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## **The impact of technology in accounting education: A systematic literature review**

Carolina Milharado Batalha

Master in Accounting

Supervisors:

PhD Ana Isabel Dias Lopes, Assistant Professor,  
ISCTE-IUL

PhD Inna Choban de Sousa Paiva, Assistant Professor,  
ISCTE-IUL

November, 2021



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Department of Accounting

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## **Resumo**

O desenvolvimento tecnológico levou a grandes alterações na profissão de contabilidade. De forma a satisfazer as necessidades da profissão e tirar proveito das tecnologias de informação, a educação da contabilidade teve de evoluir. As tecnologias são essenciais para melhor apoiar os estudantes e proporcionar-lhes uma ideia mais próxima da realidade da profissão de contabilidade. Este estudo pretende fazer uma revisão sistemática da literatura publicada entre 2000 e 2020, relacionada com o uso da tecnologia na educação em contabilidade. Além disso, fornece uma análise bibliográfica de desempenho, com o intuito de avaliar as contribuições efetuadas para o tema do estudo. Os resultados revelam que a tecnologia é uma ferramenta valiosa na aprendizagem dos estudantes, apesar disso, não é substituto dos professores. Ainda há espaço para melhorias na incorporação da tecnologia na educação em contabilidade.

**Palavras-chave:** Educação em Contabilidade, Tecnologia na Educação, Tecnologia na Contabilidade.

**Classificação JEL:** A22, O33



## **Abstract**

Technology developments led to major changes in the profession of accounting. In order to meet the profession needs and take advantage of information technologies, accounting education had to evolve. These technologies are essential to better support students and to provide a closer idea of the reality of accounting work. This study aims to systematically review the literature published between 2000 and 2020, related to the use of technology in accounting education. Moreover, it provides a bibliographic performance analysis, to evaluate the contributions to the research topic. Results show that technology is a valuable tool to enhance students' learning, nonetheless it does not replace teachers. There is still room for improvement in incorporating technology in accounting education.

**Keywords:** Accounting Education, Educational Technology, Technology in Accounting.

**JEL classification:** A22, O33





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## **1. Introduction**

Technology advancements are revolutionizing education. From a pedagogical perspective, the use of technology in education must be evaluated to establish whether their incorporation provided a beneficial impact on learning outcomes (Lange et al., 2003).

Given the fact that technology is relatively recent, its incorporation in academic environment is subject of multiple studies. These studies intend to understand the relationships between the use of technology and students' performance and evaluate which delivery methods are more effective, as well as identify and understand the most recent developments, future research opportunities and gaps in the existing knowledge.

Due to the large number of articles published on accounting education, the information is scattered and fragmented, making it difficult to analyse relationships, find the most relevant publications about a particular topic, as well as their conclusions. In order to facilitate these processes and add to the knowledge of the scientific community, this dissertation aims to systematize the scientific knowledge regarding the impact of technology in accounting education, by developing an empirical study of articles published from 2000 to 2020 on the subject in question.

This study intends to answer the following research questions:

1. Which are the main topics studied in the last 20 years, regarding the use of technology in accounting education?
2. What are the main tendencies in technology in accounting education?
3. What are the main contributions (authors, countries, universities) to the existing knowledge of technology in accounting education?

On that note, the main specific goals of this dissertation are:

1. Design a research strategy in order to identify papers addressing the use of technology in accounting education, and its impact on students' performance;
2. Identify the most relevant issues in this topic area, as well as the tendencies, developments and main contributions;

For the purposes of this dissertation, a methodological approach based on bibliometric analysis and a systematic literature review of the topic area have been followed. These two methods are complementary, together they map the evolution of the scientific knowledge and provide an in-depth investigation of the most relevant topics in the area (Pizzi et al., 2020).

This dissertation begins with a scoping study analysing the evolution of technology and its importance in accounting education. Provides a synthesis of the main effects in the accounting profession related to the evolution of technology, its impact in teaching and discusses the relevance of incorporating technology in accounting education.

The study of the key literature is fundamental to provide general knowledge of the broad literature of technology and its use in accounting education and allows the identification of the keywords to use in the systematic literature review.

In order to accomplish a systematic literature review, we followed the methodology described by Tranfield, Denyer and Smart (2003) and Denyer and Tranfield (2009). By following this protocol, we identified 170 relevant publications that are systematically reviewed and separated in four different groups, according to the main topics of the literature. Furthermore, we performed a bibliometric analysis, more specifically, a performance analysis to ascertain the volume and impact of the studies in this field of research.

The systematic review of the literature identifies and discusses the main issues in this area. The report of the findings begins by describing the process of selection of the relevant articles to achieve the final sample. Afterwards, we provide a performance analysis of the articles in the final sample. Moreover, the main issues addressed in the publications are presented and its impact on students' learning is discussed. The findings allow the identification of the topics that might be object of future investigation.

The dissertation is structured as follows: Section 2 presents a background on technology and systematic literature reviews in accounting; Section 3 consists of a description of the methodology adopted in this dissertation; Section 4 provides the results of the study as well as an interpretation of the outputs collected. Lastly, Section 5 presents the study' conclusions, its limitations and future research opportunities.

## **2. Background in Accounting Education: Technology and Systematic Literature Reviews**

This chapter addresses the background of technology in accounting education. It starts by highlighting some relevant facts regarding the importance of using technology in education and in the profession of accounting, followed by a brief presentation of the role of literature reviews and bibliometric methods.

### **2.1. Technology in Accounting Education**

Accounting is a system that collects, processes, and reports financial information about the business to internal and external users, so that they can make informed economic decisions (Lourenço et al., 2015).

Emerging technologies transformed accountants' everyday work and impacts the professional life of people worldwide (Kroon et al., 2021). Accounting technological changes have been studied over the years and have the potential to dramatically change accountants work (Moll & Yigitbasioglu, 2019). Even though accountants are open to new technologies, it is hard to fully be aware of its implications in the profession (Carlim, 2019). Therefore, it is essential that competency frameworks are developed, to cope with the changes and face predictable difficulties, as well as seize presumable opportunities (Kroon et al., 2021).

With the high speed of technological innovations, it is expected that the accounting profession will continue to face countless changes. This leads to the concern of how accountants will adapt their skills to face the changes (Kroon et al., 2021).

In order to satisfy all the needs of the companies and perform the accounting correctly, taking into account all legal requirements, qualified accounting professionals are needed. Accounting education provides help to students to learn and become professional accountants. Therefore, the learning objectives in accounting education programs must ensure that "students receive an education that prepares them to begin careers as accounting professionals" (Rebele & St. Pierre, 2019).

For more than 50 years, the need to change accounting education has been under discussion. However, there is still no consensus on how the change should be accomplished (Gordon & Howell, 1959).

Goleman (2011) argued that if education focuses only on analytical and technical skills, graduates' performance at work will suffer a negative impact. Furthermore, Buzan (2010) states that current education systems suppress creative thinking, which is connected to the decision-making process in managerial work.

According to Rebele and St. Pierre (2019), it is essential that there is a balance between the development of soft skills and technical knowledge in accounting education, considering that there are many relevant competencies beyond technical knowledge, such as communication skills, critical thinking, ethical awareness, life-long learning, and teamwork. These competencies allow professional accountants to be comfortable dealing with clients, able to write and speak clearly, capable of thinking critically, ethical, independent learners and able to work in a team effectively.

In terms of technical knowledge, it is fundamental that students learn the accounting methods and techniques and understand the financial reporting standards, in order to become professionals who correctly report relevant financial information, which will affect the decision making related to the business. It should be noted that accounting professionals are constantly learning as individuals, to comply with the developments and improve their knowledge (Özpeynirci et al., 2015).

For many years, educators had no support to teach, other than their voice. Then, tools like the chalkboards, projectors were designed. Later, digital tools emerged, such as the PowerPoint, Prezi, and many others (Dahiya & Singh, 2019).

The twenty-first century was marked by continuous change and huge technological developments. Education was also affected by these changes. Teaching revolved around passive forms of teaching and students were supposed to remember facts rather than understanding and being able to apply them to practice, while developing pervasive skills (Singer & Wiesner, 2013).

The use of technology in an academic environment has proven to offer many advantages, being a factor that generates a greater student productivity and a way to stimulate their interest, if used properly. Thus, technology has revolutionized education, becoming a fundamental element of learning (Halimatou & Yang, 2014). Technology has an increasing presence in the academic environment. Getting education is becoming easier, given the fact that an extensive amount of information (books, videos, papers) is just a “click” away (Dahiya & Singh, 2019).

