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Operations Management teaching practices and information technologies adoption in emerging economies during COVID-19 outbreak

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A B S T R A C T

The objective of this article is three-fold. First, it aims at identifying the main teaching practices and information and communication technologies (ICTs) used to teach Operations Management (OM) in emerging economies during COVID-19 outbreak. Second, it investigates the effect of contextual characteristics on the adoption level of those teaching practices and ICTs. Third, this study examines the relationship between the adoption of ICTs and OM teaching practices during COVID-19 outbreak. Expectedly, schools around the world have pivoted to online learning and digital classrooms. Thus, OM lecturers and professors located in emerging economies that have been teaching during COVID-19 outbreak were surveyed. The collected data was analyzed through multivariate techniques. Findings indicate that lecturers and professors have been remarkably adopting specific teaching practices and ICTs to teach OM. Nevertheless, when considering the contextual characteristics of the universities, departments, and lecturers/professors, the adoption level of those practices and ICTs may significantly vary, especially depending on subject type and teaching experience. Moreover, we empirically verified that ICTs positively relate with OM teaching practices in emerging economies, although in a much less extent than expected. This research provides OM instructors guidelines to better plan their courses and subjects in face of extreme disruptive moments, such as the one caused by the COVID-19. Understanding how the concurrent utilization of ICTs and teaching practices helps OM programs to continue developing their activities is particularly important for universities located in emerging economies, since they are more likely to struggle with resources scarcity and more financially humble students.

1. Introduction

The SARS-CoV-2 virus (or coronavirus disease) has spread worldwide in a matter of a few months in an unprecedented situation. Besides the damage caused by this pandemic, the coronavirus disease (COVID-19) has affected the global and local economies at a larger scale, both in developed countries and in emerging economies (Oldekop et al., 2020; McKibbin and Fernando, 2020). Indeed, developing nations have suffered more from COVID-19 than developed economies due to deprived general health and pre-existing conditions of the population, scarce adequate public health resources, growth in unemployment rate, among

other disruptions (UN, 2020; Lone and Ahmad, 2020), as well as poor leadership, e.g. in countries like Brazil (The Lancet, 2020).

The fast spread has been created indefinable disruptions in various areas such as healthcare systems (World Health Organization, 2020), supply chains (Ivanov and Dolgui, 2020; Choi et al., 2020), and also in education (Daniel, 2020; Gewin, 2020; Rzymski and Nowicki, 2020). Concerning higher education, as many governments have ordered colleges and universities to cease face-to-face to online instruction, teaching and learning have changed across the globe in developed nations and emerging economies (Daniel, 2020; Alexander et al., 2019). Schools in many places have pivoted to 100% online learning and digital

classrooms. Nevertheless, the COVID-19 pandemic is now a colossal challenge to education systems (Daniel, 2020). Thus, there are significant challenges impeding technology adoption in higher education, especially with regard to rethinking the practice of teaching (Alexander et al., 2019). Developing countries are certain to be hit hard.

The higher education institutions have then adopted information and communication technologies (ICT). The global adoption of ICT in the higher education sector has revolutionized the traditional learning and delivery system at several universities and colleges. It offers a bouquet of information and communication technology-based tools to support, enhance, and optimize the delivery of information. These include email, virtual and augmented reality devices, social networking sites, mobile applications, video conferencing, voice-over internet protocol, etc. (Oliver and Clayes, 2014). While email, video and audio-conferencing based ICTs have been used in higher education for more than a decade, the use of smartphones, social networking, and mobile apps have started gained a significant share of ICT based learning system, specifically in the management education (Deng and Tavares, 2013). The study by Vázquez-Cano (2014) also endorses the wide application of ICTs as support tools to teaching in higher education. A relatively recent study by Ginige et al. (2017) provide evidence that students enjoy ICT based learning and believe that the knowledge and general learning skills gained through ICTs would not be supported by traditional instruction.

Although the interest and applicability of ICTs have been increasing in emerging economies (Sife et al., 2007; Tongkaw, 2013; UNCTAD 2020), the introduction of ICT raises a huge challenge with the pandemic scenario. Therefore, this work takes a step in the direction to specifically understand how the adoption of operations management (OM) teaching practices and ICTs in emerging economies have been impacted by COVID-19 outbreak.

Thus, based on the aforementioned arguments, three research questions can be raised:

RQ_1. *What are the main ICTs and teaching practices that have been adopted to teach OM in emerging economies during COVID-19 outbreak?*

RQ_2. *What is the effect of contextual characteristics on the adoption level of ICTs and OM teaching practices during COVID-19 outbreak in emerging economies?*

RQ_3. *What is the relationship between the adoption of ICTs and OM teaching practices during COVID-19 outbreak in emerging economies?*

To answer those questions, this paper aims at (*i*) identifying the main teaching practices and ICTs used to teach OM in emerging economies during COVID-19 outbreak, (*ii*) investigating the effect of contextual characteristics on the adoption level of those teaching practices and ICTs, and (*iii*) examining the relationship between the adoption of ICTs and OM teaching practices during COVID-19 outbreak. To comprehensively achieve these aims, the study was grounded on three different theories. The first one was Diffusion of Innovation theory, which seeks to explain how, why, and at what rate new ideas and technology spread (Rogers, 2003). Second, we anchored our research on Resilience theory, which argues that it is not the nature of the adversity (in our study represented by the pandemic) that is most important, but how one deals with it (Greene et al., 2004). Finally, Institutional theory was also used, since it considers the processes by which structures, including schemes, rules, norms, and routines, become established as authoritative guidelines for social and firm behavior (Scott, 2004; Moser et al., 2020). We surveyed 81 OM lecturers and professors from universities located in emerging economies in Asia, and North and South Americas. The collected data was analyzed through multivariate techniques.

Besides its theoretical contribution, this study provides OM instructors, lecturers and professors guidelines to better plan their courses and subjects in face of extreme disruptive moments, such as the one caused by the COVID-19 pandemic. Moreover, understanding how the concurrent utilization of ICTs and teaching practices helps OM programs to continue developing their activities is particularly important for universities located in emerging economies (Asongu et al., 2019;

Bhullar et al., 2019), since they are more likely to struggle with resources scarcity and more financially humble students.

The remainder of the paper is structured as follows. Section 2 presents the literature background on the investigated topics. Section 3 highlights the research design and methodological procedures, while Section 4 discusses the research outcomes. Lastly, Section 5 draws concluding remarks of this work and implications for future research.

2. Background

2.1. COVID-19 outbreak in emerging economies

COVID-19 outbreak can be split into three waves. The first one was in China and East Asia, the second in Western Europe and North America, and third wave is the emerging and frontier economies. According to the contagion curve in emerging economies, Brazil, India, Peru, Russia, and Turkey are the most affected (Syzdykov et al., 2020). Policymakers face now a very difficult dilemma between protecting their societies from the pandemic with insufficient health infrastructure and protecting their economies which are strongly hit by the negative global shock (Ibn-Mohammed et al., 2020). This trade-off between health and wealth is much more prominent in emerging economies (Tortorella et al., 2020a).

The linkage of current coronavirus crisis with individuals, businesses, and societies will remain highly uncertain for a long time to come (Bapuji et al., 2020). The impact COVID-19 can have on emerging economies across the globe for the year 2020 has been projected to vary widely. Even though the majority of the emerging economies had enough opportunity to learn from the experiences of countries affected in first and second wave to get prepared, majority of them lack the key aspect of well-equipped health systems to efficiently deal with pandemic of this scale. The economic fallout from the COVID-19 shock is ongoing and increasingly difficult to predict but there are clear indications that the impact will be much worser on developing economies (UNCTAD, 2020).

