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Article abstract

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Artificial intelligence and the transformation of management education

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La inteligencia artificial y la transformación de la enseñanza de la gestión

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ABSTRACT

We develop a conceptual framework to examine the potential impact of artificial intelligence (AI) and its associated technologies on five dimensions of management education. Through the analysis of the mission statement of 785 educational technology startups, we identify five mechanisms through which AI may benefit and transform the field of management education in a post-COVID-19 world. Our research is one of the first to propose a global and comprehensive framework to advance our understanding of the impact of a disruptive technology on the traditional and immutable field of higher-education, and more particularly on management education.

Keywords: Artificial intelligence, edtechs, management education

Résumé

Nous développons un cadre conceptuel pour examiner l’impact potentiel de l’intelligence artificielle (IA) et de ses technologies associées sur cinq dimensions de l’enseignement du management. Grâce à l’analyse des déclarations de mission de 785 startups de technologie éducative, nous identifions cinq mécanismes par lesquels l’IA peut bénéficier et transformer le domaine de l’enseignement de la gestion dans un monde post-COVID-19. Notre recherche est l’une des premières à proposer un cadre théorique global pour mieux comprendre l’impact d’une technologie disruptive dans un domaine traditionnel et immuable de l’enseignement supérieur, et plus particulièrement sur l’enseignement du management.

Mots-Clés : Intelligence artificielle, edtechs, enseignement du management

Resumen

Desarrollamos un esquema conceptual para examinar el impacto potencial de la inteligencia artificial (IA) y sus tecnologías asociadas en cinco dimensiones de la educación en gestión. A través del análisis de las declaraciones de misión de 785 empresas emergentes de tecnología educativa, identificamos cinco mecanismos a través de los cuales la IA puede beneficiar y transformar el campo de la educación en gestión en un mundo posterior a COVID-19. Nuestra investigación es una de las primeras en proponer un esquema global para comprender mejor el impacto de una tecnología disruptiva en el campo tradicional de la educación superior, y más concretamente en gestión.

Palabras Clave: Inteligencia artificial, edtechs, educación en gestión

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Artificial Intelligence (AI) is often considered to be a new technology that will disrupt nearly all industries in a radical way (Agrawal, Gans & Goldfarb, 2018), as it can change the business model of a company, affect its strategic orientation, and even modify the institutional arrangements of an ecosystem (Van Krogh, 2018). For instance, AI and its associated Machine Learning (ML) capabilities can automate simple and more complex tasks to free-up time for employees and managers so they can perform tasks with higher added-value to their organization. However, AI will not only disrupt businesses but also the way business is taught (Dwivedi *et al.*, 2021).

The paradigm of the current higher educational system is very much still built upon a closed model with limited space and an immutable notion of knowledge transfer from teachers to learners (Rancière, 1991). Though, digital technologies have raised plethoric challenges to such paradigm. For example, the massive possibilities of storing data on digital platforms rather than on paper forms has tremendously increased the amount of information created by humans (Watters, 2017), which in turn affects the production of knowledge. Additionally, the amount of data available questions the way knowledge is built, that is, the volume of data may compensate for the need to resort to human analysis (Anderson, 2008). For learners, computer tools based on AI technologies help free up brain resources so students can allocate these to creative and innovative activities (Pink, 2006; Serres, 2014). For teachers, a great deal of this disruption means that they will have to adapt their pedagogical methods to such new learning environment (Cavanaugh *et al.* 2016).

Although some modern tools have challenged the traditional teacher-learner model toward more open and permeable systems thanks to digital technologies (Barnes, 2020; Iivari, Sharma, & Ventä-Olkkonen, 2020; McAndrew *et al.* 2010), they mostly intend to augment the current role of the teacher rather than questioning the dominant learning model. Therefore, digital technologies and AI have yet to disrupt the existing paradigm in the broader higher education domain. As a result, we assume that this transformation can help management educators increase their role in teaching methods, personalise support for students, as well as the development of relationships with stakeholders that are both internal (collaboration with other teachers and staff) and external to the school (collaboration with companies, professionals and partner schools around the world). Such need for change may become even more pressing in a post-COVID-19 world where distance learning will gain considerable momentum (Barnes, 2020; Iivari; 2020). The COVID-19 pandemic has also emphasized the great digital divide between those who have the abilities to develop their skills through digital technologies versus those who do not (Iivari, Sharma, & Ventä-Olkkonen, 2020).

The objective of the endeavor above may eventually be enabled by the immense disruptive power of AI and its associated technologies in the field of higher education (Dwivedi *et al.*, 2021). So far, several scholars have examined the impact of digital technologies on higher education but very few have focused on the specific role of AI, despite its radically disruptive capabilities. Our contention in this research is that AI surpasses all existing digital technologies and thus holds the promises to disrupt management education in an unprecedented way and will trigger a shift of paradigm through reconfiguring the role of teachers and learners, and the ways knowledge is acquired and shared. Therefore, our study examines the potential impact of AI focusing on Higher Education with a view to studying the implications for management education, and raises the question of *how AI may enable a shift of paradigm through the transformation of management education*. Specifically, our main objective is to investigate the areas of Higher Education which will be disrupted by AI and to assess how these disruptions may transform the field of management education. Given that AI technologies are only beginning to permeate the information systems of many higher-education institutions, our empirical setting focused on the emerging AI-based tools and systems as they were being developed in educational technology startups (Edtechs thereafter). We used Edtechs as a population of interest because AI and ML are recent technological advancements that are more inclined to embed in organizations that are at the forefront of technological innovations. We content analyzed the mission statement of 785 Edtechs to identify the core elements of their mission which may disrupt current practices in management education in ways that shift the traditional paradigm of the field.

This research is organized as follows. First, we synthesize in the theoretical background section the findings from our systematic literature review that aimed at assessing the current research on management education and how it can potentially be impacted by disruptive technologies. In so doing, we identify the shortcomings of the field and construct the five main aggregate dimensions that in turn will constitute the framing pillars for our empirical model. Then, we provide a description of our methodological approach for collecting and analyzing the data in the 785 Edtechs' mission statements. Third, our findings are surfaced around the constructed AI mechanisms and how they shape the shift in the management education paradigm. Finally, we complement our analysis by formulating a set of propositions on how AI technologies may advance management education.

Theoretical background

We performed a systematic literature review which is "a research method and process for identifying and critically appraising relevant research as well as for collecting and analyzing data from said research" (Snyder, 2019, p. 334). The systematic review scrutinizes, synthesizes, and extends a body of literature in the same substantive domain (Cortez *et al.*, 2021, Palmatier *et al.*, 2018). Following a set of predetermined guidelines and steps, the systematic literature review provides collective insights through theoretical synthesis, increases methodological rigour, and helps develop a reliable knowledge base through synthesising and accumulating contributions from a range of studies within a specific discipline. Table 1 shows the stages of our systematic reviewtable.