Educational technology is the application of technological resources and methods in teaching, with the goal to improve students’ performance and motivation (Stosic, 2015). It is impossible to deny that the possibilities of incorporating technology in the classroom are endless, even if the traditional method of teaching is preferred by some people. In traditional classrooms, the only sources of information are the teacher and the books, which can be limiting, given the fact that does not emphasize the critical thinking and interactivity. Technology improves the learning experience, by making classes more interactive with

students, stimulating their engagement and motivation (Roy, 2019). It also makes it easier for teachers to create instructional materials, by implementing useful digital tools and improving instruction methods.

It is important to note that technology does not replace teachers. The best method to grant high quality education is by pairing technology with teachers. As George Couros (2015) once said, “technology will never replace great teachers, but technology in the hands of a great teacher can be transformational”.

It is essential that accounting education keeps up with the technological innovation. Therefore, it is necessary that the teaching methods are improved, making technology a tool to support education. There are several studies aiming to find out how the incorporation of technology reinforces learning and which methods are related to a better student performance.

Technology proves to be an essential support for learning. For instance, online simulations provide an experience very close to the business reality, this knowledge would not be possible to acquire through traditional learning (Beukes et al., 2018).

## **2.2. Literature Review and Bibliometric Methods**

Literature reviews have a huge role in academic research, as it allows to understand the dimension of the information in a certain area, provides an overview regarding a certain issue or research problem, and identifies gaps in the literature that have not yet been explored. In addition, the existing studies in a subject can be analysed in terms of inconsistencies, weaknesses, and contradictions to ascertain their quality and validity (Paré et al., 2015). The quality of the literature review depends on the transparency, the way it was executed and the findings (Moher et al., 2009).

A systematic literature review intends to synthesize research findings in a systematic, transparent way, so that their reproduction is possible (Davis et al., 2014). For this, it is necessary to define inclusion criteria that must be fulfilled by the studies previously identified. Since the methodology followed is very explicit, the bias is minimized (Moher et al., 2009).

Conducting a systematic review has many contributions, for instance, it is possible to identify different outcomes from similar studies but conducted in different cultural contexts. In addition, it is also possible to ascertain whether a certain element is constant in several studies (Davis et al., 2014). The systematic review is the most rigorous in terms of methodology, since it follows well-defined rules, therefore it is the most reliable approach (Liberati et al., 2009).

To ensure the quality of the systematic review, it is necessary to be rigorous, transparent and to report the inclusion and exclusion criteria. It is also essential that the studies the

systematic review is based on have good quality, otherwise the quality of the systematic review is compromised. (Davies, 2000).

While the literature review consists in a qualitative approach, the bibliometric research methods are based on quantitative approaches (Zupic & Cater, 2015).

Bibliometric methods follow a quantitative approach to study the scientific activity in a field of research, by describing, evaluating, and monitoring the published studies in that field (Zupic & Cater, 2015). These methods are proven to be a very helpful tool to support a literature review, since literature reviews, are always subjected to a minimum bias (Tranfield et al., 2003). Thus, an analysis that presents the most influential publications, and contributions before conducting the review, provides general knowledge on the field of research, free from subjective bias (Zupic & Cater, 2015).

Performing a systematic a literature review and a bibliometric analysis combined, provides depth in the field regarding the most relevant studies as well as very useful information about the field in research, such as the most important authors, publications, and biggest contributions to the existing knowledge (Zupic & Cater, 2015). Therefore, these two methods complement each other and provide a better insight to the area subject to study (Pizzi et al., 2020).

### **2.2.1. Applications for Accounting Education**

From 2000 to 2020 there has been many literature reviews on accounting education. The literature reviews identify and summarize the contributions made to the body of the research on accounting education, during a certain period of time (Watson et al., 2003). From 2015 to recent years, literature reviews reflect the studies on accounting education published in only one year, while the reviews prior to 2015 included articles published in two or three years. The reason behind the fact that more literature reviews have been published over the years, is that accounting education is becoming a more studied topic. Therefore, each year more studies are published related to the topic. Consequently, there is a need for more literature reviews.

These literature reviews focused on articles published in five or six journals: *Journal of Accounting Education*, *Accounting Education: An International Journal*, *Advances in Accounting Education*, *Global Perspectives on Accounting Education*, *Issues in Accounting Education*, and *The Accounting Educators' Journal*. The reviews were categorized into the following sections: curriculum and instruction, instruction by content area, educational technology, faculty, and students.



After many years of contributions, and many literature reviews on the broad topic of accounting education, this dissertation intends to systematically review the papers published from 2000 to 2020, focusing on educational technology.



### 3. Methodology

This dissertation follows the methodology described by Tranfield, Denyer, and Smart (2003) – the Systematic Literature Review, combined with a bibliometric analysis. These two methods complement each other, therefore by using them combined, it is possible to map the evolution of the scientific knowledge in this field as well as provide a deeper investigation of relevant topics (Pizzi et al., 2020).

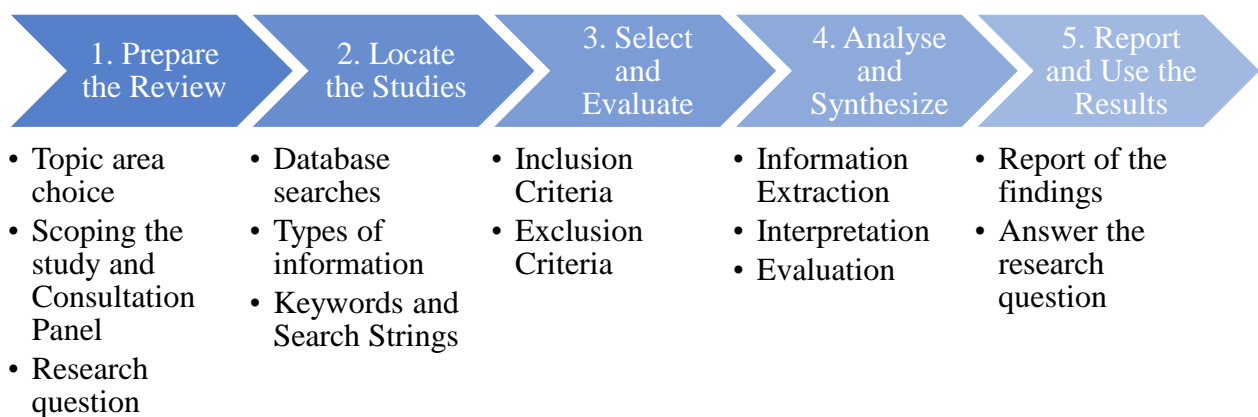
#### 3.1. Systematic Literature Review

The systematic literature review adopts a replicable, scientific, and transparent process to select the relevant studies to the research topic. This process is based on a detailed technology that allows to minimize the bias. The systematic literature review differs from the traditional literature review, which lacks thoroughness, rigour and might be biased (Tranfield et al., 2003).

The systematic process of a literature review has so clear and explicit criteria for inclusion and exclusion of papers, that the relevance and validity of the selected articles for the study are almost free from preformed opinions by the reviewer. Consequently, the results produced by the review are more reliable (Denyer & Tranfield, 2009). However, “there is no such thing as the perfect review”, considering that all reviews are written from the reviewer’s particular perspective (Hart, 1998).

According to Denyer and Tranfield (2009) a systematic literature review consists in 5 different steps (Figure 3.1).

*Figure 3.1 - Systematic Literature Review Steps, adapted from Denyer and Tranfield (2009)*



#### 3.2. Bibliometric Analysis

In this dissertation we focus on the performance analysis of a bibliometric analysis. Our goal is to support the systematic literature review by identifying the most influential authors, countries,

universities, and journals, as well as provide an overview of the research in the field of technology in accounting education.

The process to achieve a bibliometric analysis is very similar to the one to perform a systematic analysis (Zupic & Cater, 2015). Therefore, we will follow the process presented in Figure 3.1. Once we reach the final sample of papers and the information is clean, we use the Microsoft Excel Pivot Tables to identify the major contributions, tendencies, and developments in the field.

### **3.3. Description of the Processes Followed**

This section describes the steps followed regarding the achievement of a bibliometric analysis and systematic review that minimizes the problems identified in a traditional review.

#### **3.3.1. Theme**

The selection of the research topic arises from the discussion with my supervisors. We believe that the technology has a major role in accounting education, therefore the accomplishment of a systematic literature review combined with a bibliometric analysis that focuses on that topic would provide unbiased evidence from a wide range of studies of educational practices making use of the technology. Analysing the different studies allows the identification of the learning methods that are positively related to a better student performance.

#### **3.3.2. Scoping the Study and Consultation Panel**

Scoping the study is a fundamental step in the systematic review, as it allows to identify the relevance and size of the literature used in the review. The subject area and topic delimitation are also established in this step (Tranfield et al., 2003).

After discussion with my supervisors, we decided to restrict the analysis to the studies published in the last 20 years (2000 to 2020). Given the time frame, the sample is large therefore, representative of the universe. The present research focuses on the studies related to the business area, for instance accounting, finance, economy, social sciences, and ethics. Consequently, the studies related to other areas are excluded from the literature review and bibliometric analysis. This guarantees that the literature review conclusions are relevant and the major trends, developments and contributions to the area are identified.