Emerging economies have been strongly hit by COVID-19 as their policy interventions are expected to be less effective (Hevia and Neimeyer, 2020). Developing countries have to be careful of imposing swift lockdowns as they are characterized by high levels of state fragility that can potentially exacerbate the problems for individuals and businesses and also hold back their ability to respond to the crisis (Ault and Spicer, 2014). As emerging economies have a large share of the labor force employed by small firms with fewer jobs doable at home, they will experience higher direct cost of lockdown and social distancing. As workers in the informal sector in emerging economies belong to marginalized groups without resources and access to institutional infrastructure, they become the most vulnerable group while fighting the crisis (Bapuji and Chrispal, 2020). For instance, over dozen migrant workers in India have succumbed to death due to starvation and/or exhaustion from walking hundreds of kilometers to return to their villages as transportation and state borders were shut down after the breakdown of COVID-19 (Bapuji et al., 2020).

As emerging economies exhibit different characteristics and react differently to COVID-19 crisis when compared to the developed counterparts, it is important to specifically study the impact of COVID-19 on economic, social, cultural, religious, political and labor market institutions of emerging economies at micro-, meso- and macro-levels, and how the impact is influenced by the adoption of ICTs. One of the sectors that have been heavily impacted by COVID-19 outbreak is education and hundreds of higher education institutions across the world are responding to the pandemic by shutting down campuses and adapting to teaching and exams conducted online (Jack and Smyth, 2020; Sahu, 2020). This has forced integration of ICTs into teaching practices during COVID-19 outbreak, which motivated our investigation.

Coping with the pandemic's implications through the integration of ICTs into teaching practices is very much aligned with the resilience capacity (Greene et al., 2004) of higher education institutions. The

capacity to tap into a resource network allows higher education institutions to cope with events that they might not normally be able to handle. Resilience capacity helps differentiate behavior based on stakeholders' commitment toward the value of quality, and social capital resources to respond to disruption. Per Su et al. (2014), organizations with a strong capability of resilience are more likely to sustain high consistency in quality performance. According to Biringer et al. (2013), resilient systems are characterized by three capabilities: absorptive capacity, adaptive capacity, and restorative capacity. Absorptive capacity is the capability of withstanding the impact of disruptions and minimize their negative consequences, facilitating its recovery. Adaptive capacity refers to the degree at which one can adapt to overcoming disruptions through the implementation of unusual operating practices (e.g. ICTs). Finally, restorative capacity denotes how fast and efficient one can be restored if the absorptive and adaptive capacities are not able to properly address the disruptions.

2.2. OM teaching practices

After studying OM teaching in Spanish universities, Luque and Machuca (2003) and Machuca and Luque (2003) stressed the necessity to undertake in-depth studies in operations management teaching in various countries. Table 1 shows a profile of articles in the domain of OM teaching practices. This review clearly points out that there has been very less focus on emerging economies, even after multiple calls for it in the literature. Specifically, none of the research has tried to understand how any sudden external disruption (e.g. a pandemic) could impact the teaching practices of OM and how the OM academic community adapts to the shape of the 'next normal'.

Another aspect related to OM teaching refers to the extensive utilization of similar practices and methods to teach concepts and exercise practical skills with students (Tortorella and Cauchick-Miguel, 2017). Despite the commanalities in the OM discipline, Davis (1997) suggested that the design and selection of teaching practices must consider not only the nature of the subject matter, but also how students learn. This contradiction may be aligned with institutional theory's concepts, such as isomorphism which implies that, rather than necessarily optimizing decisions, practices, and structures, individuals and organizations look to their peers for cues to appropriate behavior (Marquis and Tilcsik, 2016; Srivastava et al., 2021). Our study builds on institutional theory to address the teaching of OM by integrating ICTs during the pandemic.

2.3. ICTs as supporting tools to teaching

ICTs have immense potential to redefine the efficiency and effectiveness of teaching (Lynch et al., 2019). The majority of the universities in developed countries have integrated ICTs into their teaching-learning interaction through interventions such as replacement of chalkboards with interactive digital whiteboards, inbuilt recording of lectures, usage of handheld devices for learning during class time, etc. Integration of ICTs have made 'flipped classroom' model feasible where students watch lectures at home and use classroom time for more interactive exercises and discussions (Walsh et al., 2015). Blended learning combines online teaching methods (e.g., flipped classroom) with traditional face-to-face over synchronous and asynchronous platforms to successfully deliver the learning outcomes (Bradfield et al., 2015). For instance, using Socrative™ as an online homework completing platform has shown to increase students' engagement and exam scores (Balta et al., 2018).

Answer to the questions on how much and which content to be delivered in synchronous and asynchronous platforms is very important for lecturers. By responding to this, researchers have assessed the effectiveness of different ICTs and combination of online and face-to-face delivery (Gavrilović et al., 2018). Bordoloi (2016) offered a solution to derive the optimal mixture of classroom and online platforms by developing a mathematical model. Castillo-Manzano et al. (2016a)

assessed whether the use of audience response system ICT increases the likelihood of students passing the final examinations and found that using the ICT frequently than just as a sporadic event during the course enhances the outcome. Using control-value theory of achievement emotions, Buil et al. (2016) explains how the feedback provided by clickers positively enhances students' perceived academic control, self-efficacy, and value. To delineate the mixed impact of audience response system ICT intervention on exam scores, Castillo-Manzano et al. (2016b) conducted a meta-analysis to find that the university disciplines in which the interventions are implemented have an influence on their impact.

Usage of ICTs for teaching in higher education institutions in emerging economies have also received widespread attention. For instance, by reviewing 20-year literature on technology enhanced learning in South African higher education, Ng'ambi et al. (2016) defend a 'clear shift in South Africa's higher education from relatively poor ICT infrastructure where institutions were solely responsible for both infrastructure and education provision to a more cloud-based ICT infrastructure with 'unlimited' educational possibilities, with a higher reliance on low-cost, mobile, flexible, ubiquitous technology solutions often initiated and provided by academics and students'. This increased maturity in ICT adoption trend is common across emerging markets and are also picking up in frontier markets. This is confirmed by publications from Iran (e.g. Ahmadi et al., 2011), Taiwan (e.g. Wang, 2009), Turkey (e.g. Yılmaz et al., 2015), South Africa (refer to Ng'ambi et al., 2016 for a detailed review; Padayachee, 2017), Saudi Arabia (e.g. Aljaloud et al., 2019), and Latin America (e.g. Salinas et al., 2016 who collected data from Chile, Ecuador, and Colombia; and Llambí et al., 2011 from Uruguay), among others. Most of this research has focused on architecture, medicine, music, language, and engineering (e.g. soil and rock mechanics) disciplines with limited attention to business and management. There has been a lack of research in emerging economies on how ICTs are used to teach OM.

The variation in the adoption of ICTs as supporting tools for teaching may be associated with the concepts from Diffusion of Innovation theory. According to Rogers (2003), there are five innovation attributes that may affect its adoption: (*i*) relative advantage, (*ii*) compatibility, (*iii*) complexity, (*iv*) trialability, and (*v*) observability. The proper balance among those five attributes ensures a high adoption rate of innovations (Greenhalgh et al., 2004), denoted in our study as the integration of ICTs into teaching. Moreover, Erumban and De Jong (2006) highlighted that the national culture and ICTs adoption rate of a country are closely related, justifying our focus on emerging economies' socioeconomic context. Thus, this work attempts to understand the impact of ICTs specifically in the OM discipline.