TABLE 1

Stages of the Systematic Literature Review

Stage 1: Planning the Review	Phase 1: Selecting the review panel
	Phase 2: Selecting the keywords
	Phase 3: Selection of the database
Stage 2: Conducting the Review	Phase 1: An in-depth examination of the articles' titles, abstracts, and keywords.
	Phase 2: An in-depth reading of the full text, searching for relevant theoretical frameworks.
	Phase 3: Consulting the research panel for the final sample validation.
Stage 3: Thematic Analysis	Phase 1: Building a protocol for coding and structuring the key insights provided by the articles in our final sample.
	Phase 2: Performing a qualitative analysis including an "open coding" and "axial coding".
	Phase 3: Identifying the main categories and key aggregate dimensions of our empirical framework.

Given the large variance in the definitions of AI and its associated technologies in the literature, we have selected specific definitions that fit with the context of our study. In our research, the notion of artificial intelligence (AI) is based on the definition taken by Agrawal from the Oxford English Dictionary as "the theory and development of computer systems able to perform tasks normally requiring human intelligence" (Agrawal, 2018, p.3). Machine Learning (ML) is defined as "a branch of artificial intelligence (AI) and computer science which focuses on the use of data and algorithms to imitate the way that Humans learn, gradually improving its accuracy"[1]. In addition, "Machine learning is a form of AI that enables a system to learn from data rather than through explicit programming" (Hurwitz and Kiersch, 2018, p.4). In addition, Big Data is "any kind of data source that has at least one of four shared characteristics, called the four Vs: Extremely large volumes of data, the ability to move that data at a high velocity of speed, an ever-expanding variety of data sources, veracity so that data sources truly represent truth" Hurwitz and Kiersch, 2018, p.6). Higher Education (HE) is defined as "education at a college or university where subjects are studied in great detail and at an advanced level[2]." In the following literature review, we aim to establish a state of knowledge linking the issue of AI, Big Data and digitalisation with management education: what do we know from the research produced on this topic? What are the key elements that stand out? These first questions aim to identify and define the key elements of the management education paradigm, at the heart of our research question. Further, we highlight the issues raised by the development of AI in management education. The aim is to assess to what extent the deployment of AI has an impact on the transformation of management education.

Big Data and AI in higher education

The emergence of AI and Big data in HE is a recent phenomenon that lacks both conceptual and empirical research (Hinojo-Lucena *et al.*, 2019). In a bibliometric analysis of the scientific literature, Hinijo-Lucena *et al.* (2019) show that the most cited articles between 2007 and 2017 focus on two main themes: 1) development of virtual tutoring to improve learning; 2) use of intelligent systems to predict student mood and learning style. The first theme questions the role and place of tomorrow's teacher alongside intelligent machines. The second theme questions the personalization of learning and more generally the performance of the tools and methods proposed to students. More generally, both themes question the identity of the teacher, the way of learning and the control of learning by the learner, but still conceal many submerged educational issues and allow us to imagine the extent of the underground transformations at work in the field of HE.

To explore the underside of the iceberg, we do a thorough review of the extant education management research to assess the current state of the field in relation to the use of digital technologies. In so doing, we identify the key dimension of management education that would be more likely impacted by the emerging digital transformation and implementation of digital technologies. Using an inductive approach, we reviewed over 100 articles dealing with digital technologies and education. Our literature review reveals that five areas in the sphere of education management will most benefit from digital transformation including nature of knowledge, learning processes, methods and tools, learning spaces, and teachers. These five key dimensions were in turn incorporated to form our theoretical framework. Then, our empirical investigation turns to exploring how the adoption and implementation of AI, as a disruptive, cutting-edge digital technology, may benefit and transform the key dimension of management education as portrayed in our theoretical framework. In table 2, we propose an overview of the themes and the related issues in this emerging area.

Nature of knowledge to be learned

Big Data and AI are based on the further development of knowledge. The current development of new digital technologies in HE raises questions similar to those asked when books dispossessed scholars of their role as producers and disseminators of knowledge: what should be done with this immense external storage capacity for the information produced? Which pieces of information are necessary to allow students to deepen their knowledge of a subject, to the point of eventually becoming an expert? How durable is the knowledge acquired? (Serres 2014; Watters, 2017). In this way, future knowledge development relies on the mobilization of three forms of memory: human memory (partial, contingent, malleable, contextual, erasable, fragile), material memory (permanent, stable, unchangeable) and digital memory (easy to erase, stored in files that may become obsolete, relying on electricity and batteries that are rare elements dependent on the environment and politics) (Watters, 2017). The combination of these three memories is a source of complexity and fragility.

Furthermore, if quantitative data production takes precedence over qualitative production, our collective memory may be at risk in this abundance of digital information (Boyd and Crawford 2012; Droll *et al.*, 2017). With this growing body of data, researchers will thus have to be able to avoid misinterpretations: the models discovered may be false (Prinsloo *et al.*, 2015). They will also play a very important role in rigorously cross-referencing public and private data to produce quality statistics on economic behaviour (Einav and Levin, 2014).

1. "What is Machine Learning?", IBM Cloud Education, https://www.ibm.com/cloud/learn/machine-learning. accessed on 06 September 2021.

2. Definition of higher education from the Cambridge Academic Content Dictionary, Cambridge University Press, also available on https://dictionary.cambridge.org/dictionary/english/higher-education, accessed on 6 September 2021.