The creation of a Consultation Panel was key to overcome the difficulties that were appearing along the way, as well as guide and supervise all the processes of the systematic

literature review and bibliometric analysis, detect relevant conclusions, and prevent bias. The members of this panel are my supervisors, as illustrated in Table 3.1.

*Table 3.1. - Consultation Panel*

<b>Person</b>	<b>Title</b>	<b>Organization</b>	<b>Role in the Study</b>
Ana I. D. Lopes	Professor of Accounting	ISCTE-IUL	Supervisor
Inna C. S. Paiva	Professor of Accounting	ISCTE-IUL	Supervisor

Ana Isabel Dias Lopes is an assistant professor in the Accounting Department at ISCTE Instituto Universitário de Lisboa and an integrated researcher at BRU/UNIDE, in Lisbon (Portugal). Professor Ana Lopes holds a Msc in Accounting and Corporate Finance by the Universidade Aberta and a PhD in Management, specialized in Accounting, by ISCTE-IUL. She has teaching experience in masters and doctoral programs, executive training, post-graduate and undergraduate degrees related to financial accounting and reporting, management control in multinationals and account consolidation. Currently, Director of the Master's Degree in Accounting at ISCTE-IUL and Executive Director of the Graduate Program in Advanced Financial Accounting. Her research interests include international financial accounting and reporting, integrated reporting, business concentration and account consolidation, and corporate governance.

Inna Choban de Sousa Paiva is an assistant professor in the Accounting Department at ISCTE Instituto Universitário de Lisboa. Professor Inna Paiva holds a Msc in Accounting by the Universidade do Algarve and a PhD in Accounting by ISCTE-IUL. She has experience in teaching in master's programmes and programmes for executive education, and engages with courses related to financial accounting, business reporting and public accounting. For several years, she was the director of the Master's in Accounting and Taxation and the Bachelor's Degree Course Accounting, Taxation and Auditing at Universidade Lusófona. Her research interests consist of the implementation of International Financial Reporting Standards, accounting quality and family firms.

### **3.3.3. Delimitation of research papers**

The delimitation of the research papers consists in the decision of which electronic database is used as a source of studies related to the topic area and the selection of keywords and search strings that have a better fit to the review.

### 3.3.3.1. Electronic Databases

The sources of the articles that sustain this literature review are WoS of Science (WoS) and Scopus. The decision to use both databases arose from the fact that neither the databases is all inclusive, therefore Scopus and Web of Science complement each other.

### 3.3.3.2. Selection of keywords and search strings

The selection of the keyword is based on the review theme, accordingly it has to apply not only to accounting education, but also to technology. The keywords selected to identify the relevant papers are presented in table 3.2., divided by the two main areas of interest: “accounting education” and “technology”. Despite the keywords being chosen carefully, it is possible in a database search to find publications that do not fit in the scope of the review (Zupic & Cater, 2015).

Table 3.2. - Keywords

<b>Subject</b>	<b>Keywords</b>
<b>Accounting Education</b>	Accounting Education
	Accounting
<b>Technology</b>	Technology
	Innovation
	Gaming
	Educational Technology
	Youtube
	Learning Technology
	Virtual
	Digital
	Virtual Reality
	Educational Innovation
	Educational Games
	Game Based Learning
	Electronic
	Mobile Learning
	App
	Online

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We combined keywords related to both topics, in order to cover the largest possible number of articles on this subject. From the combination of the keywords resulted 18 search strings<sup>1</sup>. These search strings attempt to identify papers that reflect the use of technology in accounting education. The resulting search strings are listed below:

- Search string 1: “Accounting Education” AND “Technolog\*<sup>2</sup>”
- Search string 2: “Accounting Education” AND “Innovation”
- Search string 3: “Accounting Education” AND “Gaming”
- Search string 4: “Accounting” AND “Education Technolog\*”
- Search string 5: “Accounting Education” AND “Youtube”
- Search string 6: “Accounting” AND “Learning Technolog\*”
- Search string 7: “Accounting Education” AND “Virtual”
- Search string 8: “Accounting Education” AND “Digital”
- Search string 9: “Accounting Education” AND “Virtual Reality”
- Search string 10: “Accounting” AND “Educational Innovation”
- Search string 11: “Accounting” AND “Educational Games”
- Search string 12: “Accounting” AND “Game Based Learning”
- Search string 13: “Accounting Education” AND “Electronic”
- Search string 14: “Accounting” AND “Mobile Learning”
- Search string 15: “Accounting Education” AND “App”
- Search string 16: “Accounting Education” AND “Online”
- Search string 17: “Accounting Education” AND “Simulat\*”
- Search string 18: “Accounting Education” AND “Delivery”

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<sup>1</sup> Search strings result from the combination of different keywords and are used in the research to find the desired results.

<sup>2</sup> The asterisk allows to find variations of a term, for example, the inclusion of singular and plural.

### **3.3.3.2. Literature Extraction**

The literature extraction is performed in both Web of Science and Scopus equally. The search is conducted by topics, in the title, abstract and author keywords. The areas selected are accounting, finance, economy, social sciences and ethics, and the studies related to other areas are excluded, for the reason that they are not within the scope of study. The documents “proceedings” and “conference papers” are also excluded. The search results are imported to individual Excel files. After that, all the information is gathered in only one Excel file. It is necessary to make some adjustments to the set of information in Excel, since the information extracted from the two databases is organized differently. Thus, this step is important to eliminate errors and inconsistencies that may exist, related to the authors’ keywords, article titles and authors’ names, for instance (Pizzi et al., 2020).

### **3.3.4. Selection and Evaluation**

In order to select the papers for the systematic literature review and bibliometric analysis it is necessary to identify the duplicates. After this first step, the remaining papers are analysed to determine which papers are relevant and fit the purpose of the study. This process is executed through reading the titles and abstracts of the remaining papers and applying the “exclusion criteria” to reduce the number of papers for the review. The final group of papers is achieved by a complete reading of the remaining papers to ensure that the “inclusion criteria” is attained. Finally, the results and discussion of the findings are presented.

#### **3.3.4.1. Elimination of duplicates**

Given the fact that two different databases were used, and the search by keywords was performed equally in both, some results are duplicated, therefore it is required to eliminate the duplicates. This process is performed by analysing the results previously exported to Excel, regarding the DOI<sup>3</sup> and the title. After this process is obtained a list of studies without duplicates.

#### **3.2.4.2. Exclusion criteria based on reading the titles and abstracts**

The keywords search in the databases identifies papers related to the research topic, however, some of them might not lie in the scope and purposes of the systematic literature review.

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<sup>3</sup> The DOI is a unique code, formed by a pattern of letters and numbers, which is assigned to publications that are available on the internet.



Consequently, through reading the titles and abstracts of the non-duplicate papers, the exclusion criteria (Table 3.3) is applied and the contributions that are not relevant for the literature review are removed. It is fundamental that the exclusion criteria are defined before reading the titles and abstracts, to mitigate the bias (Zupic & Cater, 2015).

*Table 3.3. - Exclusion Criteria*

<b>Criteria</b>		<b>Rationale</b>
1. Studies that mention the keywords as residuals		Considering that the defined keywords are not the focus of some papers, these are irrelevant for the review.
2. Insufficient relation to the topic area for the systematic literature review	2.1. Topics are not directly related to education in accounting.	Articles that refer to the use of technology on education but not specifically in accounting education.
	2.2. Topics based on accounting education but not related to the use of technology.	Studies that focus on accounting education, but do not consider the impact of technology.
3. Published documents of conference papers or proceedings		Documents that are compilations of papers, research and information presented at conferences or meetings.
4. Publications that are literature reviews		This study is a literature review, therefore should be based on original papers, instead of literature reviews.

### **3.3.4.3. Inclusion criteria based on reading of full text papers**

In order to assess the quality of the final group of papers, the inclusion criteria is applied. The papers that pass the inclusion criteria defined below are included in the systematic literature review.

**Inclusion Criteria:**

1. The literature review supports the research questions;
2. The methodology is clearly explained;
3. The scope is evident;
4. The results are well interpreted;
5. The contribution to knowledge is perceptible.

**3.4. Literature synthesis process**

As previously mentioned, the papers that pass not only the exclusive criteria but also the inclusive criteria are included in the systematic literature review and bibliometric analysis. Accordingly, it is fundamental to present and describe the main findings of the papers. The following issues should be considered:

1. How can technology be used in education to improve students' performance?
2. What is the relationship between the use of technology in accounting education and students' motivation?
3. What are the inconsistencies in the existing knowledge?
4. What are the strengths and weaknesses of incorporating technology in education?
5. What are the biggest contributions in the field?