3. Research design

3.1. Sample selection and questionnaire development

Due to this study objective, two main criteria were established for sample selection. First, respondents should be OM lecturers and professors from universities located in emerging economies. Additionally, respondents must have been remotely teaching during the COVID-19 outbreak. To verify this criterion, an initial survey question asked whether respondents had been teaching during the COVID-19 outbreak.

The questionnaire was constructed in three parts. Its first one aimed at collecting descriptive variables (demographic information) of respondents' location, professional profile, department and university. The second part asked OM lecturers/professors about the adoption level of 88 teaching practices during the COVID-19 outbreak. These practices have been widely evidenced in academic research (e.g. Lovejoy, 1998; Casado, 2000; Medina-López et al., 2011; Brandon-Jones et al., 2012; Tortorella and Cauchick-Miguel, 2018; Medini, 2018; Tortorella et al., 2020b) and institutional reports (e.g. University of Exeter, 2020; New Castle University, 2020; and in the US by Lathan, 2020) related to

Table 1

- Literature in the domain of OM teaching practices.

Author (Year)	Geographical focus	Research focus	Research methods	Findings
Goffin (1998)	Europe	Investigates how is OM taught on full-time MBA courses at 10 European business schools? What approaches are there to course content, teaching methods, assessment methods, and integration of OM with other subjects? What are the views of OM faculty on the key challenges they will face in the future in teaching the subject?	Exploratory investigation involving collection and comparison of OM course outlines from each school followed by telephonic interviews	Course content is similar across schools, but there are large variations on three dimensions: the time allocated by schools to the subject, the balance between operations strategy and tools and techniques in teaching, and the level of emphasis given to service operations
Machuca and Luque (2003)	Spain	Explores the current status of course contents, teaching staff and teaching methodology used in the teaching of POM in Spanish universities	Survey	The content of POM programs being taught are discussed and illustrated the type of instruction available in Spanish universities. This points out the differences between the main academic degrees in which the discipline figures
Luque and Machuca (2003)	Spain	Analyses the characteristics of the POM faculty, their teaching and assessment methods, and the didactic material employed to teach in this discipline in Spanish universities	Survey	POM teachers are lesser in number than that of other business disciplines, but they have been increasing in the recent years
Visich and Khumawala (2006)	No geographic focus	Reviews OM curricula literature along with their respective authors' conclusions	Literature review	Propose a customer-focused business plan to address the gap between industry and academia in OM
Hays et al. (2007)	Multi-country (subject matter experts were academics and practitioners across the world)	Applies the newly developed Collective Causal Mapping Methodology to create a causal map for the entire field of OM	Expert opinions collected from over 250 academics and practitioners	Develop a framework for understanding and teaching OM covering the following aspects - which topics to teach, how to group and sequence these topics, and what are the interrelationships among the topics that should be informed to students
Pal and Busing (2008)	USA	Presents and analyzes the experience of teaching OM by integrating it with other business disciplines	Data gathered using survey instrument was subject to factor analysis and structural equation model	Students perceive learning OM in an integrated format quite useful and they are trained to understand the interrelationship of OM with other business functions
Medina-López et al. (2011)	Spain	Develops and assesses a complex and truly interactive ICT-based teaching tool for instruction in OM	Questionnaire-based survey	Interactive multimedia application is valued for the way it conveys information and for its usability, for the way the application is structured and the improvements to students' understanding of the knowledge. The application's ease of use, the high degree of satisfaction with its interface, its marked interactive character, the flexibility with which it adapts to different learning styles and its ability to facilitate understanding of the concepts and user self-assessment confirm its potential as a self-learning tool.
Arenas-Márquez et al. (2012)	Spain	Describes a computer-assisted learning experience in OM higher education that entailed the development of interactive learning software, its evaluation in an experimental environment, and an analysis of the teaching method's influence on student perceptions	Experimental design	Confirm the pedagogical effectiveness of the software and presented ICT-based methods as an alternative to traditional methods used in OM education
Bamford et al. (2012)	United Kingdom	Analyses the relative effectiveness of a continuous problem-based assessment and a traditional final exam assessment in OM on student learning, classification of student performance and on reasonable costs of each method	Quantitative analysis of longitudinal data on student performance, feedback and satisfaction	Problem-based assessment can be cost-effective and can provide a better learning experience for the students, but it is worse in classification of student results when compared to the conventional exam
Yousef (2012)	United Arab Emirates	Investigates the state of production and OM teaching in United Arab Emirates universities	Survey by email questionnaire followed by descriptive statistical analysis	Identify main objectives of the courses, common assessment methods, most frequently covered topics, main teaching method, and main didactic materials
Bak and Boulocher-Passet (2013)	United Kingdom	Explores the challenges faced by key stakeholders (clients, lecturers and students) participating in SCM consultancy module	Case-based research combined with students' feedback and customer interviews	In addition to confirming the existence of 13 challenges in literature, identified four distinct challenges namely health and safety risks, expertise assessment, depicting SCM boundaries, and SCM consultancy skills
Doran et al. (2013)	United Kingdom	Investigates the content of OM modules delivered by UK academics in higher education to explore its relevance to industry's needs	Survey using online instrument	Infer that although there is a broad degree of cohesion among academics relating to module content, gaps exist between academics and practitioners understanding

Table 1 (*continued*)

Author (Year)	Geographical focus	Research focus	Research methods	Findings
				of the relative importance of key content areas
Prashar (2015)	India	Assesses students' actual and preferred preferences of two different environments (i.e., flipped and traditional) for OM instruction	Case-based research involving qualitative and quantitative data gathered on students' perceptions	Flipped classroom scores higher than the conventional lecture-oriented setup on student involvement, task orientation, and innovation
Rao (2015)	USA	Examines if web-based homework and testing software improves student learning	Survey students combined with pre-test homework assignment grades and test grades	Guide the instructors of OM in deciding whether to use a web-based homework and testing software in their classes
Bordoloi (2016)	USA	Develops a mathematical model that helps to devise an efficient use of a mixture of classroom and online platforms for covering the necessary OM material for a specialized group of healthcare students	Mixed-integer programming	Develop a method to organize the materials for teaching a course in an innovative setup that better fits student lifestyles
Miyaoka et al. (2018)	USA	Describes an experiential OM course for undergraduate business students	Survey combined with student performance	Experiential format of the course with computer labs and 'hands-on' group activities engages students and improves their performance when compared to that of traditional lectures. Learning outcome analysis shows that students in the lab-based class were significantly better at identifying the proper method and executing it but not at reaching the correct conclusion
Finne (2018)	United Kingdom	Takes a professional service operation perspective to reconceptualise a persistent pedagogical dilemma of teaching large classes into a process design challenge	Single-case analysis	Develop a six-step systematic approach to reduce the labor intensity of university-level teaching operations while achieving customizable in-class active learning
Pekkanen et al. (2019)	Finland	Analyzes how the main generic skills in the SCM/OM study program can be described and categorized	Empirical case analysis of a SCM/OM study program	Offer an approach to describe and categorize the focal SCM/OM generic skills and analyze how the skills can be adopted and implemented in SCM/OM study programs
Leseure (2019)	United Kingdom	Defines and compares the two standard options available to instructors teaching planning within an undergraduate OM module: (a) the traditional "technical" approach or (b) the "conceptual" or "conversational" approach	Reflective action research	Technical approach helps in staging learning in manageable chunks and conceptual approach offers more opportunities for learning. Students undergoing technical approach rarely end up with an insightful understanding of planning systems and students undergoing conceptual approach can benefit only if they engage and have enough knowledge prerequisites
Hoefle et al. (2020)	USA	Describes the process followed for transforming a traditional, core OM/SCM course into an experiential, integrated,, and coordinated course	Analysis of data related to OM course from 30 schools and a case study	Create a reference point for redesigning the course and to be relevant to all business majors, the redesign process incorporated learning goals about integration across operations, the supply chain, and the business

teaching of Engineering and Business Management. Hence, these practices were consolidated in this survey instrument. Each teaching practice was assessed according to a 5-point Likert scale (1 referred to 'not used' and 5 denoted 'fully used'). The last section of the questionnaire examined the adoption level of ICTs as supporting tools to teach during the COVID-19 outbreak. For that, 14 ICTs were listed and evaluated based upon a similar Likert scale that ranged from 1 (not used) to 5 (fully used). These ICTs have been consistently reported in many studies (e.g. Sife et al., 2007; Mabunda, 2010; Waycott et al., 2010; Salinas et al., 2017), which justified their adoption in the survey. The complete list with all teaching practices and ICTs comprised in the questionnaire is shown in Appendix.