TABLE 2
Didactic and pedagogical issues of AI and big data in higher education

Didactic issues	
Nature of knowledge to be learned	• The transformation of the definition of knowledge, the way it is constructed, and the reading of reality (Anderson, 2008; Boyd and Crawford, 2012; Watters, 2017); • The development of new knowledge based on: - The combination of three forms of memory: human, material, digital (Watters 2017); - The ability to search, collect, analyse digital data (Anderson, 2008; Boyd and Crawford 2012; Einav and Levin, 2014; Grimmer, 2015; Prinsloo *et al*. 2015; Kosinski *et al*., 2016; Droll *et al*. 2017).
Pedagogical issues	
Learning process	**The learning process is defined by:** • Easy access to digital tools (Brown, 2015); • The development of a critical, creative, inventive, reflexive, emotional mind (Sarasvathy, 2003; Pink, 2006; Serres, 2014; Alexandre, 2017; Cavanaugh and al., 2016); • Multidisciplinarity and experiential learning (Cavanaugh *et al*. 2016; Alexandre, 2017); • High personalization of learning based on a better understanding of the learner's cognitive processes (Boyd and Pennebaker, 2017); • Digital interconnections and interactions between the learner and the members of his or her learning community via digital platforms and social networks (Al-Dhanhani *et al*. 2015); • Thorough search for educational efficiency (Maritz, Brown, and Shieh, 2010); • Learning assessment tools based on the use of these new technologies (Calderón and Ruiz 2015; Manero *et al*. 2015; Fox *et al*. 2018).
Tools and methods	***For teaching:*** • Concept of "flow of learning" based on a combination of small-group learning and digital tutoring/mentoring (Stevenson and Zweier, 2011; Redfield and Larose 2010; Cavanaugh 2017; McAndrew *et al*. 2010); • A wide variety of tools that accompany a pedagogy based on the use of multi-media (Jones and Lau 2010), in particular: - digital mentoring via chatbots (Redfield and Larose 2010; McAndrew *et al*. 2010; Cavanaugh 2017); - digital books and MOOCs (Al-Atabi and DeBoer 2014; Passarelli 2014; De Waard *et al*. 2011; Cirulli *et al*. 2016); - E-conferences (Shi and Morrow, 2006); - Video games and virtual reality (Martín-San José *et al*. 2015; Cavanaugh, 2017); - Collaborative platforms and social networks (Al-Dhanhani *et al*. 2015); - The combined management of structured and unstructured data (Bryant 2017). ***For management education:*** • Machine learning to reinforce the quality of the university's personalized response to the student's learning needs (Daniel 2015; Yates and Chamberlain 2017; Grimmer 2015).
Learning spaces	• Learning spaces: - Are diverse, combining private and public, personal and professional spaces (McAndrew *et al*., 2010); - Facilitate the active, engaged use of digital technologies (Seely and Adler, 2008; Tritz, 2015); - Help the learner define what he or she wants and wants to learn by interacting with members of the learning community (Joksimović *et al*. 2015a, 2015b).
Teachers	• The evolution of the teaching profession is defined by: - The nature of the piloting of academic programs and student support (Tritz, 2015; Shulman, 2016); - The formation of multidisciplinary teams (Tritz, 2015; Brown, 2015 Shulman, 2016); - The definition of new forms of leadership based on the use of AI and Big Data technologies to support students in a personalized manner using a wide variety of data and technological tools according to the specific needs of the learner (McAndrew *et al*. 2010; Shulman 2016).

Learning process

Like books, AI and Big Data can contribute to improving learning by providing a rich and easily accessible digital environment for learning different subjects, such as mathematics (Brown, 2015). Additionally, the use of these technologies in HE frees both time and brain resources allocated to certain technical and rational knowledge, making it possible to focus attention on the development of imagination, creativity, inventiveness, reflexivity and emotional awareness (Pink 2006; Serres, 2014). Other researchers stress that the emergence of Big Data and AI in all sectors of society will force educational institutions to radically transform themselves—something they have not been able to do for several centuries—by focusing more on experimentation and the development of an intelligence which is no longer based on memorization.

The qualitative use of Big Data leads to more personalised study pathways by improving, for example, students' knowledge of their own personalities, which means not just a fixed description of their characteristics but also understanding their cognitive processes, that is, their ways of acting, thinking and expressing themselves (Boyd and Pennebaker, 2017). Digital technologies, including social platforms and networks, play a crucial role in strengthening collaborative and social learning by improving information selection, enabling learners to connect with the right people and motivating community members who contribute and collaborate (Al-Dhanhani *et al*., 2015). The mobilization of these new learning resources therefore questions the nature of the knowledge produced and the evaluation of learning (Calderón and Ruiz, 2015; Manero *et al*., 2015; Fox *et al*., 2018).

Tools and methods

Technologies related to AI and Big Data are available in the form of a wide variety of tools that support blending learning-based pedagogical approaches (Jones and Lau 2010). Stevenson and Zweier (2011) mention the "flow of learning" concept, which is based on mixing faculty learning (small groups) with help from a teaching assistant and/or a tutor. Mentoring and/or intelligent tutoring via a chatbot allows the student to progress towards his or her learning goals (Redfield and Larose 2010; Cavanaugh 2017; Hinojo-Lucena *et al*. 2019).

Mentored training is personalised and can be done remotely and at the university (McAndrew *et al*. 2010). Students build the learning experience by themselves and move along a pathway previously established with the help of their personal data (interests, previous academic background, professional background, etc.). The programme is varied and includes digital textbooks, participating in MOOCs (Al-Atabi and DeBoer, 2014), social platforms and networks (Al-Dhanhani *et al*. 2015), E-Conferences (Shi and Morrow, 2006), and carrying out assignments based on structured and non- structured data (Bryant, 2017). Students also participate in certain activities, for example, courses based on experimentation in the form of small group practical projects guided by a teacher, participation in a video game (Martín-San José *et al*., 2015), or immersion with total interaction via virtual reality: "immersive learning will surpass active learning, which in its day surpassed passive learning in effectiveness" (Hinojo-Lucena *et al*., 2019). At the university level, the analysis of data produced through Big Data and AI can strengthen the quality of teaching programmes, student monitoring and strategic decisions in order to adapt more quickly to educational needs (Daniel, 2015).

Learning spaces

Technology is a resource. It implies the creation of adapted learning environments, facilitating active, engaging and collaborative use of technology (Tritz, 2015). Aided by new digital technologies, learning allows learners to define what and how they wish to learn (Seely *et al*., 2008) by interacting with members of the learning community (other students, teachers, etc.) (Joksimović *et al*., 2015a; 2015b). AI and Big Data amplify the possibility of learning from different locations, whether private, public, personal or professional (McAndrew *et al*., 2010). This evolution therefore raises questions about the future definition of the university learning space (Toutain *et al*., 2019).

Teachers

AI and Big Data also offer new solutions for creating and managing academic programmes and university functions, and for monitoring students as they move along their personalised study pathway. This personalised learning system is strongly linked to the development of an organic system, which encourages interaction and the use of a diversity of data sources and technological tools adapted to the learner's specific needs (Shulman, 2016).

Big Data and AI are accelerating the transformation of an educational model traditionally tasked with "civilizing each generation of children as if they were a barbaric invasion" (Arendt, 1971). The traditional educational model is generally a closed model, limited in its space, specialized in transmitting knowledge in an authoritarian manner by one type of intelligence (that of the teacher), considered superior to other types of intelligence (that of the learner) (Rancière, 2014). Such model is disappearing in favour of an open, permeable system that moves beyond the physical limits of the learning space, crossing disciplines, and multiplying interactions with actors in the environment outside the school, as well as technological tools and ways of learning (McAndrew *et al*., 2010).

AI and big data also redefine the nature of the knowledge to be transmitted, the learning process, the tools and methods used to learn, the dedicated spaces and the role and place of the teacher. New stakeholders (i.e. computer scientist, social scientist, tech giants, or the new actors of the digital economy in education—tutors, trainers, publishers) play a growing role. In this context, the aim of our research is to observe, from the perspective of AI-Edtechs, the paradigm transformation processes at work in management education. Overall, given the immense potential of AI to disrupt the current paradigm in management education, through the five dimensions presented above, we collect data on 765 Edtechs to examine how their mission statement may disrupt and change the institutional arrangements in the field of education.