## 4. Results and Discussion

This chapter provides an analysis of the papers included in the systematic literature review. The analysis aims to present the main research hypothesis, data, and findings of each publication. After careful analysis of the final sample, the studies were divided into four main groups. Primarily we present a performance analysis of the articles included in the final sample. Then, we present the findings, according to the groups selected previously.

### 4.1. Descriptive analysis of the selected papers

#### 4.1.1. Process description

The database search with the search strings defined previously provided a large number of papers. The number of papers obtained per search string, through each database is presented in table 4.1.

*Table 4.1- Search Strings*

Search String Number	Papers Obtained from WoS	Papers Obtained from Scopus
1	81	154
2	35	39
3	1	2
4	16	82
5	1	0
6	14	29
7	8	14
8	19	21
9	2	0
10	8	12
11	2	11
12	18	22
13	6	8
14	11	26
15	2	2
16	42	54
17	28	26
18	15	49

<b>Total</b>	<b>309</b>	<b>551</b>
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The total number of studies identified with these search strings are 309 and 551, in Web of Science and Scopus, respectively. It is possible in both databases to restrict the resulting papers to specific areas. On that account, by restricting the results to only business-related areas were identified 157 and 485 papers on WoS and Scopus, respectively. Hence, 642 results were obtained from both databases in total. As previously mentioned, the use of Web of Science and Scopus simultaneously allows to access a larger number of studies, however among this number of results are duplicates, that must be eliminated.

The duplicate search in each database resulted in 44 and 138 in WoS and Scopus, respectively. Remained 460 articles, 113 from WoS and 347 from Scopus. These results were gathered in one Excel file and analysed, in order to identify duplicates in both databases. In this way, 79 more duplicates were determined, leaving a total of 381 non-duplicated papers. The exclusion criteria (table 4.2) was applied to the non-duplicate papers. The main reason for excluding papers is related to the exclusion criteria 2, according to which papers that have an insufficient relation to the topic area should be eliminated. The total number of papers removed by applying the exclusion criteria were 211. Therefore, the final sample of documents for the bibliometric analysis is 170. We use all these studies to clarify the topics of interest based on the titles, abstract and keywords. However then, to present the main results of the systematic literature review, 62 papers were removed and not reviewed because they were not written in English, Portuguese, or the access to the papers was restricted.

*Table 4.2 - Exclusion Criteria Application*

	WoS	Scopus
Documents from all sources	309	551
Only business Areas	157	485
Duplicates in Each Database	(44)	(138)
Documents After Duplicates Removal	113	347
Total Documents from both Databases	460	
Duplicates in Both Databases	(79)	
Documents After Duplicates Removal	381	
Papers excluded based on criteria 1	(56)	
Papers excluded based on criteria 2.1	(70)	

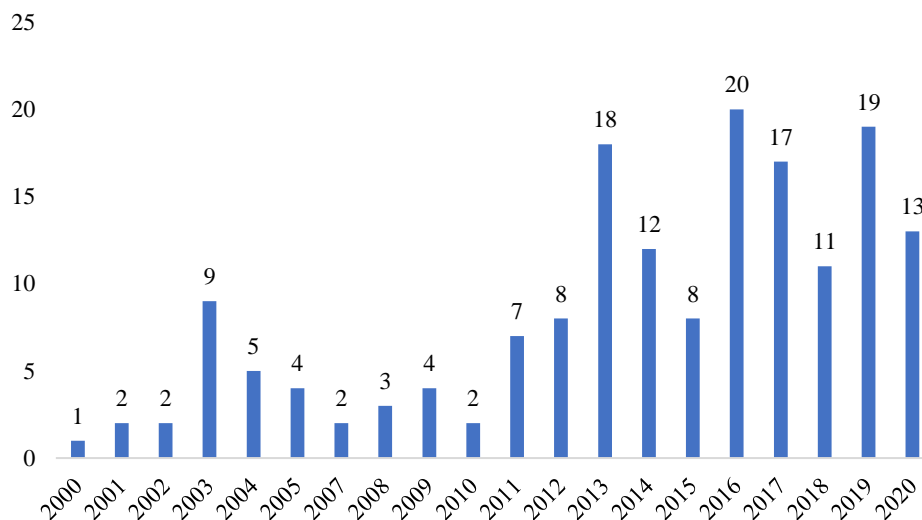
Papers excluded based on criteria 2.2	(31)
Papers excluded based on criteria 3	(44)
Papers excluded based on criteria 4	(10)
Final sample of papers for the bibliometric analysis	170

## 4.2. Results of bibliometric analysis

In this section we present the results of the bibliometric analysis, more specifically, the performance analysis.

First, we consider the evolution of the field (Figure 4.1.), from 2000 to 2020. The number of papers published per year has increased over the years, which reveals that on the last decade the interest and development in this field of research has grown. The increasing debate on the topic of technology in accounting education was expected since the technological innovations on the last decade have been quite remarkable. Therefore, it is natural that its use has been extended to teaching and object of multiple studies.

*Figure 4.1. - Papers distribution from 2000 to 2020*



During the period analysed, 86 journals published at least one paper about technology in accounting education, and 63 journals were cited at least once. This means that despite the use of technology in accounting education being a novelty, the research is producing a good impact.

There is no certain measure to evaluate the impact of journals and papers (Hall & Page, 2015), however measuring the contributions of an author or a journal by the total number of citations, papers published or the average citation per paper is well accepted (Garfield & Pudovnik, 2015).

Table 4.3. presents the 20 most cited journals. The total number of citations highlights the most influential journals in this field of research. The most cited journal is *Accounting Education*, followed by *Journal of Accounting Education*, *British Accounting Review*, *British Journal of Educational Technology* and *Journal of Education for Business*. All these five journals have at least 100 citations. The average citation reflects the number of times each article was cited, in average. It shows the impact of the journal in the field. By analysing Table 4.3. we can notice that the journal *British Accounting Review*, with only one paper published, is placed in the third position of the most cited journals. *British Accounting Review* is also the journal with higher average citation per paper. This allows us to conclude that the number of articles published by a journal does not reflect its impact in the field.

Table 4.3. - 20 Most Cited Journals, ordered by total number of citations

Journal	Cited by	Articles	Average Citation
Accounting Education	399	27	14,78
Journal of Accounting Education	314	18	18,47
British Accounting Review	121	1	121
British Journal of Educational Technology	112	1	112
Journal of Education for Business	100	8	12,50
Issues in Accounting Education	67	7	9,57
Managerial Finance	67	1	67
International Journal of Accounting Information Systems	41	1	41
Campus-Wide Information Systems	36	1	36
Meditari Accountancy Research	26	4	6,50
Active Learning in Higher Education	26	1	26
Education and Training	18	2	9
Accounting Research Journal	17	3	5,67
Management Research News	16	1	16
Revista de Contabilidad - Spanish Accounting Review	15	3	5
Advances in Accounting	15	1	15
Internet and Higher Education	13	1	13
Educational Technology and Society	10	1	10
Open Learning	10	1	10
Advances in Accounting Education: Teaching and Curriculum Innovations	10	4	2,50
Journal of Emerging Technologies in Accounting	10	3	3,33

Regarding the most cited papers, in the field of accounting education, table 4.4., presents the 10 most cited articles. All of them were published in the 20 most cited journals. The article with a higher total number of citations is “Accounting practice in the new millennium: Is accounting education ready to meet the challenge”, published in *British Accounting Review*, the third most influential journal. However, it is important to consider that the total number of

citations itself might not reflect the impact of an article, since it depends on other aspects, such as the publication year. Thus, the most cited article might not be the most relevant, as it has been published for 18 years, with an average of 6,72 citations per year. By analysing the table 4.4. we can see that the article “Innovators or inhibitors? Accounting faculty resistance to new educational technologies in higher education” was published in 2016 and has a total of 41 citations, which is an average of 24,2 citations per year, reflecting its impact in the field, despite the fact of being in the eighth position of the most influential articles.

*Table 4.4. - The Most Cited Articles, ordered by the total of times cited*

<b>Article Title</b>	<b>Journal</b>	<b>Year</b>	<b>Cited by</b>
Accounting practice in the new millennium: Is accounting education ready to meet the challenge?	British Accounting Review	2003	121
What campus-based students think about the quality and benefits of e-learning	British Journal of Educational Technology	2005	112
Integrating a virtual learning environment into an introductory accounting course: Determinants of student motivation	Accounting Education	2003	76
Accounting knowledge and skills and the challenges of a global business environment	Managerial Finance	2003	67
Knowledge base and skill development in accounting education: Evidence from China	Journal of Accounting Education	2005	47
The future of accounting education: A regional perspective	Journal of Education for Business	2003	47
Using computerized business simulations and spreadsheet models in accounting education: A case study	Accounting Education	2004	44
Innovators or inhibitors? Accounting faculty resistance to new educational technologies in higher education	Journal of Accounting Education	2016	42
Assurance practitioners' and educators' self-perceived IT knowledge level: An empirical assessment	International Journal of Accounting Information Systems	2004	41
Technology readiness, internet self-efficacy and computing experience of professional accounting students	Campus-Wide Information Systems	2008	36

Considering the number of publications, we identified the authors that contributed the most to this field (Table 4.5.): Kern, T. (5), McGuigan, N. (5), Stoner, G. (3), Oliveira, H. (3), Weil, S. (3), Cameron, C. (3), Phillips, F. (3). Lange, P. (3), Watty, K. (3), Broad, M. (3), Dellaportas, S. (3), Moya, S. (3). The higher number of publications by an author in this field of research is five papers. The number of articles published does not reflect the impact of an author. The number of citations and the average citation per paper published is a better measure to evaluate the influence of an author in the field.