Following recommendations from Forza (2002), a pre-test of the questionnaire was performed with three academicians, who have suggested some minor improvements in wording and presentation of questions. This pre-test also helped to improve face and content validity of the instrument (Hair et al., 2014; Sunder and Prashar, 2020). Table 2 provides an overview of survey instrument.

The online questionnaire had its link firstly sent by e-mail to 285 OM lecturers/professors in April 2020. A follow-up message was sent two weeks later. Ninety-seven responses returned but only 81 of them were

Table 2
– Summary of survey questionnaire.

Part	Goal	# items	Answer type
(*i*)	Provide profile data of respondents, departments and institutions (country, type of university, # of students, experience of lectures, etc.)	07	01 open-ended ('country') 06 multiple choice
(*ii*)	Provide the adoption level of teaching practices and methods	88	Likert scale (1 to 5)
(*iii*)	Provide the adoption level of ICTs	14	

actually from lecturers/professors who have been teaching during COVID-19 outbreak, which resulted in 28.4% valid response rate, which was slightly higher than the 15% rate suggested by Hair et al. (2014). Table 3 displays the characteristics of the study sample. Most respondents' universities were located in Brazil (55.6%), public-owned (54.3%), and had more than 30,000 students (45.6%). The majority of respondents' departments taught to both undergraduate and graduate students (70.4%), and 39.5% of them had between 10% and 35% of their students in poorer financial conditions. Regarding respondents'

Table 3

– Sample characteristics ($n = 81$).

Country			University ownership			Students in a poorer condition in the department		
Brazil	45	55.6%	Public	44	54.3%	< 10%	31	38.3%
India	24	29.5%	Private	37	45.7%	10% - 35%	32	39.5%
Mexico	3	3.7%	University size (n° of students)			> 35%	18	22.2%
Colombia	3	3.7%	< 5000	23	28.4%	Department teaching		
Morocco	2	2.5%	5000 - 15,000	13	16.0%	Undergraduate	11	13.6%
Chile	2	2.5%	15,000 - 30,000	8	10.0%	Graduate	13	16.0%
Malaysia	2	2.5%	> 30,000	37	45.6%	Both	57	70.4%
Respondents' generation			Respondents' subject type			Respondents' teaching experience		
Baby-boomers (born between 1946 and 1964)	15	18.5%	Qualitative	26	32.1%	< 5 years	16	19.8%
Xs (born between 1965 and 1979)	34	42.0%	Well-balanced	39	48.1%	5 - 10 years	15	18.5%
Ys (born after 1980)	32	39.5%	Quantitative	16	19.8%	> 10 years	50	61.7%

characteristics, most of them (42%) were born between 1965 and 1979 (i.e. were from the X generation), had more than 10 years of teaching experience (61.7%), and taught subjects that were fairly well-balanced between qualitative and quantitative approaches (48.1%).

Moreover, we checked all responses related to the adoption level of OM teaching practices and ICTs for reliability based on their Cronbach's alpha values (Meyers et al., 2006a). The obtained alpha values were 0.832 and 0.843, respectively, indicating a high reliability of responses (i.e. above 0.6).

3.2. Sample and method bias

Initially, non-response bias was checked utilizing Levene's test for equality of variances and a t-test for the equality of means between early ($n_1 = 52$) and late ($n_2 = 29$) respondents (Armstrong and Overton, 1977). Particularly, regarding the assumptions for the applicability of the t-test for the equality of means, we firstly identified that the means of the two groups being compared, followed normal distributions (Lumley et al., 2002). For that, histograms were plotted and analyzed for each group. Secondly, based on the results for the Levene's test, we identified that the variance of the groups was not statistically different, meeting the requirements for the second assumption for the t-test (Markowski and Markowski, 1990). All variables were verified between both groups, and no significant statistical differences were found for means and variation (p-value < 0.05).

To avoid common method variance, we randomized items within each part of the questionnaire. This prevents from misguided or biased associations of items that belong to same construct (Podsakoff et al., 2003; 2012). As mentioned earlier, the survey was limited to key respondents who were lecturers and professors of OM in universities located in emerging economies and that have been teaching during COVID-19 outbreak. This fact helps to ensure the legitimacy and validity of their judgements. These respondents were notified upfront in the email sent with questionnaire about the anonymity of their answers, and that there was no 'wrong' or 'right' response.

With respect to statistical procedures, we conducted Harman's single factor test (Malhotra et al., 2006), which is one technique to identify common method variance, and its use has been evidenced in many survey-based studies with similar objectives (e.g. Marodin et al., 2018; Tortorella et al., 2020b; Saurin et al., 2020). Results for this test indicated that 22.5% of the variance was represented by the first factor, which suggests that common method variance was not likely to be a problem because most of the variance was not loaded into one factor. Because this is an exploratory method and not a statistical test, we complemented this analysis by running a Confirmatory Factor Analysis (CFA), which provides a chi-square test so that it is possible to judge whether the model fits the data or not (Williams et al., 2010; Rodríguez-Ardura and Meseguer-Artola, 2020). Results for the CFA model confirmed that no single factor emerged, indicating common method variance issues could indeed be disregarded.

3.3. Clustering of data

To identify the main ICTs and teaching practices that have been adopted to teach OM in emerging economies during COVID-19 outbreak (RQ_1), two clustering analyses were conducted. In the first analysis we used the 88 teaching practices as clustering variables. To verify the most adequate number of clusters, we applied Ward's hierarchical method using squared Euclidian distance metric as the measure of original distances between observations (Rencher, 2002). This occurs because the objective function is usually chosen to be the minimum variance, or minimum squared error. The Euclidean distance is related to the measurement of the sum of squared errors; hence the use of this metric when using Ward's linkage method (Vogt and Nagel, 1992; Abu-Jamous et al., 2015).

The dendogram depicted in Fig. 1 indicates two main clusters of teaching practices, which are grouped according to their adoption level. The teaching practices with lower adoption level were clustered in the group labeled as 'lowly adopted teaching practices', while the ones with higher adoption level were grouped and denoted as 'highly adopted teaching practices'.

The second analysis followed a similar procedure but using the 14 ICTs as clustering variables. Ward's hierarchical method was applied to check the appropriate number of clusters based on the ICTs adoption level. The dendogram analysis showed in Fig. 2 suggested two clusters. The cluster whose ICTs presented a lower adoption level was named as 'lowly adopted ICTs'. In turn, ICTs with higher adoption level were clustered into the group labeled as 'highly adopted ICTs'.

