in the literature reviewed were explored, some significant understandings and findings were identified that respond to the research question formulated. Next, the contributions of CBL to the education of new business managers are presented, an aspect that reflects a field of research in full evolution.

a) Interdisciplinarity as a Formative Goal

One of the fundamental characteristics of the CBL is its interdisciplinary and multidisciplinary foundation obtained from the results of the work carried out by students from different careers who approach the challenges and their solution from different disciplines. Pons Valladares (2022) focuses on learning alternatives for work development in architecture students in conjunction with engineers and business administrators to advance innovation projects of spaces with new materials. Eraña-Rojas (2019) integrates the fields of medicine, law and marketing, Vázquez-Villegas (2023) involves his students in the preservation of biodiversity, the management of environmental resources and the preservation of cultural heritage, providing identity to communities through projects based on the Sustainable Development Goals.

Rodriguez-Chueca (2020) applies concepts related to sustainability and circular economy in courses of environmental management, business administration, environmental engineering and industrial ecology, in order to think together how to bring progress and development to certain regions, but with an ethically sustainable and rationally justified awareness of environmental care. Collombelli (2021) works in collaboration with 73 PhDs from different areas in an entrepreneurial education program that integrates the results of research in very varied fields to understand the idea of generating productive processes and economic growth, but built under the paradigm of "complexity". Along the same lines, Mesutoglu (2022) explores the multidisciplinary work of engineering, management and physics students to demonstrate how organizations benefit when these three areas are integrated to contribute to the quality and improvement of products.

The idea of viewing administrative processes from an interdisciplinary perspective is perhaps one of the most relevant contributions of Challenge-Based Learning. We know that teamwork is one of the key competencies in the 21st century, but by taking the step of forming interdisciplinary teams to solve the challenges of organizations, we perceive an evolution in the way of understanding the planning, management and control that underlie the production of goods and services that society demands.

b) Educational Innovation

Educational innovation is conceived as the introduction of new paths that consolidate changes in education with the possibility of improving its quality; in this attempt, technological tools are used in combination with new curricular processes associated with highly specialized work teams, which intentionally and in a planned manner, guide the transformation of educational practices.

The studies of educational processes developed with CBL (ABR) show how teachers become subjects who seek different methods to think about their role as professionals who train new administrators. ABR involves educating and being educated, understanding and being understood in the changes, activities and events in which students are immersed, in order to find ways together to overcome the limitations and obstacles that arise in the challenges. Education is understood, then, as "an attitude, a process of inquiry of new ideas, proposals and contributions, made collectively, for the solution of problematic situations of practice, which will bring about a change in the contexts and in the institutional practice of education" (Macanchi, 2020).

These same ideas are supported by Lara-Prieto (2023), when she uses technological innovations using 3D printers to apply challenges with more than 1,000 students during two years in the areas of industrial engineering, business, mechanics and mechatronics, generating a synergy between teachers from different disciplines who teach immersed in the challenge, side by side with the students. In turn, Yáñez de Aldecoa (2022), from the social sciences, allows us to understand the changes in management teachers when using ICTs in a project to strengthen cultural heritage using the TPACK model (technological and pedagogical knowledge of content). These experiences show how RBA re-signifies what it means to teach in the 21st century, and also invites us to reflect on the search for better conditions for student learning.

c) Business Skills

Entrepreneurial skills are behavioral and consist of sets of actions developed by organizational managers, who effectively carry them out, and which lead companies to the achievement of certain expected results. In the current context, entrepreneurial skills respond to the renewal of labor markets and the need for the type of professionals they require. In business schools, these types of skills used to be developed with greater emphasis during internships in organizations, but the ABR reveals how these skills are brought into play in every challenge to be overcome. In other words, students from the first semesters are linked to challenges that keep them competitively trained in business skills that gradually unfold and evolve, thus materializing the training paradigm promoted by current knowledge societies that define education as a lifelong exercise, and not only as a set of tasks to be performed in the time of "business practices" (Campos, 2022).

The different research reviewed accounts for these new educational developments. Mele (2022) proposes that CBL-driven student entrepreneurship is relevant in those universities in which the mechanisms used to promote managerial skills through university incubators of business ideas are analyzed. Fernandez Rivas (2022) provides a challenge-based learning context for developing persuasion and empathy as fundamental entrepreneurial skills. The mastery of "soft skills" is thus not an object of study at the end of the degree, but an essential element that is part of the comprehensive training of the new manager. Kukreti (2019), implemented a training program with CBL for the creation of new companies where students were sought to expand emerging innovation by acquiring entrepreneurial skills in human talent management, leadership and intellectual capital development.

Colombelli (2021), for his part, investigated the implications of CBL programs on entrepreneurial skills focusing on financial literacy, creativity and planning. Luna (2022), developed ABR experiences where he established the teaching of integration, trust, communication and collaboration competencies for business programs; the central objective was to strengthen technical knowledge and personal competencies to face an adequate adaptation to the challenges posed by the new digital era. Finally, Portuguez Castro (2020), worked on the implementation of an online course on entrepreneurship using the CBL with a group of students from various disciplines. This experience showed an effective way to reconcile the training objectives of business administration teachers, who must meet the demands of the curricular designs established by the university, with the needs of management skills that students must acquire during their time at university.

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d) **Sustainability**

Concern for the environment is gaining more and more strength every day, proposing new visions in all professions, which affects the political, cultural, economic and social spheres. The Sustainable Development Goals proposed by the UN are a clear expression of this new era of humanity, where companies must commit to the rational use of available resources, but with the ethical awareness that it is necessary to preserve the planet for the next generations. Portuguez Castro's study (2020) shows a group of 20 students from various disciplines who worked on challenges framed in the SDGs; against this background, the proposals developed provided sustainable business solutions aimed at solving local and national problems faced by various communities. In this vein, Membrillo-Hernández (2021) reflected on the implementation of sustainability as a transversal competence that should be cultivated in the training of managers, taking into account the balance that must be maintained between economic growth, care for the environment and quality of life.