Methods

Combining top-down theorizing and inductive theory building, our main theoretical approach rests on combining top-down theorizing (Lee *et al*., 1999; Shepherd and Sutcliffe, 2011) and inductive theory building (Eisenhardt, 1989; Ridder *et al*., 2014) to explore our research question. Combining top-down theorizing and inductive theory building is more appropriate when a phenomenon is not comprehensively understood and there is little or no built theory that explains the emerging relationships between relevant concepts and the mechanisms through which these relationships operate (Christensen and Raynor, 2003). This follows Konecki's (2008) argument that in nascent research fields research serendipity, comprising both theoretical and substantive, is important (Konecki, 2008). Theoretical serendipity pertains to the unexpected possibilities of inventing and merging categories and creating new and theoretical constructions. Substantive serendipity refers to the importance of open-coding procedures which allows categories to inductively emerge. The original idea of grounded theory (i.e. Glaser and Strauss, 1967) demands a circular relationship between data collection, analysis (and presentation), and to move between the literature and the data with "scepticism, as well as interest and curiosity" and this seems appropriate for a nascent field such as the role of the AI-technology in reconfiguring and reimagining the existing education paradigm. In this respect, we uncover our key AI mechanisms which derive from the data and perform our analysis in light of the key aggregate dimension from our systematic literature review. Through the combination of these two complementary approaches of theoretical and substantive serendipity we aim at developing an empirically grounded framework that surfaces a potential shift from the traditional education paradigm to an AI-driven education paradigm.

Sources of evidence

To explore our research question, we collected data on 785 new ventures which were listed on Crunchbase and Angelist in 2019 as startups in an early funding stage (seed and series-A) and were categorized in both "AI" and "education". The final sample of 785 startups was reached after a manual cleaning of the larger sample of 1152 startups based on the two matching categories. For instance, we eliminated startups whose mission statement and activities were unrelated to education, such as training tools for specialized professions or Entreprise-Resource-Planning software companies. These Edtechs in the final sample employ AI systems and associated technologies to provide innovative tools to augment or transform education. We relied on a set of descriptions that explain the mission statements, visions, and goals of the Edtechs under study. In our analysis, we relied on the descriptions that are most relevant to how the investigated Edtechs transform the world of education through the adoption and implementation of AI. Since the descriptions are mostly provided by the startups to the two online platforms, we were aware that they represented the narratives of the mission rather than actual implementation. In the meantime, given our aim to examine the ways AI may disrupt management education, studying mission statements is relevant in that they reflect the values and aspirations of the startups (Grimes, Williams, & Zhao, 2019), and thus may well represent their strategic intentions (Crilly, Zollo, & Hansen, 2012). Consequently, mission statements are useful information in the study of how some of the main actors in the educational ecosystem intend to disrupt the field. In the management literature, mission statements have been widely used to elicit strategic intent (Bart Baetz, 1998; Klemm, Sanderson, & Luffman, 1991; Sidhu, 2003), and therefore represent an important source of information for understanding an organization's values, intent and behaviours.

Data Analysis and Coding Methodology

As our aim was to unravel the mechanisms that explain how Edtechs impact the world of education through AI adoption and implementation, we pursued a grounded theory approach to data analysis (Strauss & Corbin, 1990). The analysis process involved three main stages: 1) Identifying relevant segments of text through "micro-analysis"; 2) creating a large set of codes through "open coding"; and 3) Identifying the key themes or AI mechanisms through "axial coding", while relating these latter to the identified key dimensions from our review of the literature. Table 3 describes the three stages.

TABLE 3
Stages of the analysis process

Stage 1: Identifying relevant segments of text through "micro-analysis"	Following Strauss and Corbin (1990), the first phase started by a microanalysis, which consisted of screening the sources of evidence that have been collected to identify segments of text that were relevant to the investigated research question. This micro-analysis was performed by two co-authors independently. The authors agreed to maintain only the accounts that were consensually judged relevant to the investigated research question.
Stage 2: Creating a large set of codes through "open coding"	The second phase started by "open coding" (Strauss & Corbin, 1990), which consisted of creating a large set of codes that classify the identified AI impact accounts from phase 1. Specific codes were used to label and summarize the identified impact accounts. This process was performed by two co-authors in isolation to minimize the subjective interpretation of the data and better capture all the AI impact accounts embedded in the Edtechs database. A comparison of the two coding schemes was accomplished, resolving eventual inconsistencies between the two coders.
Stage 3: Inductive analysis of the AI mechanisms through "axial coding"	In phase 3, open coding was followed by what Strauss and Corbin (1990) refer to as axial coding, which involved grouping the large set of codes under broader theoretical categories, which we label in this paper as "AI mechanisms". These mechanisms provide plausible explanations of how the explored Edtechs impact our world through the adoption and implementation of AI.

Boundary application of artificial intelligence

In this study, we consider AI as an umbrella technology that comprises machine learning and deep learning techniques (Agrawal, Gans, & Goldfarb, 2018), whose functioning is deeply dependent upon the availability of data or "big data", that is, large-scale data made available through cloud storage (Microsoft Azure Architectural Guide, 2021). Therefore, big data and cloud computing technologies are assumed to be supporting technologies for AI and thus are mentioned in that sense. For instance, when mentioning big data as a technology in a particular service, it is assumed that the use of big data has a broader purpose such as the exploitation of these large-scale data through AI-based algorithms in the case of personalization of learning experiences.

Findings

The data offered important insights into identifying the mechanisms through which the Edtech startups disrupt the field of management education through the adoption and implementation of AI-associated technologies. Our analysis reveals that five AI mechanisms explain how Edtechs employ AI to disrupt and empower educational management. We developed these AI mechanisms in relevance to the key aggregate dimensions of our educational management generic model, and we label these mechanisms as: 1) AI-driven knowledge creation and sharing; 2) AI-enabled hyper-personalization of learning; 3) AI-maximized efficiency and productivity of learning; 4) AI-augmented learning environments; and 5) AI-empowered educators. Table 4 provides a synthesis of the achieved findings and the sample quotations from the mission statements.

Aggregate dimension: The knowledge to be learned

First mechanism: AI-driven knowledge creation and sharing. This mechanism captures how the frontiers of scientific knowledge are being expanded through novel research collaborations and creative knowledge sharing. The Edtechs deploy AI-associated technologies to bring together multidisciplinary researchers with the aim of creating synergies that result from closer links between AI and ML scholars and experts on one side, and other disciplines' researchers and specialists on the other. Despite their heterogeneity, these different actors rest on the consensus that AI and its pioneering technologies can advance significantly various fields of research including education.

AI can be deployed as a vehicle in the knowledge creation process, that minimizes the need for human intervention. The process of knowledge creation involves investigating complex phenomena and framing novel solutions to unresolved problems. Toward achieving this aim, colossal amounts of data need to be treated, processed, and interpreted; a task that turns out highly challenging and unlikely achievable by the sole human intervention. A number of contemporary educational organizations have recognized the need for tuning their knowledge creation processes with AI-based systems and tools. This does not only attenuate the need for "armies of people" to pursue research quests,

TABLE 4

Data supporting salience of AI mechanisms explaining how Edtechs revolutionize and empower our world through the use of AI.