3.4. Data analysis

For analyzing data, two distinctive procedures were carried out using the SPSS® Statistics 23 software. First, we performed a MANOVA (Multivariate Analysis of Variance) using Wilks' lambda test to identify differences in levels of each characteristic related to universities (ownership and size), departments (teaching and students' financial condition), and lecturers/professors (generation, experience, and subject type) when considering the degree of the most adopted ICTs and OM teaching practices. That allowed us to comprehend the effect of contextual characteristics on the adoption level of ICTs and OM teaching practices during COVID-19 outbreak in emerging economies (RQ_2). It is worth mentioning that we examined upfront whether countries' differences affected the adoption level of ICTs and teaching practices. Results for this specific MANOVA were not statistically significant indicating that there was no effect of country on responses and, hence, all responses could be treated as representative of the emerging economy context. Fourteen MANOVA models were then tested, each considering a specific characteristic as independent variable. As dependent variables, we only considered the adoption level of the teaching practices and ICTs clustered within the 'highly adopted teaching practices' and 'highly adopted ICTs', respectively. We checked the assumptions of normality, linearity and homoscedasticity for all variables (Hair et al., 2014). Residuals were examined to confirm normality of the error term distribution. We
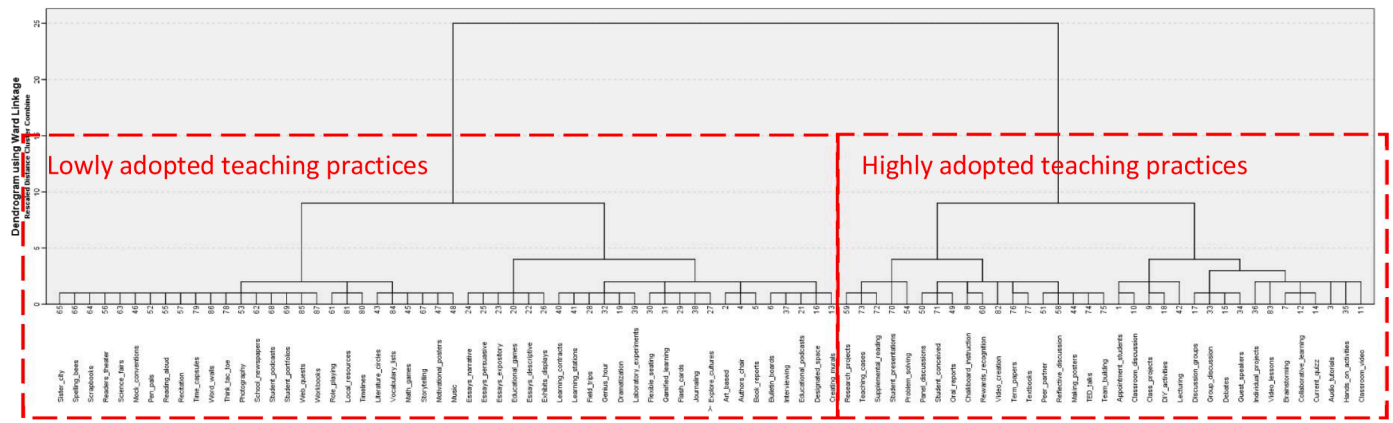
Fig. 1. – Dendogram of teaching practices adoption level (Ward's clustering method).
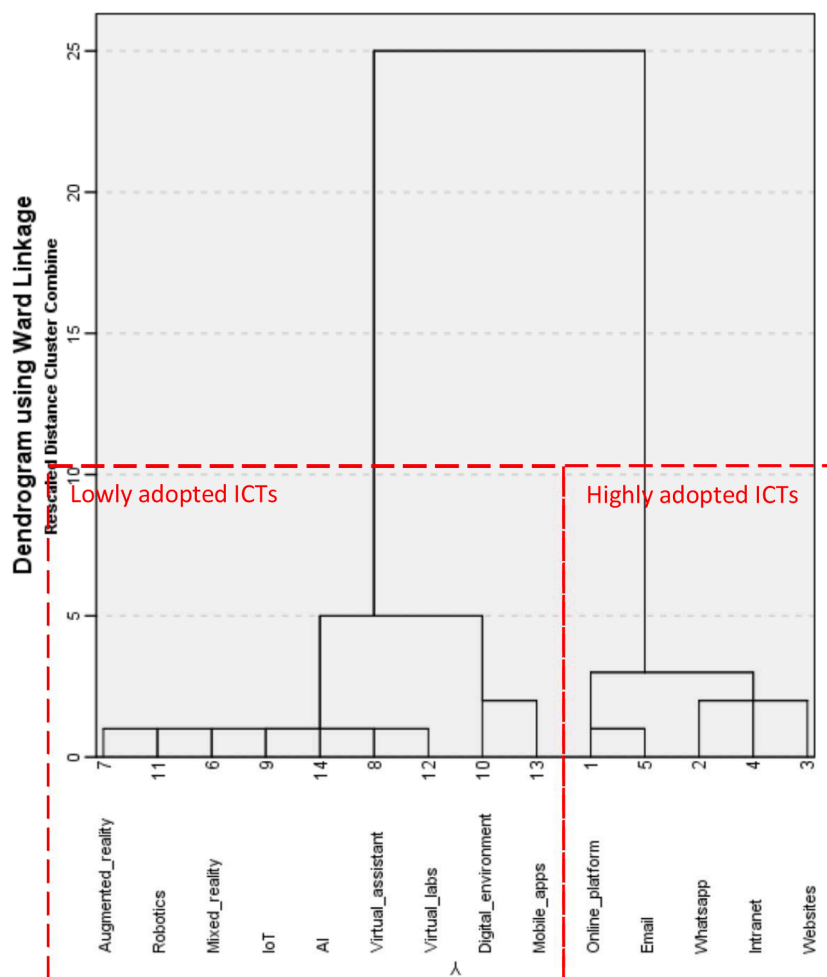

Fig. 2. – Dendogram of ICTs adoption level (Ward's clustering method).

verified linearity based on plots of partial regression for each variable. Homoscedasticity was assessed by plotting standardized residuals against predicted value and visual examination. These tests confirmed the assumptions for multivariate data analysis. Box's test for equality of covariance matrices for all MANOVA tests resulted not significant, satisfying the MANOVA model's assumption (Hair et al., 2014). Whenever a MANOVA model displayed a significant *F*-value we ran individual ANOVA tests to better examine differences in the dependent variables.

It is worth mentioning that there is a disagreement in the literature on whether the utilization of Likert scale items in parametric statistical procedures that require interval data (Carifio and Perla, 2008). In fact, there are two streams of thoughts that discuss such issue. One stream maintains that as ordered categories, the intervals between the scale values are not equal. Any mean, correlation, or other numerical operation applied to them is invalid. Only non-parametric statistics should be used on Likert scale data (Kuzon et al., 1996; Jakobsson, 2004; Jamieson, 2004). The other stream argues that, while technically the Likert scale item is ordered, using it in parametric tests is valid in some

situations. For example, Lubke and Muthen (2004) found that it is possible to find true parameter values in factor analysis with Likert scale data, if assumptions about skewness, number of categories, etc., were met. Likewise, Glass et al. (1972) found that F tests in ANOVA could return accurate p-values on Likert items under certain conditions. Pell (2005) and Norman (2010) argue that ANOVA is robust against the violation of continuous scale assumption and, since the choice of non-parametric methods results in a loss of power, ANOVA is preferable. Additionally, in the absence of a definitive consensus, Carifio and Perla (2007) and Grace-Martin (2008) recommended a few guidelines if a Likert data is analyzed through a parametric procedure; they are: (*i*) each item must have at least 5 points, (*ii*) the underlying concept of the item is continuous, (*iii*) there is some indication that the intervals between points are approximately equal, and (*iv*) ensure the other assumptions (i.e. normality, linearity and homoscedasticity) are met. Because our analysis met all those guidelines and the use of individual Likert-type responses as dependent variables for the MANOVA is commonly observed in the literature (e.g. Friedman et al., 1994; Marodin et al., 2016; Correia et al., 2016; Tortorella et al., 2020c), we followed this parametric approach.