*Table 4.5. - Authors that most contributed to the field*

<b>Authors</b>	<b>Publications</b>	<b>Citations</b>	<b>Average Citation</b>
Kern, T.	5	18	3,60
McGuigan, N.	5	18	3,60
Stoner, G.	3	11	3,67
Oliveira, H.	3	2	0,67
Weil, S.	3	20	6,67
Cameron, C.	3	17	5,67
Phillips, F.	3	56	18,67
Lange, P.	3	99	33
Watty, K.	3	45	15
Broad, M.	3	31	10,33
Dellaportas, S.	3	8	2,67
Moya, S.	3	30	10

Regarding the total number of citations, the most relevant authors in this field of research (Table 4.6.) are the following: Cambell, M. (122), Flynn, A. (112), Concannon, F. (112), Lange, P. (99), Suwardy, T. (84), Mavondo, F. (76), Lashine, S. (67), Mohamed, E. (67), Phillips, F. (56), and Johnson, B. (51). The three most cited authors only have one paper published. However, they had a higher influence on the topic than the authors with more publications presented in table 4.5., according to the average citation per paper. The three most cited authors co-authored the paper “What campus-based students think about the quality and benefits of e-learning”, which is the second most cited article of this field of research. It is necessary to bear in mind that it is impossible to know the reason that a certain publication was cited, and it is possible for an article to be cited to be refuted (Zupic & Cater, 2015).

*Table 4.6. - Most cited authors*

<b>Authors</b>	<b>Citations</b>	<b>Publications</b>	<b>Average Citation</b>
Campbell, M.	112	1	112
Flynn, A.	112	1	112
Concannon, F.	112	1	112
Lange, P.	99	3	33
Suwardy, T.	84	2	42
Mavondo, F.	76	1	76
Lashine, S.	67	1	67
Mohamed, E.	67	1	67
Phillips, F.	56	3	18,67
Johnson, B.	51	2	25,50



Finally, we present the countries and universities that contributed the most to the development of this field of research. It is important to notice that for the purposes of analysing the countries and universities, we considered the affiliation of the corresponding authors. The countries that contributed with a higher number of articles published (Table 4.7.) were the United States of America (47), Australia (29), United Kingdom (13), Spain (12) and South Africa (9), making a total of 110 articles published out of 170. The remaining 60 articles were published in other countries, such as Portugal, Malaysia, Canada, among others.

*Table 4.7. - Countries with more publications*

Country	Articles Published
USA	47
Australia	29
United Kingdom	13
Spain	12
South Africa	9
<b>Total</b>	<b>110</b>

As for the universities that contributed the most to the field of research (Table 4.8.), the following stand out: Deakin University (5), Macquarie University (5), Griffith University (4), University Technology Mara (4), Kwansai Gakuin University (3), Polytechnic Institute of Porto (3), University of Glasgow (3) and Winona State University (3). By analysing the Table 4.8., we can conclude that the four universities with a higher number of articles published are all located in Australia, the second country with more publications on technology in accounting education. Despite the fact that Malaysia, Japan and Portugal are not included the countries with more publications in this field of research, three universities located in these countries are among the ones that contributed the most to the field.

*Table 4.8. - Universities with more contributions*

University	Country	Articles Published
Deakin University	Australia	5
Macquarie University	Australia	5
Griffith University	Australia	4
University Technology Mara	Malaysia	4
Kwansai Gakuin University	Japan	3
Polytechnic Institute of Porto	Portugal	3
University of Glasgow	United Kingdom	3
Winona State University	USA	3

### **4.3. Results of the systematic literature review**

The careful reading of the final papers revealed that the incorporation of technology in accounting education has many advantages, but there is still much room for improvement. The impact of the use of technology in learning is discussed in this section.

The final sample of 170 papers was divided in four different groups: technology in the classroom (56), online learning (55), use of technology as a complement to learning (32) and accounting curriculum reform (27). However, a number of these papers were removed from the systematic review hereafter presented because of the criteria previously mentioned (language and availability). So, the four aforementioned groups are resumed to 108 papers distributed as follows: technology in the classroom (29), online learning (43), use of technology as a complement to learning (25) and accounting curriculum reform (11).

The following subsections review the final papers, divided by the groups mentioned above. Section 4.3.1 reviews the papers in respect of the impact of technology in the classroom, Section 4.3.2 refers to online learning in accounting, Section 4.3.3 reviews the papers related to technology as a complement to accounting learning, and finally, Section 4.3.4 presents a review of the papers regarding curriculum reform.

Findings are presented according to the theme and emphasize the main issues regarding the use of technology in accounting education.

#### **4.3.1 Technology in the Classroom**

##### **4.3.1.1 Use of digital pedagogies**

Digital pedagogies are a way to teach and learn using digital technologies such as smartphones and tablets, and digital platforms, which refer to the way the knowledge is transferred, for instance as video recordings, online videos, or online discussion groups (Pink et al., 2016).

Regarding the perceptions of using different teaching methods among practitioners and academics, Alshurafat et al. (2020) concluded that practitioners consider essential that students have knowledge of the practice of the accounting work, since it improves students' employability. Therefore, there are some teaching tools that can be incorporated in classes to replicate the accounting work practice, for instance the use of videos and role play exercises. In addition to the use of technology in academic environment enabling greater knowledge of how accounting work is effectively carried out, it is also a way to make classes more interactive.

The use of online digital video technology in accounting classrooms is a valuable method to spark students' motivation and interest. By using these tools, it is possible to show videos

related to the subject, assign students to create accounting videos and organize activities much easier, for instance, inviting guests to talk about certain topics to students, which without these tools required a lot of effort, time, and resources, and by using them the process becomes much efficient (Holtzblatt & Tschakert, 2011). A text-to-video animation software allows instructors to generate videos that address a variety of accounting subjects. This tool extends the learning outcomes beyond what is achieved in a traditional class, since it can show hypothetical situations to students and create a discussion in class related to certain topics (Phillips & Sheehan, 2013). Green and Repetti (2015) studied the impact of the use of clickers in students grades and motivation. Clickers are student response systems, that can be assessed with smartphones and tablets for both students and the instructor (Coates, 2010). It allows to obtain immediate feedback and assessment. The use of clickers improved the students' concentration and motivation, as well as their performance.

Involving students in the creation of the pedagogies, is proven to be an advantage since it develops students' awareness of the learning processes, helps the educators to adapt to students' needs and incorporate new ideas and innovations, which leads to an improved success in exam performances (Coovadia & Ackermann, 2020).

In accounting education, educators tend to use information technology for e-mail, internet, word processing, spreadsheets, presentations and data analysis (Ahadiat, 2008). It is essential that students have computer literacy. Before the use of technology in education, most research done by students was through books and libraries. In order to begin incorporating technology, students were proposed to use internet resources to complete assessments, to improve their computer skills and their perceptions towards technology (Bhattacharjee & Shaw, 2001). In 2003, Zawawi et al. affirmed that students having their own computers or having access to them in universities helps in the development of computer literacy. Students must learn to use accounting software, to be prepared to start their careers. It was shown that students who found technology to be more useful in their future, revealed to be the ones that learned to use the software more proficiently (Becker et al., 2016). The use of an accounting software makes learning concepts easier and faster (Nori et al., 2016). Accountants work daily with Microsoft Excel, not only to prepare, but also to analyse and report financial information. Therefore, it is fundamental that accounting students have a high knowledge of this skill. Lee et al. (2019) defend that Excel shortcuts should be incorporated in accounting classes, since they are a useful tool to improve the speed of completing a task in Excel, considering that it does not need the mouse to use some functions or sorting data. Willis (2016) studied a project designed to help students learn to use Microsoft Excel, that divided students in groups according to their Excel

skill level and knowledge and intended to teach them new functions and their relevance in a work environment.

To understand the link between Informational Technology (IT) and other accounting subjects, a critical learning outcome approach could be implemented. This approach focuses on teaching the way technology can support organizations by communicating relevant information, instead of teaching technology. Therefore, students would be more motivated and interested in understanding rather than memorizing (Wessels, 2010).