Finally, (Ma, 2022) develops CBL in sustainable fashion design education using a graduate course in South Korea. In this context, the principles of business administration were combined with processes characteristic of industrial engineering and certain concepts of innovative product design, to understand how growth and transformation of organizations is possible, through the recognition of new customer sensitivities, the situation of emerging markets inspired by care for the planet, and current marketing mechanisms aimed at attracting new audiences seeking products in harmony with the idea of sustainability.

e) **Research Training in Administrative and Business Sciences**

In higher education, particularly in the field of business administration, the relevance and pertinence that CBL brings to consolidate research processes is evident. Solving a challenge implies resorting to the available literature that makes it possible to illuminate possible courses of action. But it also implies understanding new conceptualizations and discourses of the world in which we live, which pushes the student to place him/herself at the frontiers of knowledge (Martin, 2021; Lozano-Rodríguez, 2021; Membrillo-Hernández, 2021; Gallagher, 2020; Bombaerts, 2021). Along the same lines, different challenges described how the solutions demanded by 4.0 industries became real problems that triggered research processes in subjects such as Operations Management, a key topic for business students (Vilalta-Perdomo, 2022).

Other challenges in this same direction of new technologies, digital transformation and smart cities, posed to students the need to update their knowledge in systems and digital mindset to respond to the requirements of companies of the fourth industrial revolution (Pons-Valladares (2022). Sidhu (2021) describes the proposal for students to design technology-based applications to solve real problems of the new business era. Lara-Prieto (2023) promotes business projects in which technological innovations are made that resort to 3D printing engineering, DC motors and microcontrollers, under this orientation students had to deepen on Lean Thinking and Manufacturing; (Pérez-Rodríguez (2022) integrates learning in computer-assisted technology projects in the field of industrial engineering for solutions oriented to sustainable development.

Bombaerts (2021) established a field of study of ethics in technology, inviting students to investigate aspects of moral philosophy, social architecture and philosophy of technology, to understand the link between business administration and technological development with ethical criteria and social responsibility. Fernandez Rivas (2022), on the other hand, analyzed empathy and persuasion in entrepreneurial students with science and technology products, and Luna (2022) developed business engineering projects that enabled research on different aspects of collaboration and communication that are required in the new digital era, at this point students had to delve into disruptive technologies. Finally, Guitert (2020) conducted a project led by administrators for the development of basic digital skills for unemployed citizens, an aspect that required research on a wide variety of disciplines such as: social economy, databases and analytics, programming languages and collaborative leadership.

Conclusions

This research focused on the review of the published literature on the pedagogical contribution of Challenge-Based Learning to the training of business administrators, the analysis yielded several findings on the important potential of this educational methodology to renew the pedagogical processes required by the faculties of economic and administrative sciences. In a changing environment such as the one we live in, the most significant breaks are oriented to the articulation between knowledge acquired in the university context and the needs of the organizations, or, in other words, to shorten the existing gap between the theoretical knowledge of the administrator in training and his or her real practice.

This link between theory and practice materializes in certain integrative understandings of the managerial and management processes that the business administration student must master, as well as certain competencies that he or she must put into practice in the different scenarios of today's organizations. Challenge-based learning contributes to these two formative objectives. The inter- and multidisciplinary vision that CBL develops in students stands out significantly. Most of the researches consulted report the holistic and organic learning that is acquired through the interaction between different sciences that study topics of entrepreneurship, labor, product, process and service innovation. The different findings, therefore, demonstrate how students, acting under the concurrence of different professions to solve a challenge, acquire an added value to their training through the appropriation of a much more complete organizational knowledge than the one they would have interacting only among managers.

The CBL also offers the possibility of developing certain skills that are determinant in the XXI century, such as critical thinking, creativity, collaborative work, problem solving and mastery of digital technologies. These skills are essential for the new manager to assume roles, functions and various tasks within organizations, as well as to formulate processes and operations with rationally justified criteria from the practices carried out, which is called a multivalent and multifaceted manager who has enriched his training based on visions that emanate from the paradigm of complexity.

Another of the competencies provided by the CBL is oriented to the consolidation of the entrepreneurial mentality that should be fostered in students, and which is a reiterative aspect that appears in the challenges developed in different research studies. In this aspect, it highlights the importance of providing the new manager with a "social intelligence" that prepares him/her to be a team leader, to negotiate, to understand human emotions, to resolve conflicts, to act with ethically sustainable criteria and to provide imaginative and creative solutions that arise in the development of the challenges.

Finally, the circular economy, sustainability and sustainability, which are the basis of environmental education, are emerging on the horizon as the cornerstones of the development of future management professionals. The challenges encountered show the relevance of these formative axes that should mark the link between universities, companies, communities and the public sector. Environmental problems urgently require the development of projects, strategies and effective responses by organizations, an issue that invites us to conceive the administrator not only as an expert in resource optimization, productivity and profit maximization, but also as a person who understands the processes of social and environmental transformation that are necessary to produce an authentically human development.

The above elements are only indicators of the drifts and prospects that open up with the CBL in business administration faculties. It is a different intentionality that orients learning, and a perspective that invites us to think about a new model of business administration graduates who must be trained with other assumptions that emanate from the complexity of today's social and organizational world. This reflection is in full development, and we wanted to record these results so that the discussion does not stop.

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