The second procedure aimed at verifying the relationship between the most adopted OM teaching practices and ICTs during COVID-19 outbreak (RQ_3). For that, a partial correlation analysis was conducted between pairs of the highly adopted teaching practices and highly adopted ICTs. Partial correlation analysis clarifies the nature of the pairwise interaction between two variables, since it controls the effect of the remaining investigated variables (Baba et al., 2004). Partial correlation analysis is suitable to situations where a pairwise relationship might be influenced by their relationships with other variables (Legendre and Legendre, 2012). This method has been applied in studies with similar purposes (e.g. Tortorella et al., 2018; 2020d). It is important to highlight that we controlled the partial correlation analysis for the effect of the contextual characteristics whose MANOVA models were significant. To verify the existence of multicollinearity on the estimated correlation coefficients the variance inflation factors (VIF) was determined for all variables, which ranged from 1.08 to 3.59. As all VIF values were below five (Belsley et al., 2005), multicollinearity between variables was disregarded.

4. Results

The hierarchical cluster analysis on the adoption level of OM teaching practices pointed to two clusters of teaching practices. The cluster labeled 'lowly adopted teaching practices' comprised 53 teaching practices that have been poorly utilized during COVID-19 outbreak. The second cluster denoted as 'highly adopted teaching practices' consisted of 35 teaching practices that displayed higher adoption levels among respondents. The extensive utilization of most of these teaching practices, such as *teaching case studies, debates,* and *class projects,* is somewhat expected in light of previous studies that have already indicated their positive impacts on OM teaching (Arenas-Márquez et al., 2012; Bak and Boulocher-Passet, 2013; Prashar, 2015). In turn, the high adoption of others, such as *making posters, chalkboard instruction,* and *hands-on activities,* was quite surprising since they are not apparently easy to use in a remote manner. This particular result suggests that OM respondents have been adapting typical classroom methods to the remote condition implied by the COVID-19 outbreak.

Similarly, the hierarchical cluster analysis on the 14 ICTs pointed to two clusters. Five of them were grouped as 'highly adopted ICTs'; they were: *online platform, whatsapp, websites, intranet,* and *email.* The remaining 9 ICTs seem to be poorly used to support OM teaching during COVID-19 outbreak, hence, being categorized as 'lowly adopted ICTs'. Contrary to common belief, novel ICTs popularized with the advent of the fourth industrial revolution, e.g. *augmented reality, artificial intelligence,* and *Internet of Things,* did not figure as the most adopted ones. Nevertheless, this result is coherent with the particular situation faced in

universities located in emerging economies. In this socioeconomic context, universities are likely to struggle to implement new ICTs due to the required capital expenditure and skilled labor (Ng'ambi et al., 2016; Salinas et al., 2016; Dalenogare et al., 2018), thus restricting their utilization. This outcome might be aligned with the Diffusion of Innovation theory's attribute denoted as 'compatibility', the degree to which an innovation fits with the existing values, experiences, and needs of potential adopters (Rogers, 2003). The more compatible the innovation, the greater the adoption trend (Greenhalgh et al., 2004). In this sense, our results indicate that the utilization of novel ICTs from the fourth industrial revolution may be less compatible with the context of higher education institutions located in emerging economies, explaining their lower adoption level.

Low utilization of new ICTs can also be attributed to the reduced push or support extended from the formal institutions, which has led to a significant gap in the uniform prevalence of ICT prerequisites across the country such as internet connectivity and availability of trained staff. This explains the wide disparity in adoption of new ICTs between institutions in urban and semi-urban/rural parts of the country. Even if semi-urban and rural universities get motivated by the impact of COVID to invest in new ICTs, they will be discouraged by the lack of ICT enabling infrastructure as they will not be able to reap the complete benefits for their investment as compared to their urban counterparts.

Table 4 displays the results from the MANOVA analyses. Two tests were run for each contextual characteristic. For instance, Models 1 and 8 were conducted using 'university ownership' as independent variable, and the 5 highly adopted ICTs (Model 1) and the 35 highly adopted OM teaching practices (Model 8) as dependent variables. When considering the highly adopted ICTs as dependent variables, only Model 3 (subject type) was statistically significant (p-values < 0.05). In opposition, only Model 13 (teaching experience) was significant among those using highly adopted OM teaching practices as dependent variables. For MANOVA tests whose F-values were significant, we ran univariate analysis of variance (ANOVA) for each dependent variable so that we could discriminate the effect of the contextual characteristics. Levene's test did not indicate differences in dependent variables' error variances enabling the use of ANOVA tests. Surprisingly, no contextual characteristic related to the university or department appeared to be relevant for the adoption of ICTs and OM teaching practices. Only variables associated with the lecturer/professor (i.e. *subject typ* and *teaching experience*) seemed to be impactful.

Table 5 shows ANOVA results that enable verifying the effects of

Table 4

– MANOVAs using Wilks' lambda test.

Effect	Highly adopted ICTs		Effect	Highly adopted OM teaching practices	
	Value	F		Value	F
Model 1 – University ownership	0.887	1.117	Model 8 – University ownership	0.290	0.978
Model 2 – University size	0.875	0.385	Model 9 – University size	0.029	0.795
Model 3 – Subject type	0.646	2.097 *	Model 10 – Subject type	0.085	0.905
Model 4 – N° of poor students	0.712	1.594	Model 11 – N° of poor students	0.042	1.445
Model 5 – Students type	0.827	0.857	Model 12 – Students type	0.040	1.487
Model 6 – Teaching experience	0.731	1.457	Model 13 – Teaching experience	0.015	2.616**
Model 7 – Generation	0.776	1.166	Model 14 – Generation	0.056	1.192

Notes:.

* p-value < 0.05.
** p-value < 0.01.

Table 5

– Univariate ANOVAs for the highly adopted ICTs.

Highly adopted ICTs	Subject type			ANOVA value	Significant pairwise comparisons (LSD test)
	Qualitative	Well-balanced	Quantitative		
Online platform	4.562	4.708	4.700	0.229	
Whatsapp	3.312	4.083	2.600	5.492***	[1, 2]* [2, 3]***
Websites	2.937	3.917	3.500	3.124*	[1, 2]**
Intranet	2.188	3.709	2.400	6.031***	[1, 2]*** [2, 3]**
Email	3.875	4.250	4.200	0.803	

Notes:.
*** p-value < 0.01.
** p-value < 0.05.
* p-value < 0.10.

subject type on individual ICTs. Three out of five ICTs were significantly different among the types of OM subject respondents have been teaching (i.e. qualitative, well-balanced between qualitative and quantitative, and quantitative). Regarding *whatsapp*, lecturers and professors that teach OM subjects that are fairly balanced in terms of qualitative and quantitative approaches seem to more prominently utilize it as a supporting ICT. Remarkably, such difference in adoption level was not observed when comparing purely quantitative and qualitative OM subjects. This is corroborated by a recent study by Birgin et al. (2020), who found out no significant difference in the effectiveness of ICTs between qualitative and quantitative courses. Analogously, results for *intranet* adoption presented a similar trend to *whatsapp*; i.e. its utilization is significantly higher when considering OM subjects that are well-balanced between qualitative and quantitative approaches. Finally, with respect to *websites*, a significant adoption difference was only evidenced when comparing OM subjects that are either qualitative or present a balanced approach between qualitative and quantitative. No significant result was observed for online *platform* and *email*. Concerning the latter, the result is somewhat contradictory to Alfawareh and Jusoh (2017), who points out a wide application of email in the contemporary higher education setup, at least in management education.