Mcvay et al. (2008) studied the impact of classroom configuration and instructional technologies in good practices in accounting education. For the purpose of their study, the authors took into account The Seven Principles for Good Practice in Undergraduate Education, created by Chickering and Gamson in 1987. The seven principles are the following: encourage contact between students and faculty, develop reciprocity and cooperation among students, encourage active learning, give prompt feedback, emphasize time on task, communicate high expectations and respect diverse talents and ways of learning.

The incorporation of technology in education has a very positive impact and changed the way professors teach and students learn. The importance of its use in an educational setting has grown over the years, due to many developments, and is expected that accounting graduates can use accounting software in the work environment. According to Wahab et al. (2017) students' past IT experiences influence positively their acceptance of a technology-based education and their IT skills, therefore, universities should provide IT courses.

#### **4.3.1.2 Gaming**

In recent years, digital games have been used as a tool to teach. The relationship between its use and the learning outcomes have been object of multiple studies. According to Carens and Moya (2016) the educator has an essential role in the digital game-based learning approach as he is responsible for the effectiveness of student learning.

Silva et al. (2019) examined whether the incorporation of games in the classroom would be a useful resource to improve students' learning. The effects of the game were analysed regarding the students' concentration, challenge provided, autonomy, interaction during the learning process, perceived learning, and clarity of game goals. In what concerns the clarity of the game resource, contrary to what was expected, it is noted that giving clear objectives, did not improve the students' learning. That might be related to the students' lack of perception of the objectives of the game. The challenge provided by the game is one of the main reasons why students get interested and involved in the game, which improves learning. Regarding the

autonomy, it is noticeable that students who are more invested in the game's tasks, develop their knowledge more efficiently. The interaction between the students promotes a healthy competition and creates bonds among them, creating a significant impact on the flow. The students show a perception of learning by using games. In terms of feedback, results show that it is not an essential element, even though it is the way that the students can understand their evolution. The reason behind the fact that the feedback is not significant in learning might be because the students are so immersed in the game that do not ask for feedback. This study concluded that contrary to what usually happens, the clarity of the game and the feedback are not always essential to the students' involvement while playing.

Regarding the development of skills, Viviers et al. (2016) found that educational games are a very useful tool to teaching, since it does not only develop the technical skills, promoting the understanding of the theory, but also improves pervasive skills, while the students benefit from a more fun learning environment. According to this study the most developed skills were the following: teamwork, listening and verbal communication and problem-solving. And the least prominent skills were writing communication, professionalism, ethical awareness, and leadership. However, there were some negative aspects about the game, such as missing important information due to being too focused in winning, which leads to failure in full understanding the concepts and the fact that an educational game is very time consuming.

The use of games to teach/learn purposes have a high benefit value, since it gives an image of modernity, by bringing new technologies to the higher education and promotes innovation, while helping to standardize the teaching tools used among different universities (Calabor et al., 2019). Students perceive these new technologies as a valuable asset to their knowledge, since it allows to practically apply the learned concepts and makes learning more dynamic and easier. Technology is a very important tool to improve motivation, concentration, interest and present a positive effect to enhance learning.

The digital game-based learning needs to be properly implemented and clarified to students, otherwise they may not understand what is expected for them to do and will not be motivated, engaged, and benefit from this approach (Carenys & Moya, 2016).

There are some factors that determine the effective implementation of game-based learning. Since not all learning games provide a high efficacy of learning, the determinant factors must be identified. Sugahara and Lau (2019) based their research on the five facilitators identified by Matsuo (2015) – seeking challenging tasks, critical reflection, enjoyment of work, learning goal orientation, and development network – to analyse whether a management game was

effective. They concluded that the game addressed the five factors of the Matsuo (2015) model, therefore the management game was an effective game-based learning.

There are some barriers to using them as a teaching tool, such as their high cost, the instructor' capacity to facilitate the process of learning and having the necessary skills, the fact that not all games deliver the desirable learning outcomes, and the difficulty in blending the game-based learning with the traditional learning (Carenys & Moya, 2016). However, the better approach that is proven to bring more advantages to students is blending the games with the traditional methodologies.

The benefits of the incorporation of games in the classroom outweigh the costs, however, due to the lack of resources and incentives provided by the institutions, might be impossible for many institutions to use them (Calabor et al., 2019).

Simulations and videogames can be used simultaneously, as they complement each other. While a simulation bridges the gap between the learning environment and the future workplace, videogames promote a greater engagement (Carenys et al., 2017).

#### **4.3.1.3 Simulations**

It is hard for students to acquire the necessary professional skills with traditional teaching. Simulations are a way to help students gain hands-on experience in class (Saadullah & Elsayed, 2020). To students acquire experience in an educational setting, accounting educators use computer simulation. These allow to apply the learned concept in a practical way. Students develop their knowledge of how business work in real world context, by solving very realistic problems, practicing accounting skills, learning from their mistakes, and realizing that failure not always is a negative experience (Marriott, 2004). The more realistic the simulation is, the better prepared the students get for their future careers (Oliveira et al., 2016).

Some authors studied whether the simulation would promote students learning in specific contexts. Saadullah and Elsayed (2020) studied how a simulation could help audit students to detect errors and identify its consequences and effects on the financial statements. The simulation provided very realistic source documents and accounting records. They concluded that students were very eager, motivated to learn and were connecting the theory to the practice and had an overall excellent performance. Capelo et al. (2015) analysed the impact of a business simulation in teaching the balanced scorecard and found that the students' understanding of the concepts and usefulness of the balanced scorecard was enhanced, as well as the systems perspective.

Another great way to develop critical workplace skills for students is creating a simulated internship (Bayerlein, 2015). Bayerlein (2020) studied the effects in students' learning outcomes related to the use of the simulation and found that students with limited prior-work experience developed cognitive and skill-based learning outcomes more successfully than students that had more work experience. However, they were only able to recognise the benefits of the simulation after they gained experience in real work environments.

### **4.3.2 Online Learning**

#### **4.3.2.1 Fully Online Learning**

In a fully online learning environment, student engagement is crucial, whether with the online content, with their colleagues or educator. A regular interaction between the educator and the students leads to more students being active and successful completing the module entirely online (Malan, 2020). Virtual learning environments are student centred, more oriented to their learning, and enhance students' learning, motivation, and problem-solving skills (Broad et al., 2004). It is proven that students who frequently use the computer, tend to be more open towards course delivery modes different than traditional teaching (Basile & D'aquila, 2010).

The educators' work is essential in virtual classrooms, as they need to be thoughtful when designing the teaching-learning process (Lengyel, 2020). Providing students with lecture notes, bulletin board, online assessment, and other tools, is essential to motivate students in a virtual learning environment, since they feel more engaged when facing new and innovative media that requires their interaction. Given the advantages of the use of informational technologies in education, the cost commitment of the resources is justified (Lange et al., 2003).

Using Information and Communication Technologies (ICT) in an online learning can improve the process of learning. Since students feel involved in this process, they perceive it as useful. However, there are some other factors that influence their perception, such as their work experience. Herrador-Alcaide and Hernández-Solis (2017) found that work experience can diminish students' perceived usefulness of ICT in a virtual environment, which might be a consequence to students with prior work experience having already acquired skills through work, that students without work experience only acquired through the virtual learning environment.

As mobile devices are used very frequently for daily routines, it is natural that their integration in higher education has gained attention (Almaiah et al., 2016). Mobile learning consists in a wireless learning environment, through mobile devices, smartphones, and iPads

(Kengwe & Bhargava, 2014). These devices allow students to access course materials and learning activities despite their location, in real time (Abachi & Muhammad, 2014). According to Moorthy et al. (2019) the factor that influences students the most to adopt mobile learning is their habits, so they should be encouraged to use the mobile devices as a tool to complete tasks.

In online learning, using ePortfolio assessment can influence learner behaviour and develop their employability skills. An ePortfolio is an electronic collection of evidence, that verifies the achievement of learning outcomes (Watty et al., 2016). These tools can be used to enhance students' engagement, by assigning them to reflect upon their progress and the quality and quantity of their contributions. Promoting a continuous participation in discussion, not only improves student engagement, but also helps educators to know when it is important to intervene (Mihret et al., 2017).

Videoconferencing can be used to communicate with people geographically distant. Florit et al. (2012) found that this teaching method does not influence negatively students' performance, therefore it can be an appropriate teaching tool.

Digital game-based learning can motivate the students and stimulate the effectiveness of the learning process, especially in virtual classrooms, where it helps to integrate the theoretical and practical knowledge through games. In a gamified learning environment, students' progress should be continuously assessed and rewarded with "playful rewards", such as coins, badges or scoring (Lengyel, 2020). Some educators are reluctant to adopt a game-based approach in learning, as the use of the games is sometimes perceived as leisure time rather than an activity with pedagogical value (Hwang & Wu, 2012). However, these games help students learn in an easier and more interesting way, therefore it is important that both students and educators accept digital games as a pedagogical tool (Lengyel, 2020).