Key aggregate dimensions from the literature review	2nd Order Concepts: AI Mechanism	1st Order Concepts: Open Codes	Representative quotes from the Edtechs data
The nature of knowledge to be learned	AI-driven knowledge creation and sharing	Multidisciplinarity emerges as a key trend in future scientific research. AI capabilities enable pushing the frontiers of multiple disciplines and research areas.	"Institute of Intelligent Systems and Robotics' is a multidisciplinary research laboratory that gathers more than six thousand organizations and 3000 investors. It brings together researchers in the fields of AI, biotechnology, education, electronics, and robotics."
		AI scholars and experts are being extensively solicited by other researchers to take an active participation in their research projects, and think of how AI can benefit these various fields.	"The Paris Machine Learning meetup' is a gathering of experts and researchers, which provides an avenue for data science and machine learning professionals to meet monthly in the Paris area and exchange with other experts and researchers from other fields such as CRM and education."
		The fields of education and knowledge management seek collaborative knowledge sharing with the fields of AI and ML to improve the existing educational and knowledge management practices.	"Collaborative Knowledge Network' is a service venture launched in 2015, based in Washington, DC. It promotes collaborative knowledge sharing in the fields of AI, education, knowledge management, ML, and mobiles."
		Exploring and implementing applications of ML algorithms in biotech and medical diagnosis relevant education.	"'Lovelace Respiratory Research Institute (LRRI)' is a research firm that offers applied research, development, and testing services. It operates within the fields of biotech, education, and health care. It uses ML algorithms to substitute for human medical diagnosis for respiratory diseases."
		Relying on AI and ML to enable new forms of content creation via social networks and crowd participation.	"'Founded in 2017 and based in Berlin, 'WRIBE' is the social network where crowd-based writing is the heart of the story. It relies on AI and ML to enable a new form of content creation."
The learning process	AI-enabled hyper-personalization of learning	Relying on AI courses are adapted to each student's learning abilities."	"'Augmental' is an educational technology solution initially targeting students where courses are adapted to each student's learning abilities."
		Using AI-based technology to enable early childhood assessment.	"'Cognitive ToyBox' Is an AI-based technological platform that focuses on early childhood assessment to help teachers uncover insights about their students."
		The emergence of personalized learning as a key trend in the future pedagogical paradigm.	"'I Dream Academy DC' is a digital school that provides students personalized learning paths based on their interests, passions, and dreams."
		AI identifies the specific needs, knowledge, and interest of students and thus guides them in their learning accordingly.	"'Teaching Future Generations' is an AI-based Mentor to guide students in their technology learning process according to their needs, knowledge and interest."
		Relying on AI to predict the fit between students and teachers, and maximize success among students.	"'Goandteach' is an AI company that helps students find the best teacher for being more successful."
Learning tools and methods	AI-maximized efficiency and productivity of learning	AI enables synthesis of educational content and course material to maximize knowledge acquisition.	"'Content Technologies Inc.' uses AI to help disseminate and breakdown textbook content into digestible 'smart' study guides that include chapter summaries, true-false and multiple choice practice tests, and flashcards.
		Using ML to improve task management for students and professors.	'Journalenders' is a German-based venture, which applies machine learning to task management to help students and professionals never missing a deadline.'
		Using AI and ML to drive inclusion at work and school.	''Forefront' is a peer to peer learning software for employers and students. It relies on AI and ML to drive inclusion at work and at school.'
Learning spaces	AI-augmented learning environments	Augmenting the medical learning environments by providing field specific AI-based translations.	''Canopy Speak' is an AI medical translator, which runs on a phrase library, using the largest corpus of pre-translated medical phrases, organized by frequently encountered procedures and medical specialties.'
		Using the AI-based optical character recognition technology to provide instant, real-time image and textual translations.	'"Textgrabber" is an AI-based system that digitizes images from any surface and translates the text on the images in almost real-time using the optical character recognition technology. It allows the user to take a snapshot of the image and select the text from the image'.
		Augmenting the medical learning environments through AI-based simulation to enable medical students perform virtual diagnosis.	''InSimu' is a Hungarian Edtech that has developed an interactive patient simulator application, allowing doctors and medical students to practice and make a diagnosis on virtual patients.

TABLE 4

Data supporting salience of AI mechanisms explaining how Edtechs revolutionize and empower our world through the use of AI.

Key aggregate dimensions from the literature review	2nd Order Concepts: AI Mechanism	1st Order Concepts: Open Codes	Representative quotes from the Edtechs data
Teachers	AI-empowered educators	AI is used to reproduce complex human behavior; performing essay automated grading.	''EdX' is a MOOC provider and a combined initiative of Harvard and MIT towards improving online education. It provides one of the leading technologies for essay automated grading.'
		AI-based technologies are used to perform a number of teaching tasks that were traditionally exclusively performed by teachers.	''Netex Learning' is a smart digital content platform that provides students with content delivery, practice exercises, and real-time feedback and assessment.'
		AI-based technologies are used to perform a number of teaching tasks that were traditionally exclusively performed by teachers.	''Carnegie Learning' uses cognitive science and AI technologies to provide personalized tutoring and real-time feedback for post-secondary education students'.
		Ai performs the tasks of assessment and curriculum adjustment on an individual basis; a task which is highly time consuming and unlikely achievable by the solely intervention of human teachers.	''Assessment and Learning in Knowledge Space (ALEKS)' is an online learning platform that relies on AI to gauge students' current knowledge on a range of subjects and uses assessment to adjust its curriculum to fill in the students' knowledge gaps.'
		Using AI to enable continuous, individual diagnostic testing to assess students' knowledge and deficiencies.	''Squirrel AI' is a Chinese Edtech unicorn that focuses on identifying what a student does and doesn't know based on diagnostic testing.'

but also help scholars and researchers figure out the right, "root-solving" problems to focus on. Here, we emphasize the element of human-machine collaboration as a key building block of AI-driven education organizations. Our conception of AI-generated education management models incorporates AI as a human augmenter, and thus sees future collaborations between machines and humans as fundamental to the sustainable functioning of contemporary educational institutions. Further, the role of AI in shaping the knowledge sharing process will depend on educational institutions' capabilities for performing precise prediction of incremental shifts in market aspirations in terms of human capital skills and competencies. As such, knowledge sharing and transfer would be directed toward equipping the right skills and capabilities, thus fulfilling organizations' needs for talented, pertinent profiles.

The Edtechs relied in their mission statements on phrases such as "collaborative knowledge sharing", "gathering of experts and researchers", and "multidisciplinary research laboratory" to outline this emerging trend for collaborative research and knowledge sharing among AI and other fields' scholars to push the limits of the existing scientific knowledge. These accounts mirror the emerging collaboration between a multitude of disciplines including management scholars and researchers from scientific disciplines.

Further, our first mechanism delineates how Edtechs deploy the potential of AI to advance the way knowledge is constructed by scholars and researchers. For instance, within the field of healthcare it has been suggested by recent research that ML algorithms can provide more reliable medical diagnosis as compared to traditional diagnosis performed by human doctors. In the era of cutting-edge digital technologies, the creation of knowledge is no longer a mission restricted to scholars and researchers.