Table 6 provides ANOVA results for MANOVA model 13, which relates teaching experience (independent variable) and the adoption level of OM teaching practices (dependent variable). From the 35 teaching practices deemed as highly adopted ones, teaching experience appears to be associated with 17 of them. Eleven out of these 17 teaching practices seem to be more extensively adopted by OM lecturers and professors whose teaching experience is less than five years. This result is somewhat surprising, since one might expect that less experienced OM lectures/professors would be less likely to present a broad portfolio of teaching practices. Nevertheless, our results point out in a contrary direction. In other words, our findings suggest that less experience OM lecturers/professors have been more intensively exploring different teaching practices during COVID-19 outbreak. This outcome converges to findings from Snow et al. (2017), which posed that more experienced academic staff are prone to present more sedimented teaching practices, being less likely to integrate new approaches or methods to their classes. This fact seems to be also true when teaching OM during COVID-19 outbreak. Complementarily, institutional theory assumes that imitation is a key feature in organizations, resulting from the social pressures among peers (Scott, 2004; 2013). Our findings suggest that such social pressure occurs at an individual level, rather than at an organizational level. In other words, experienced OM lecturers/professors may have been exposed to higher loads of social pressure, being more susceptible to adopting similar and widely deemed teaching methods than less experience ones, on which this social pressure has not yet acted so strongly.

Finally, Table 7 reports the partial correlation coefficients between the highly adopted teaching practices and ICTs to teach OM during COVID-19 outbreak in emerging economies. Because the MANOVA analyses pointed that *subject type* and *teaching experience* were influential for the adoption level of ICTs and teaching practices, respectively,

partial correlation analysis was conducted controlling for the effect of those contextual variables. Out of the 175 pairwise relationships analyzed, only 28 were significant (p-value < 0.05). Furthermore, all significant coefficients were positive, evidencing the existing synergy between OM teaching practices and ICTs. Among the highly adopted ICTs, *whatsapp* was the one that presented the largest number of significant partial correlation coefficients (7). All ICTs were significantly and partially correlated with at least 4 teaching practices. In opposition, *student presentations* and *supplemental reading assignments* stood out among the teaching practices with four significant partial correlations with the ICTs each. Intriguingly, 21 teaching practices did not present significant partial correlation coefficients with the most adopted ICTs. This result suggests that the utilization of those five ICTs as supporting tools to teach OM during COVID-19 outbreak in emerging economies is more concentrated in a few teaching practices, and not as widespread as expected. This result was somewhat surprising, since the adoption of ICTs is supposed to present positive impacts on service organizations (e. g. higher education institutions) in face of disruptive events, e.g. the pandemic (Narayanamurthy and Tortorella, 2021). Additionally, a number of researchers (e.g. Mark and Semaan, 2008; Lopes, 2016; Tortorella et al., 2021) claim that ICTs adoption contribute to an enhanced resilience regardless of the industry sector of the organization. Nevertheless, our study suggested that the pervasiveness of ICTs associated with highly adopted OM teaching practices is still in its early stages, which makes the OM teaching in emerging economies less resilient as they are unable to adapt and restore to disruptions presented by the pandemic. Reduced pervasiveness of ICTs associated with highly adopted OM teaching practices can also be rooted to the gap in the uniform prevalence of ICT prerequisites, which can be alleviated by the intervention of institutions.

5. Conclusions

This study aimed at (*i*) identifying the main teaching practices and ICTs used to teach OM in emerging economies during COVID-19 outbreak; (*ii*) investigating the effect of contextual characteristics on the adoption level of those teaching practices and ICTs; and (*iii*) examining the relationship between the adoption of ICTs and OM teaching practices during COVID-19 outbreak. Our findings provided arguments to answer three research questions raised from existing gaps in both theory and practice. Such findings are better discussed as follows.

5.1. Implications to theory

With respect to theoretical implications, our study provided empirical evidence on the role played by contextual characteristics on the adoption level of teaching practices and ICTs (RQ_2). The findings suggest that their effects are much less pervasive than expected. In fact, none of the studied characteristics of universities and departments seemed to matter to the adoption level of both ICTs and teaching practices. Unexpectedly, the age of lecturers/professors does not seem to influence either. This finding apparently conflicts with indications from Morris

Table 6

– Univariate ANOVAs for the highly adopted OM teaching practices.

Highly adopted OM teaching practices	Teaching experience			ANOVA value	Significant pairwise comparisons (LSD test)
	< 5 years	5 – 10 years	> 10 years		
Class discussion	3.400	3.778	3.484	0.215	
Appointment with students	3.700	3.333	3.516	0.228	
Lecturing	4.200	3.667	3.064	2.487*	[1, 3]**
Class projects	3.700	2.556	3.420	2.012	[1, 2]* [2, 3]*
Problem solving activities	3.400	2.000	3.387	4.425**	[1, 2]** [2, 3]***
Do-it-yourself activities	2.500	3.000	3.290	1.213	
Individual projects	3.500	3.111	2.677	1.269	
Student presentations	3.600	3.222	2.581	1.931	[1, 3]*
Video lessons	3.200	1.889	2.936	2.053	[1, 2]* [2, 3]*
Supplemental reading assignments	3.000	2.667	2.548	0.319	
Teaching case studies	3.400	2.222	2.548	1.826	[1, 2]*
Research project	3.400	2.333	2.484	1.634	
Collaborative learning spaces	2.400	2.839	2.600	1.434	
Hands-on activities	3.000	1.778	2.645	1.755	[1, 2]*
Audio tutorials	2.900	2.111	2.516	0.645	
Discussion groups	2.300	2.111	2.710	0.734	
Debates	2.200	2.111	2.710	0.917	
Class vídeo	2.800	2.111	2.484	0.432	
Brainstorming	2.400	2.778	2.387	0.321	
Group discussion	2.000	1.889	2.742	1.619	
Guest speakers	2.600	2.333	2.323	0.180	
Current events quizzes	2.500	2.222	2.355	0.093	
Student-conceived projects	3.100	1.778	2.226	1.926	[1, 2]*
Textbook assignments	2.700	1.889	2.161	0.759	
Reflective discussion	2.900	1.222	2.258	3.790**	[1, 2]*** [2, 3]**
Oral reports	2.900	1.333	2.000	3.015*	[1, 2]** [1, 3]*
Panel discussions	2.700	0.889	2.129	5.353***	[1, 2]*** [2, 3]**
Rewards & recognition	2.500	1.222	1.968	2.058	[1, 2]**
Team-building exercises	2.700	1.111	1.903	3.211**	[1, 2]**
Video creation	3.500	1.000	1.677	8.668***	[1, 2]*** [1, 3]***
Peer partner learning	2.400	1.009	2.000	3.953**	[1, 2]*** [2, 3]**
Term papers	2.700	1.333	1.742	2.132	[1, 2]* [1, 3]*
Chalkboard instruction	2.200	1.444	1.774	0.885	
TED talks	3.100	1.000	1.387	9.564***	[1, 2]*** [1, 3]***
Making posters	2.100	1.333	1.600	1.260	

Notes:.