Online learning also has some disadvantages, for instance the learning students might feel that there is not as much openness to ask questions as in traditional learning. So, it is important that the educator varies the approaches to help students' engagement and level of retention (Chen et al., 2018), and also students are more prone to academic dishonesty. Therefore, educators should implement measures to combat dishonesty in online exam environments. These measures should make it harder for students to cheat in exams, as well as discourage it. Allowing students to consult textbooks and notes, eliminating easy questions that do not require cognitive effort, and limiting the time to take the exam, are measures that would meet these goals. Students that actually prepared for the exam would feel more familiar with the questions and their exam performance would be more efficient, and the consultation of the materials would be faster (Goldwater & Fogarty, 2012).



When recruiting employers consider the reputation of the candidate' institution, work experience, the delivery mode of their education and the GPA (Tabatabaei et al., 2014). For accounting students to be prepared for a real-life work experience, they not only need to have technical skills, but also several generic skills, for instance: teamwork, leadership, communication, business awareness and interpersonal skills (Albrecht & Scak, 2000). Graduates of online accounting degrees have lower scores in the CPA exam than graduates of face-to-face accounting degrees, which might influence accounting students that intend to pursue careers as certified public accountants (Morgan, 2015).

In online lectured classes, the lack of an instructor negatively influences the satisfaction and perceived effectiveness on the course, since effective instructors provide a better understanding of complex learning experiences. However, students that usually have a higher GPA, will perform well despite of the course delivery mode (Chiu et al., 2015).

#### **4.3.2.2 Blended Learning**

Bliuc et al. (2007) defines blended learning as “a mix of traditional methods of teaching, such as face-to-face teaching, and on-line teaching”. Blended learning technologies improve the flexibility, fairness and efficiency in assessment (Dickfos et al., 2014).

The instructor can design a unique course that combines online and classroom learning, that reflects the instructor requirements. When designing the course, the instructor can gradually “e-hance” it, and start by modifying the existing traditional course to achieve a course that suits the instructor and the students the best way possible (Zabriskie & McNabb, 2007).

E-learning consists in adopting an electronic educational technology, either as blended learning or an entirely online learning environment. The main benefit of using this tool is the optimization of the teaching processes efficiency. However, implementing e-learning requires an extensive amount of work associated with the design and update of course materials and technical problems and increases the risk of students' dishonesty (Grabinski et al., 2020).

The use of discussion boards has a positive impact in students' performance and can be the link between traditional and online learning (Zhou, 2015), as they promote students' discussion of relevant topics, by asking and answering questions, without involving geographical meeting of students (Marra et al., 2004) and real-time communication (Mitchell et al., 2001). Therefore, students can read the posts and take their time to reply and think of an answer rather than giving an immediate one, which leads to a higher willingness to contribute to the discussion and benefit from the discussion boards. Students' participation in the forums is voluntary, however, the students who posted on the discussion boards have higher marks (Halabi & Larkins, 2016).

These forums encourage the development of critical thinking, problem solving and knowledge constructing (Marra et al., 2004).

It is fundamental for students' learning that they get assessed and receive feedback. It is also important to understand the criteria followed in the assessment (Helfaya, 2016). Using computer-based assessment with prompt computer-based feedback, makes these processes easier and faster, as students receive timely and detailed feedback, that allows them to monitor their academic process, diagnose weaknesses and improve their future performance (Marriot & Lau, 2008).

Social media can be a useful tool for learning, while making it more interesting and motivational. For instance, Sexton (2019) studied the impact that using Facebook in learning had. Students could post photos, and interact with each other posts, as well as communicate with colleagues and educators. Students developed pervasive skills and awareness of the risks of social media. The author concluded that it was an effective and efficient tool, as it does not have costs associated and users were familiar with it. It kept students engaged and promoted their active learning.

Silva et al. (2012) created applications that simulate e-government applications, making possible for students to practice and experiment these tools in an educational environment. These simulators make learning more interesting and motivational for students.

#### **4.3.2.3 Traditional Learning versus Online Learning**

There are several media that can support learning, complementing self-studying, such as the use of clickers, interactive spreadsheets, virtual collaboration work, online quizzes and online journal research. Students tend to have a positive attitude towards ICT resourced blended learning, nonetheless they appear to have a preference over lectures and step-by-step instruction. Regarding group works, students show a preference towards informal methods of communication than using virtual learning environments (Osgerby, 2013).

Students find face-to-face learning more effective in influencing their assessment outcome and also feel more motivated. The lack of social interactions in a fully online environment influences students to prefer face-to-face learning. The minority of students that prefer online learning, does not consider social interaction essential in learning (Wong & Fong, 2014).

According to Gavira and Omoteso (2013), the reason behind some students' preference of a virtual learning environment is influenced by the following factors: the facilities that enables access to internet, the learning characteristics, their relationship with the teacher, the usefulness of complementary assistance (for instance, the email, discussion boards, and module

evaluation), the satisfaction of materials and their effect on students' performance, knowledge and soft skills and the ease of use. On a more personal level, the perception of easier communication with colleagues and a faster and more motivational way of learning through online environments or blended learning, can also impact their preference.

Despite their preference, the performance of higher education accounting students is not correlated with the teaching modality (Liu et al., 2013). Both recruiters and other professionals in the field value mostly face-to-face teaching (Mauldin et al., 2018), and they also show a preference for hybrid teaching, instead of teaching entirely online. It appears that the higher the level of training carried out online, the lower the openness to recruit (Grossman & Johnson, 2016). However, when the training of employers took place online, they tend to recruit graduates who obtained their education in the same modality, which is seen as quite competitive and superior to traditional education in terms of the development of soft skills (Grossman & Johnson, 2017).

When confronted with the possibility to purchase their ideal course structure, students presented a preference to face-to-face classes than web-based classes and demonstrated a willingness to spend more time on tutorials and less on lecture time. Students recognize the efficiency of lectures and online delivery does not necessarily increase effectiveness on teaching (Taplin et al., 2017).

McCarthy et al. (2019), examined the effects that teaching accounting courses in three delivery modes (face-to-face, blended and online) had in students' performance and found that online and blended learning courses promotes self-discipline, motivation, and organization in students, and students dedicated more time to the course.

Regarding students' ability to transfer skills and knowledge, when changing learning environments, in prerequisite and post-requisite courses, Wisneski and Ozogul (2019) found that students that maintained in online learning did not change their perception of online learning. Students who changed from face-to-face to online learning reported a positive opinion of online learning, unlike students who switched from online learning to face-to-face environments, that had a less favourable opinion regarding online learning. To face the effects of knowledge transfer due to switching learning environments, instructors should orient the student to the electronic resources, monitor the pace of the course as well as revise students' assessments. The development of standard technology materials for online and face-to-face courses decreases the inconsistency of both courses (Wisneski et al., 2017).

### **4.3.3 Technology as a Complement to Learning**

In this section we review the papers related to the use of technology outside the classroom, as a complement to students' self-studying and testing their knowledge.

#### **4.3.3.1 Technology in Self-Studying**

Technological tools that were not specifically developed for the educational field, such as podcasts can also contribute to students' learning, as they not only expose students to school contents in a new way, but also improve students' vocabulary. This tool makes possible for students to organize their own schedule according to their needs (Martins et al., 2020). A vodcasting can also be used in education, featuring audio recordings of lectures with lectures slides or videos of lectures recorded previously (Copley, 2007). Vodcasting enhances students' engagement, their learning outcomes and reveals to be very beneficial for off-campus students, since it overcomes the physical barriers. Regarding international students, those are the students who benefit vodcasting the most, whether they are off-campus students or not (Castro et al., 2021). Regarding the screencasts, these are more easily adapted to accounting topics, comparing with vodcasts and videos, since there is a wide variety of visual formats that support the presentation of these topics. According to Wakefield et al. (2017), screencasts consist of a "digital recording, or screen capture, of actions taking place on a computer screen, accompanied by an audio narration". Screencasts can be generated by students to explain a certain topic or concept. This activity develops students' communication, creativity, multimedia skills, as well as their exam performance (Wakefield et al, 2017).

Stanley and Edwards (2005) developed a CD ROM that offered experiences close to the real-life world to students regarding the concepts studied in the classroom. The CD ROM aimed to bridge the gap between the theory of the concepts and their application in practice, and combined video and interactive content in a carefully developed environment. Even though this virtual experience does not replace the real-life experiences, this media provided a supplementary resource to the traditional teaching methods for students.