Aggregate dimension: The learning process

Second mechanism: AI-enabled hyper-personalization of learning. Our review of the literature reveals that the learning process can be improved through a number of different elements relevant to digitalization. Our qualitative analysis led to identifying a second mechanisms that delineate how Edtechs deploy the potential of AI to tackle the pedagogical challenges that hinder the improvement of educational learning processes.

A key distinguishing element that characterizes AI technologies is self-learning capability (Ferràs-Hernández, 2018; Mazzei and Noble, 2017). As opposed to existing digital technologies, ML algorithms are capable of learning. They first learn from the tremendous amounts of data provided to construct and train the algorithms through establishing meaningful patterns among the multiple data variables. Interestingly, this process of autonomous learning continues through the interaction of the machines with the users once the algorithm is operational, thus progressively increasing the reliability and accuracy of the algorithmic predictions.

While traditional algorithms are built to perform a predetermined set of tasks, AI algorithms are built to learn from past, current, and future interactions with the user. In this respect, we surface the mechanism of hyper-personalization as a key tenet of the future AI-driven education management. We advocate the emergence of a new pedagogical paradigm, which is enabled by AI learning and predictive capabilities. ML algorithms are designed to learn from curriculum historical data to identify patterns in relevance to the specific needs of each student. While the traditional pedagogical system is designed to meet the needs of large groups of students following pre-determined disciplines and fields of study, the AI-driven pedagogical system tends to hyper-personalize the taught material to match the particular needs and aspirations of students on an individual basis. Thanks to continuous interactions with students, ML algorithms can identify students' areas of improvement and areas of strength, and thus provide highly personalized career recommendations and tips for improvement.

The extreme heterogeneity that characterizes today's classrooms renders the process of learning highly complex and ineffective. Relying on state-of-the-art AI systems, Edtechs try to tackle this pedagogical issue through achieving a better understanding of students' specific cognitive capabilities, career aspirations, and learning needs. Accordingly, classes can be built and structured based on personalized content and learning outcomes, thereby maximizing the learning and responding to the very specific needs of learners in various academic institutions. These Edtechs rely, in their mission statements, on phrases such as "find the best teacher",'according to their needs, knowledge, and interest', and 'adapted to each student's learning abilities', to signal the importance of personalization in responding to highly specific needs and aspirations of students who may have significant variations in their intellectual and cognitive abilities, skills, knowledge, and competencies.

Aggregate dimension: Learning tools and methods

Third mechanism: AI-maximized efficiency and productivity of learning. The extant educational management research summarizes the emergence of a host of new tools, technologies, and methods that can potentially revolutionize the world of education (Maritz, Brown, and Shieh, 2010). Our analysis reveals that the ultimate goal for developing and creating new innovative, novel learning tools and methods is to maximize the efficiency and productivity of learning. We label, thus, our third mechanism "AI-maximized efficiency and productivity of learning". This mechanism portrays the process through which Edtechs use AI-based technologies to improve the educational efficiency and productivity not only in academic institutions, but within professional settings as well.

AI-based tools have revolutionized the traditional learning mechanisms in unprecedented ways. For example, a key distinguisher of AI is its ability to emulate complex human behavior (Shneiderman, 2020). Synthesizing educational material is a task that has been traditionally exclusively performed by human teachers. Our analysis reveals that ML algorithms can provide more accurate and more reliable material syntheses and summaries. Our argument lies in the idea that instructors and lecturers construct summaries based on specific cognitive capabilities. Yet, the viability of such competences is restricted by the teachers' limited capacity for data processing and understanding, making AI a promising avenue for revolutionizing the learning experience. Relying on natural language processing (Kang *et al*., 2020), AI can learn then emulates the complex human behavior of synthesizing, performing it with a much higher efficiency, accuracy, and reliability. As such, Edtechs attempt to tackle the efficiency and productivity issues to maximize and accelerate the learning among various audiences of learners.

Aggregate dimension: Learning spaces

Fourth mechanism: AI-augmented learning environments. Our review of the literature suggests that learning environments in the future will be diverse (McAndrew *et al*., 2010), involve active and engaged use of digital technologies (Seely and Adler, 2008; Tritz, 2015), and help the learner engage with the members of his/her community to identify his/her learning aspirations (Joksimović *et al*., 2015a, 2015b). In relevance to the learning spaces aggregate dimension, our qualitative analysis revealed a fourth mechanism that depicts how educational learning environments can be augmented through AI pioneering technologies.

We identified an emerging trend among the Edtechs for creating universal world-classes. AI can help democratize universal classrooms and make them available to all including learners who speak various languages, suffer certain handicaps, or need special arrangements. AI-systems can help people with special needs or skill deficiencies maintain active participation in class, namely in heterogeneous learning environments that are characterized by a diversity of learners. Further, some Edtechs are creating smart virtual environments and applications that draw on AI and augmented reality to develop authentic virtual characters and realistic social interactions. The idea is to complement traditional educators with virtual human-like characters that can interact with learners in a natural way. Such examples illustrate useful applications that are enabled by the emulation, automation, and augmentation capabilities of AI. These use cases disrupt the traditional education paradigm and result in novel configurations of the existing educational business models. As a result, important structural reforms are required to adjust to the emerging AI-driven education paradigm.

Aggregate dimension: Teachers

Fifth mechanism: AI-empowered educators. Early education management research suggests that the evolution of the teaching occupation is dependent on a number of factors including the nature of the piloting of the academic programs and student support (Tritz, 2015; Shulman, 2016), the formation of multidisciplinary teams (Tritz, 2015; Brown, 2015 Shulman, 2016), and the definition of new forms of leadership to assist students given the specific needs of each learner (McAndrew *et al*., 2010; Shulman, 2016). An important part of an educator's occupation is concerned with non-teaching tasks such as grading, assessment, and routine admin tasks that are highly time consuming and effort demanding (Fournier, 2019). In this vein, a number of Edtechs explore how AI systems can relieve some of the efforts that are associated with these challenging tasks, thereby empower educators to focus on more important silos of their occupation such as closer and more personalized follow-up and monitoring of students. Accordingly, we label our fifth mechanism "AI-empowered educators". Human-AI collaboration surfaces as a pilar of the evolving AI-driven education paradigm and an "ethical", "socially acceptable" implementation strategy for educational institutions that aim at enhancing the capabilities of their collaborators, as supposed to the radical alternative of an integral replacement of their human capital.

Discussion

In this paper we provide a critical analysis of the qualitative accounts embedded in Edtech ventures' mission statements. We aimed at assessing the collective judgments depicted in a large sample of Edtechs' mission statements in relevance to the interplay of AI-based technologies within higher education, and consequently the education management field. Our findings surface five key mechanisms that delineate the functionality of AI in enabling a shift of the existing education paradigm. We shed light on the main distinctions between the traditional paradigm and the AI-driven paradigm, surfacing the fundamental changes triggered by AI implementation within educational institutions.