*** p-value < 0.01.

** p-value < 0.05.

* p-value < 0.10.

and Venkatesh (2000) and Morris et al. (2005), who suggested that older individuals tend to be less open to new technologies adoption in particular. The adoption level of both ICTs and teaching practices appears to be more dependent on OM lecturers'/professors' characteristics, such as teaching experience and subject type, converging to findings from Aldunate and Nussbaum (2013).

This result somewhat demystifies certain assumptions associated with the availability of capital and human resources that may significantly vary among departments and universities in emerging economies. In fact, this research has evidenced that less experienced OM lecturers/professors might have been diversifying their teaching practices more intensively than more experienced ones. Although more experienced lecturers/professors are more likely to be aware of the benefits of different teaching practices (Riedler and Eryaman, 2016), our results indicate that they might be less prone to diversify their practices, particularly during the pandemic. Experienced OM lecturers/professors may have well-established teaching approaches that were consolidated after many teaching experiments over their careers (Munby and Russell, 1994; Meyers et al., 2006b). Complementarily, from institutional theory perspective, experienced OM lecturers/professors might have been exposed to higher social pressures from peers, leading to the utilization of common and widely accepted teaching practices, justifying their less innovative results. By extending this implication, it will be interesting to investigate how the experience attained over the years by being embedded with institutional structures influences the inclination to adopt new ICTs and how the influence differs for the new entrants or relatively less experienced. Moreover, OM subjects that reasonably balance the integration of qualitative and quantitative approaches seemed to more extensively benefit from ICTs than either purely qualitative or quantitative ones.

Concerning the relationship between the most adopted ICTs and teaching practices (RQ_3), this study has evidenced the existing synergy (positive partial correlation coefficients) to remotely teach OM, which is also recently argued by Ferdig et al. (2020) and Code et al. (2020). However, ICTs support was only observed with a few teaching practices, which indicates that OM lecturers/professors are not fully benefitting from existing ICTs during COVID-19 outbreak, which somewhat corroborates to the findings from König et al. (2020). This fact also suggests that ICTs have been used in isolation, with no association of any of the teaching practices, undermining the resilience of OM teaching in emerging economies.

5.2. Contributions to practice

Regarding the main ICTs and teaching practices, the clustering analyses provided means to identify the ones that have been predominantly used to teach OM in emerging economies during COVID-19 outbreak (RQ_1). Specifically in terms of teaching practices, outcomes suggested that, although some of the highly adopted ones were originally conceived to a regular classroom environment (e.g. *chalkboard instruction* and *hands-on activities*), OM lecturers/professors have been adapting them to also work in a remote manner. This outcome raises novel insights to OM teaching, with implications that go beyond the COVID-19 outbreak. The extensive adaptation of typical classroom teaching practices to a remote environment indicates the opportunity that OM instructors have to revise their methods after the pandemic, fostering a more creative and assertive teaching of OM at lower costs. This is especially relevant in emerging economies where higher education costs are usually restricted to an upper socioeconomic niche of the population (Ramírez-Correa et al., 2012). Additionally, novel ICTs derived from the fourth industrial revolution (e.g. IoT and augmented reality) are still much far from OM teaching in emerging economies (Loyalka et al., 2014), indicating an incompatibility with the current situation of higher education institutions in this socioeconomic context which undermines the diffusion of those innovative ICTs. Reducing the gap in the uniform prevalence of ICT prerequisites across the country with the intervention of formal institutions will narrow the disparity in adoption of new ICTs between academic institutions and their academic staff in urban and semi-urban/rural parts of the country. This has gained a very crucial importance after COVID, which has uncovered that technology is a *sine qua non* condition in education of the next generation (Code et al., 2020).

Table 7

– Partial correlation coefficients for the pairwise relationships between the highly adopted ICTs and OM teaching practices during COVID-19 outbreak controlled for the effect of subject type and teaching experience.

Highly adopted OM teaching practices	Highly adopted ICTs					N° of significant partial correlations
	Online platform	Whatsapp	Websites	Intranet	Email	
Class discussion						0
Appointment with students						0
Lecturing			0.331	0.377		2
Class projects			0.323			1
Problem solving activities						0
Do-it-yourself activities				0.320		1
Individual projects						0
Student presentations	0.334	0.403		0.347	0.373	4
Video lessons						0
Supplemental reading assignments	0.294	0.369	0.372	0.334		4
Teaching case studies	0.302	0.384				2
Research project					0.364	1
Collaborative learning spaces						0
Hands-on activities						0
Audio tutorials						0
Discussion groups						0
Debates						0
Class video						0
Brainstorming						0
Group discussion						0
Guest speakers		0.285				1
Current events quizzes						0
Student-conceived projects						0
Textbook assignments					0.297	1
Reflective discussion		0.388				1
Oral reports	0.303				0.472	2
Panel discussions		0.347	0.346	0.356		3
Rewards & recognition			0.383	0.375	0.317	3
Team-building exercises						0
Video creation		0.340	0.378			2
Peer partner learning						0
Term papers						0
Chalkboard instruction						0
TED talks						0
Making posters						0
N° of significant partial correlations	4	7	6	6	5	28

Note: Only significant partial correlation coefficients (*p*-value < 0.05) are shown in the table.

5.3. Limitation and research opportunities

Limitations of this research should be highlighted. The first one comprises the reduced sample size and the extent of emerging economies. Such limitation may be related to the few institutions that have continued teaching OM during COVID-19 outbreak in some emerging economies, e.g. Brazil. Thus, adopting larger sample sizes could allow the rise of additional insights, contributing to the body of knowledge in the subject. Second, the specific context might be relevant since the COVID-19 outbreak has impacted several countries worldwide in a different way. Each country has used different practices to curb the pandemic effect and our study involved only a few of them. In this sense, to better represent the impact of COVID-19 on the teaching of OM in emerging economies, future studies could encompass respondents from other countries with similar socioeconomic conditions. This would increase external validity and reproducibility of the findings.

Third, it would be interesting to further explore the drives of the integration of ICTs into OM teaching. The adoption of ICTs usually has a rationale that can reveal more about the social networks that connect individual adopters, specifically by using a Social Network Analysis or other sociometric techniques. In our study, we limited adopters (i.e. OM lecturers/professors) as individual units, which ignored the role of networks in facilitating this adoption. Fourth, because our instrument was comprised of Likert scale items, a common issue is whether it is legitimate to use Likert scale data in parametric statistical procedures that require interval data, such as the ones applied here. Although there is not a definitive consensus on this issue, further research could address the utilization of non-parametric data analysis techniques in order to

compare with our results. Such comparison would allow the indication of more robust findings without any potential influence of biased analyses.

Fifth, our instrument lacks concrete constructs and measures for assessing the institutional (rather than just contextual) factors at play within the investigated universities. Because a longer-term integration within institutional structures (and the resulting organizational routines, which may be static) may inhibit more experienced OM lecturers/ professors to adopt innovative ICTs and teaching practices during the pandemic, future studies could encompass measures that directly assess such institutional factors and clarify their relationship.

Finally, as emerging economies exhibit unique characteristics and react differently to COVID-19 crisis when compared to the developed counterparts, it will be worthwhile and interesting to build on the current study and investigate the impact of COVID-19 on economic, social, cultural, religious, political and labor market institutions of emerging economies at micro-, meso- and macro-levels across sectors, and how the impact is influenced by the adoption of ICTs.

Declaration of Competing Interest

As corresponding author and leader of this research I hereby confirm that authors have no conflict to declare.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.techfore.2021.120996.

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