Web conferences can be used to complement face-to-face classes, as additional tutorials (Montgomery, 2010). It allows to discuss information and new knowledge in real time (Giannakos & Vlamos, 2012), despite the geographic location of students (Wang & Hsu, 2008). Implementing web conferencing has some challenges associated, such as the schedule and the use of the web conference platform. Students perceive this tool as very beneficial as it makes possible to ask questions and interact with the educator and learn from colleagues' questions (Coetzee et al. 2018). Tutorial attendance is very beneficial for students, as it enhances the

knowledge gained in the classroom. When combined with class attendance, it has a positive impact on students' performance (Matsoso & Iwu, 2017).

Seow and Wong (2016) developed the Accounting Challenge (ACE) app, aiming to engage students to learn accounting in a fun way out of the classroom. This was the first mobile gaming app for learning accounting and allows students from around the globe to play and learn anywhere and anytime as well as learn from their mistakes, since the app gives feedback on answers. Students became much more interested and engaged in learning. However, students find it difficult to perceive mobile phones as a learning tool, which might be a consequence of universities relying mostly on traditional learning methods (Marzuki et al., 2020).

Koedinger and Alevan (2007) described an intelligent tutoring system as a system developed using the principles of artificial intelligence technology, that supports students in learning complex problem-solving and reasoning by providing an interactive instruction that adapts to their needs, based on the student's performance tracked before. The feedback provided by the system is tailored to each student and allows them to learn step-by-step which results in effective learning (Johnson et al., 2009). This tool is very beneficial for students. However, it is very labour-intensive and time-consuming task (McGuigan et al., 2012).

Online discussion forums are perceived by students as a facilitator to case-based-learning, as it promotes discussion and opinion sharing with other students, so they are encouraged to think critically and debate issues, while improving their communication skills (Weil et al., 2013), ability to identify the relevant data in a case as well as summarize the information (Weil et al., 2011).

The Virtual Office Hours platform provides students with opportunities to learn and reflect the practice of concepts beyond the classroom environment. Students get to know the applications of the theory taught during classes, that have a high probability of being present in students' future work careers. Educators are able to monitor students' performance and help support students (Lillie & Wygal, 2011).

#### **4.3.3.2 Assessment**

Providing activities to students outside of the classroom, that students can complete at their own pace, is essential to improve their active participation and engagement in the course. It increases students' time dedicated to the subject without significantly increasing instructors' work (Fratto et al., 2016).

The online homework software includes accounting problems, multiple choice questions and discussion of a certain topic. The software gives immediate feedback to students and the

grade of their work, in this way, it spares educators' time grading and processing students work. Students can also use this software to practice for the exams. Although the main purpose of the software is for homework, it can also be used for assessment. As the algorithmic capacities of the software provides similar questions to students but with different values, the probability of student cheating is reduced (Humphrey & Beard, 2014).

Online quizzes are a great way to students test their knowledge, but not to learn course content. Students find that self-assessing their progress with online quizzes, whether using a computer, tablet, or a mobile phone, has a positive impact on their academic performance (Meo & Martí-Ballester, 2020).

Feuerstein (1979) developed a dynamic assessment tool. The tool aimed to emphasize students' learning process and potential and through guidance could diagnose students' difficulties and provide assistance, so that students can overcome the difficulties. Ku et al. (2014) found that a computerized dynamic assessment system has a positive impact in students exam performances and by following the feedback and guidance could achieve good progress.

Students perceive e-learning as a valuable support for the learning process, as it reinforces the traditional face-to-face approach. The materials available, and the flexibility of access makes it an important tool to study and prepare for exams (Concannon et al., 2005). However, its use depends on students' perceived easiness of use, technical support, social factors, complexity and organizational support (Olasina, 2018). The design features of Blackboard are important to stimulate students' participation, effort and overall satisfaction. The accessibility to online chat, online assessment, and provision of model of answers are also factors that contribute to their satisfaction (Basioudis & Lange, 2009).

It is essential that students are willing and motivated to learn in order to have a high academic achievement.

#### **4.3.4 Accounting Curriculum Reform**

In 2003, accounting education was already under pressure to change the teaching methods. According to Burnett (2003), accounting students should acquire at least three technological skills, that would be fundamental for their future careers: spreadsheet software, Windows, and word-processing software. Education does not keep up with the technological advancements in the same pace that the firms do.

Qasim and Kharbat (2020) defend that the accounting curriculum must "reach a balance between existing accounting knowledge and informational skills relevant to the profession". The accounting curriculum should not only serve technical skills to students, but also

knowledge and competence required by the industry. However, according to Aldhizer (2015), the accounting curriculum is more focused in transmitting the accounting technical skills than technological and competence skills that the market needs. The technological advancements have a great impact in the accounting profession (Al-Htaybat et al., 2018), so it is essential that new technologies are incorporated in the accounting curriculum and influence the way it is designed, delivered, and assessed (Qasim & Kharbat, 2020), otherwise the accounting courses will be obsolete, which will impact accounting graduates' employability.

Technology advancements led to change the accounting tools, for instance, the accounting standard program changed to software. Therefore, the accounting curriculum will inevitably change and adjust to new technologies (Zhang, 2018). The new curriculum should emphasize critical thinking, high abilities of interpretation, capacity to analyse data, programming as well as a good statistical knowledge (Al-Htaybat et al., 2018).

Students must acquire soft skills, essential in the real-life work. Lin et al. (2005) identified computer techniques, foreign languages, interpersonal skills, decision-making, critical and analytical thinking, oral and written communication, teamwork and leadership as the most important skills. However, the provided education does not always satisfy the development of the needed skills.

The CPA examination, which once focused on memorizing rules and regulation, suffered a content modification. Consequently, CPA candidates require new skills to successfully complete the exam. Therefore, a curriculum reform is fundamental for the viability of accounting (Bolt-Lee & Foster, 2003).

Boulianne (2016) investigated the place IT should occupy in the accounting program, since it is very important that students have an advanced level of education in this subject. However, the study concluded that IT does not occupy the place it should, due to the challenges involved in developing IT courses, the lack of incentives for this course, the materials needed to teach and also test this subject. Lai (2008) assessed the state of technology readiness accounting students were. The students did not have a high level of technology readiness nor resistance and proved to have a moderate level of internet self-efficacy. The accounting applications were not mastered by students, however it is essential that students learn to use accounting software on campus.

Kotb et al. (2013) gave the example of e-business, which is getting more relevance in the business industry. Therefore, it should be taught to students, to reflect the changes of the business environment. However, there is some resistance to address this topic due to accounting

educators not having sufficient time in the syllabus for addressing this topic and the lack of accreditation requirements.

Despite the resistance of some professors, lack of time, the need of experienced staff and teaching resources, it is essential that students learn in which environment accounting is practiced (Kotb & Roberts, 2011). Accounting education needs to be reimaged, incorporating technologies that can adapt to the learning needs, and that can be used anywhere, anytime (Watty et al., 2016).



## **5. Conclusions, Limitations and Recommendations**

Technology development over the years changed the way accounting education is practiced. Accountants use software in their daily work, and with technology, the processes are much easier and automatized.

Accounting courses must reflect these changes, in order to keep up with the accounting profession developments. Otherwise, the courses will become obsolete and put the future of the accounting profession at risk. In recent years, for accounting graduates to succeed in the work environment it is essential that they have not only technical skills, but also soft and technological skills.

For those reasons, technology must be implemented in accounting education. It is fundamental that students learn to use the tools that are going to be part of their daily work life, for instance, accounting software, Microsoft Excel and other useful information technologies. The accounting curriculum still does not reflect those needs, so it is imperative that it suffers a reform.

Technology can enhance learning and students' motivation and performance. A beneficial way to incorporate technology in education is through games, simulations, online homework, and assessment.

There are some barriers to the inclusion of technology, such as the amount of resources needed, the high cost associated, the immense time required, and the need of educators qualified to work and teach with technology. However, the benefits outweigh the costs.

The results of this dissertation show that students prefer face-to-face teaching to a fully online learning environment, however, perceive technology as very beneficial. It is important to notice that technology does not replace teachers. According to Kastantin and Novicevic (2008), the key is to merge technology with traditional teaching to enhance a greater students' engagement.

This dissertation has some limitations. Regarding the sample, since the papers were retrieved from only two databases, not all journals published related to the topic are covered. In other databases there would certainly be more articles related to the theme of the dissertation. Being a systematic literature review, the bias is minimal, however it is impossible to fully eliminate the bias, for instance in the keywords choice or the definition of exclusion criteria. Regarding the limitations of the bibliometric analysis, the number of citations of a publication does not always mean that that publication is relevant, as it is impossible to establish the reason of citation. For instance, a publication can be cited, to be refuted (Wallin, 2005). However, citations for negative reasons are not frequent (Garfield, 1979).

We suggest that future studies to investigate the impact of technology in different areas of education. The study of this dissertation can also be extended to other databases.

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