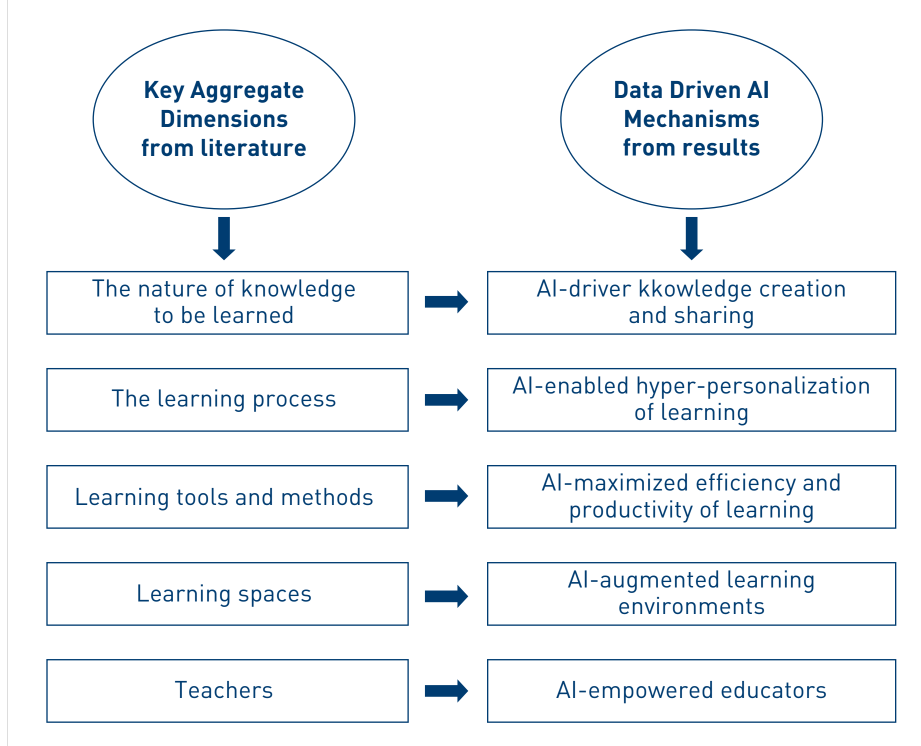
Specifically, we argued that AI triggers some fundamental changes that transform the prominent elements of the existing education process in unprecedented ways. We show through our analysis that AI is not simply a mere extension of existing digital technologies, but rather a true self-dependent, game changer for contemporary educational institutions. Our argument lies in the identification of the unique specificities that characterize AI-based technologies. Digital technologies are operational tools that power digital transformations within educational organizations. We advocate that while such traditional technologies guide colleges and universities through the process of transforming their traditional, physical processes to digital, virtual ones (Schallmo *et al.*, 2019), AI plays a fundamentally different role (Agrawal *et al*, 2017; Jordan, 2017; Keding, 2020). AI's unique capability for revolutionizing educational institutions' operations stems from a number of key characteristics including predictability, self-learning, human emulation, automation, and augmentation (Raisch & Krakowski 2021).

Overall, our empirical framework suggests the emergence of an AI-driven education paradigm, triggered by fundamental changes at the levels of the learned knowledge, methods, learning processes, learning environments, and instructors. Our main argument lies in the idea that although digital transformations have greatly helped educational institutions in digitizing their processes and virtualizing the learning experience, AI has led, given its unique capabilities, to a shift in the existing education paradigm. This significant shift constitutes and is enabled by: 1) the ability of AI to emulate complex human behavior; 2) augment human teachers and learning environment; 3) automate critical parts of key processes such as knowledge creation and sharing; and 4) hyper personalized teaching and material. We shed light through our findings on a number of useful applications that are enabled by AI's predictability, learning, emulation, automation, and augmentation. We showed that such use cases disrupt the traditional education paradigm and result in novel configurations of the existing educational models. Consequently, important structural reforms and business model reconfiguration are required to adjust to the emerging AI-driven education paradigm.

Through our analysis of the mission statement of 785 Edtechs, we found five emerging mechanisms that address the five areas of management education which would most benefit from the development of AI in a post-COVID-19 world, namely knowledge to be learned, learning process, learning tools and methods, learning spaces, and teachers. Figure 1 shows the connections between emerging mechanisms and areas of management education. We discuss the implications of each mechanism below.

These five mechanisms thus provide a framework for responding to two major educational challenges that were amplified during the COVID-19 pandemic. Firstly, to ensure that higher education is taught at a distance and that it includes quality pedagogical follow-up (Barnes, 2020), which is an essential condition for its sustainability. Secondly, these mechanisms offer the possibility of guiding reflection and action for a more inclusive management education, accessible to participants who are precarious or discriminated, suffering from disabilities for example, or, in general, who cannot be present or access a classroom, and thus benefit from the same teaching and pedagogical follow-up (Livari, Sharma, & Ventä-Olkkonen, 2020; Giraudon *et al.*, 2020).

FIGURE 1
Five emerging AI mechanisms in management education



AI-driven knowledge creation and sharing.

The rise of AI questions many tenets of the current knowledge creation and sharing practices including: 1) the traditional educational ecosystems by decompartmentalizing between disciplines and professions to bring together the interests of very heterogeneous actors, thus facilitating their networking, collaboration and cooperation (both professionally and geographically); 2) the verticality of the discipline, defined by the recognition of experts specialized in management and recognized by their peers, in favour of a horizontal model, which crosses fields of expertise and scientific disciplines; 3) a planned and stable approach to the content of the knowledge to be taught to the benefit of unlikely associations of information favouring the emergence of new and unfixed knowledge (data relatability); 4) the nature of the management knowledge to be taught (didactic level of teaching) as well as the way to teach it (pedagogical level); 5) the deployment of new means to implement pedagogies based on learning experience and the shared construction of knowledge.

The results observed in our study show that Edtechs can contribute to the acceleration of a movement to break down barriers between disciplines and professions. The need to mobilize AI and to have massive digital data brings together the interests of these very heterogeneous players. Consequently, our study shows that the technologies of the Edtechs calls into question the nature of the management knowledge to be taught (didactic level of teaching) as well as the way of teaching it (pedagogical level). The analysis of the positioning of the Edtechs thus shows that they are no longer the only management specialists, but rather extended multidisciplinary networks, both public and private, which are already involved in defining the new knowledge to be taught. Thus, the study of the positioning of Edtechs in the creation and sharing of knowledge extends the general approach of the literature on the impact of AI and massive data in education.

AI-enabled hyper-personalization of learning.

Our results show that Edtechs which mobilize AI and massive data in the field of education offer tools and methods that contribute to a reinforcement of the personalization or even hyper-specialization of learning, to offer teachers more information (especially socio-cognitive information) about their students, to act on the student's motivation in order to encourage his or her involvement in the learning process, and to optimize the adequacy of the teaching offer with the individual demand for learning. First, the mobilization of AI and Big data via Edtechs offers the possibility of providing a better knowledge of the student's learning capacities based on her or his learning path, results and preferred ways of learning. Second, some Edtechs target the motivation and commitment of the student in his or her own learning. AI may be an effective tool for improving the development of the feeling of self-efficacy in management education. Third, AI can enable students to mobilize teaching according to their desires, needs and desired teacher. This approach underpins a vision of education considered as an offer proposed to potential applicants (students) in a principle of market economy education. The student is thus led to make personal choices that can reinforce his or her autonomy and the responsibility it entails.

However, the growing literature on algorithmic bias raises the risk that automated choices may produce discriminatory outcomes (Lambrecht & Tucker, 2019). Given that ML algorithms are trained on historical data and reinforced with new personal data, the risk is particularly pronounced in the case of hyper-personalization of learning as learning style (the way a student learns) tends to differ between males and females (Severiens & Dam, 1994), between cultures (Carroll & Garavalia, 2002), and between social classes (Cooke *et al.*, 2004). Therefore, using automated algorithmic decision making for personalized learning raises the risk that the algorithm may reinforce an existing bias through offering contents and experiences that fit with the personal preferences of female or male students. For example, past studies show that learning process influences study choices and performance of male and female students in college such that the way we teach science may discourage female students to enroll in science programs (Severiens & Dam, 1994). In management disciplines, the difference in attitude between female and male students in teamwork may widen if the algorithm segments the learning process based on gender (Kaenzig *et al*, 2007). Automated personalized learning based on past learning preferences of female students may reinforce such bias rather than correcting it. An important task is to account for potential biases in this area and examine potential solutions to avoid them or, even better, to correct them.

AI-maximized efficiency and productivity of learning

AI-based tools and methods can improve the effectiveness and efficiency of learning in several ways. AI and massive data facilitate the exploitation and analysis of information in a way that is adapted to the needs and comprehension capacities of the student. Also, AI can help the student experience what he or she knows through immersion in a distant and/or virtual universe. Finally, AI-Edtechs are now able to offer tools aimed at bringing the student's demand closer to the company's needs, which potentially favours his or her professional integration. More generally, the growing heterogeneous offer of Edtechs allows students to learn in a more personalized, engaging and faster way. However, the quest for efficiency and productivity may also come with new challenges. The greater accessibility to information and knowledge offered by AI does not guarantee the quality of successful learning. For instance, less time spent on a subject can generate "butterfly" behaviour, i.e. scattered, superficial learning that is not anchored in the memory and, in the end, loses its sense of usefulness.

AI-augmented learning environments

AI-solutions can potentially accelerate the transformation of learning spaces. Our findings reveal that the services Edtechs offer raise the possibility of universal international classes. AI increases the possibility of involving a wider variety of participants from all over the world by reducing constraints related to the place of learning (e.g. physical presence in the classroom, the problem of geographical distance or disability). The technological solutions offered by AI thus provide greater teaching flexibility adapted to the constraints of the school, the participants and the teaching community (teachers and external stakeholders such as experts and collaborating teachers). Thus, the use of AI and massive data offer the possibility of preserving and combining particularities that were formerly inevitable barriers to learning. The reorganization of learning spaces and their enlargement without spatial limitations encourage management schools and their teachers to reconsider the use of traditional places of learning.

AI-empowered educators

Our study shows that AI-Edtechs are now able to offer tools capable of alleviating time-consuming and repetitive tasks for teachers in higher education: administrative management of programmes, teaching and management of the resources involved, and management of student activities, particularly those related to the administration of exercises, automated answers to common questions (automated chatbots), real-time feedback, classification, progress and evaluation of their work. Thus, the automation of certain tasks and activities opens new opportunities for teachers and especially management educators (deeply connected with professional world) to develop new pedagogical approaches and new partnerships with the educational learning ecosystem, mobilize new tools, have more precise information about the student, his abilities, difficulties, involvement and progress in the training.

Conclusion

In conclusion, the contributions of our research are multiple. On the theoretical level, our literature review has enabled the identification of key dimensions of education—and their associated educational challenges—that are most concerned by the development of AI and big data. These dimensions open up questions that we have summarized into an analytical framework composed of five key themes: the nature of knowledge, the learning process, methods and tools, learning spaces and the evolution of the teaching profession. This framework thus proposes avenues for further research on the subject as well as a structured reflection for educational practitioners awaiting methodology.

In other words, each axis opens research perspectives aimed at better understanding the transformation processes at work.

Our paper has also identified five key mechanisms that explain how AI-based technologies can reconfigure and reimagine the existing education paradigm. It is highly important in this regard to emphasize that AI implementation within educational institutions should be adopted as a strategic option that matches the core goals of these organizations. Many educational organizations may instead adopt and implement AI strategies as a symbolic response to attenuate the various institutional pressures for being a technology-driven organization (Bromley and Powell, 2012). Such symbolic management strategies may lead the firm to fall into the trap of policy-practice decoupling and means-ends decoupling (Jabbouri *et al.*, 2019; Wijen, 2014). As such AI technologies should ideally be adopted and implemented within educational institutions with the sole purpose of serving the core goals of these organizations for improving the mechanisms of knowledge creation and knowledge transfer. Organizations in HE may use the insights from our five mechanisms to deploy AI in ways that transform both the learning experience for their students and the knowledge sharing experience for instructors. We believe that the five mechanisms can serve as useful guidelines to undertake changes towards such ends.

Limitations and future research

Our study involved the analysis of written and communicated information on a sample of Edtechs operating internationally. Given that mission statements are meant to be concise, future studies should examine larger written information with more detailed accounts of the mission and role of Edtechs. For example, we have not accounted for the cultural disparities, and more generally the political and educational contexts of the countries in which an Edtech belongs. The educational landscape is changing very quickly and amplified by events such as the coronavirus crisis. Future studies should examine and account for these limitations. Finally, a reasonable assumption is that our findings mostly apply to developed countries as they rely heavily on advanced technologies to enhance management education, and thus will be impacted by technological disruption (such as AI) earlier than countries with less technological endowment. We therefore encourage scholars to conduct cross-country studies to investigate whether the impact of AI on management education ecosystem is moderated country-specific characteristics such as technological infrastructure, educational system or simply geographical location. Further, it is important to delineate that effective AI adoptions require a set of pre-requisite structural adjustments. AI implementations require a ground of solid technological and data infrastructures. Given the technical and organizational complexity of AI implementations, we predict that areas of the world, sectors, and organizations which lack basic technological infrastructures, a proper corporate culture for technology acceptance, and the necessary capabilities for efficient data management are likely to benefit less for the current era from the evolvement of the AI-driven education paradigm. Future studies may examine such assumption. Finally, our sampling method was based on the categorization of Crunchbase and Angelist to identify AI-based education startups (using "AI" and "Education" as keywords for categories). We acknowledge that this may lead to including startups that do not operate directly in high education. In the meantime, the lens of the theory of diffusion of innovation (Rogers, 2010) suggests that a compelling innovation tends to diffuse to other fields (e.g. from secondary to higher education institutions) once it is broadly adopted by a segment of the population.

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