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SYSTEMATIC REVIEW
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"EdTech Integration Framework in Schools": Systematic Review of the Literature

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The process of integration of Information and Communication Technologies (ICT) in the Educational System is a dynamic process influenced by multiple interdependent factors. The most relevant studies published to date have highlighted the following as systemic levels of ICT integration: teachers, schools, and educational policy. The general objective of this work is to carry out a Systematic Literature Review (SLR) on the strategic planning of technology in primary and secondary schools from 2010 to 2021. This study is supported by a qualitative methodology based on a SLR, guided by the PRISMA protocol. For this purpose, a keyword-based document search was carried out in three databases: Eric, Scopus, and WOS. For the collection of information, the criteria applied for the inclusion of papers was by date (last 12 years) and type of document (journal articles). A total of 6,187 scientific journal articles were initially included in the CADIMA platform, where finally, after screening, 42 articles were selected that met the established criteria: studies with teachers and students in the educational stages of Primary and Secondary Education, excluding Higher Education. Empirical studies with quantitative and/or qualitative methods are also included, discarding theoretical studies. Research on digital technologies from a general perspective is also considered relevant, excluding studies on specific technologies. This SLR concludes by providing an explanatory theoretical model, defining the integration of ICT in educational centres as a complex, systemic and ecological process, where legislative and organisational structures, such as leadership, strategic planning, and collaboration among professionals, are essential elements. Therefore, the incorporation of technology in the classroom requires a redefinition of the organisational culture of schools.

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INTRODUCTION

The general objective of this manuscript is to provide an understanding of the current state of the planning strategy and the integration of technologies in education. At the same time, it aims to provide empirical evidence on the effectiveness of educational strategic planning of Information and Communication Technologies (ICT). For this purpose, a previous search for systematic reviews

on ICT strategic planning in educational centres was carried out. This search was carried out through the Eric, Scopus, and WOS databases.

When reviewing the literature that studies the ICT integration process in the Educational System, it was found that numerous research and didactic experiences try to explain and describe the conditioning factors that promote or impede the adequate development of the process in an educational centre, as well as their degree of influence and the relationships between them. It can be stated that the ICT integration process in schools is a dynamic process influenced by multiple factors that can be grouped according to their level and nature. The most relevant studies pinpoint the following systemic levels of integration: teachers, schools, and educational policy (Zhao et al., 2002; Kozma, 2003; Tilve and Álvarez, 2009; Area and Correa, 2010; Correa and Martínez, 2010; Sanz et al., 2010; Gewerc and Montero, 2013). Normally, these factors along with their characteristics have different responsibilities in the face of changes, are hierarchically related and have a different influence on the amount and type of ICT use in the classroom.

The first level, named "Micro," is the level of individual responsibility for the ICT integration process, since it includes aspects related to the personal dimensions of teachers, such as beliefs, attitudes, technical, and pedagogical skills and abilities for ICT access and use, their experience and motivation, as well as their willingness to work as a team. The second level, designated "Meso," is the level of institutional responsibility, since this issue brings together aspects that make up the organisation of the school, such as leadership, infrastructure, and access to technological resources, ICT strategy or micro-policies or school climate, among others. The last level, called "Macro," is the level of responsibility for educational policy. At macro-political levels, such as the state or autonomous region, as well as international trends, decisions are made for the process of development, review, and implementation of ICT measures to be carried out in schools, in addition to the objectives, budget and effects to be achieved in order to make technologies part of their Educational System (Nachmias et al., 2004; Correa and Martínez, 2010).

However, most of the research studies implemented on ICT integration are too biassed and focus mainly on the influence of some characteristics of the ICT integration process, forgetting the systemic nature of the phenomenon (Tondeur et al., 2008). The focus is mainly on the "Micro" level, especially, on the individual characteristics of teachers and not so much on the "Meso" or "Macro" level variables that also affect ICT integration in schools.

As such, one of the most neglected elements in the ICT implementation process is strategic planning. This is determined by the political decisions developed in each educational system and which represent the legal and social-political framework for changes (Sanz et al., 2010). Technology plans exist at multiple levels: state, autonomous and school levels, which are multi-purpose and will vary according to the level of policy carried out in each (Fishman and Zhang, 2003; Vanderlinde et al., 2008). Therefore, the ICT integration process is delimited and built as we go down the levels, giving schools autonomy and an important part of the responsibility for the development of the process (Vanderlinde et al., 2012a,b).

At macro-political levels, measures have been developed in terms of organisational aspects and school planning. The result is that ICT educational policies, from a "top-down" model, aim to define the organisational basis of schools in order to have a decisive influence on the life of schools (Sancho and Correa, 2010). However, educational centres are acquiring more and more autonomy and responsibility, which makes the existence of an educational policy developed by these centres essential and even more important and necessary than the policies established by the Administration (Valverde-Berrocoso, 2012).

Thus, numerous research studies point out that an educational centre's ICT policy is a key factor in the process of integrating technologies (Tondeur et al., 2008). In this way, the existence of an institutional plan, project, or programme that promotes innovation and the use of technologies in the school is a crucial step toward their integrated use in the teaching-learning and other administrative processes and it is concluded that the problem of technology in schools begins with poor planning. Only those schools that build a technology policy ultimately have successful ICT integration (Baylor and Ritchie, 2002; Fishman and Zhang, 2003; Area, 2005; Gülbahar, 2007; Hew and Brush, 2007; Tondeur et al., 2008; Vanderlinde et al., 2008; Valverde-Berrocoso, 2012).

Given these problems, the strategic planning of ICT integration in schools needs to be analysed and questioned, as well as rethought in terms of the objectives, methodologies and organisation that is currently being carried out, in order to identify those factors, barriers or conditioning aspects that favour or impede the integration of ICT and establish measures to improve the process (Casanova, 2007). That said, the need to develop this study is evident, in order to provide greater knowledge about ICT planning in educational centres. Therefore, an attempt will now be made to compile and review the scientific works that have studied strategic planning in the ICT integration process at the "Meso" level, in order to build an explanatory theoretical framework and in order to solve the unknowns that arise in the research study.

METHOD

Objectives, Research Questions, and Coding

The intention throughout the research has been to go deeper with the processes of ICT integration in primary and secondary schools, so that a theoretical model can be built to explain the process and phenomena occurring. In this sense, the objective of this research is to understand and analyse how strategic planning influences the process of introduction and use of ICT and the organisational dynamics of an educational centre to face technological changes.

According to the characteristics of our research problem and the stated objective, we selected a qualitative methodology based on a systematic literature review (SLR), guided by the PRISMA protocol (Moher et al., 2009), on the strategic planning of technology in primary and secondary schools from 2010 to 2021.

As can be seen in **Table 1**, the following research questions have been formulated to meet the proposed objective from different areas of analysis: conceptual framework, documentary characteristics, and pedagogical dimension. In each research question, the coding criteria used for the analysis of the articles obtained were identified.

Eligibility Criteria

As shown in **Table 2**, in keeping with the documentary characteristics of the papers, only articles from scientific journals have been included, accepting "in press" articles and documents that have, at the least, the abstract available in English and/or Spanish. The period of publication of documents was established such that studies published between January 2010 and December 2021 (last 12 years) were considered. In terms of content criteria, empirical studies with quantitative and/or qualitative methods were included, discarding theoretical studies, dealing with research on digital technologies, from a general perspective and excluding studies on specific technologies. To define the sample, the educational level was taken into account in a compulsory manner, accepting studies proposed in the educational stages of Primary Education and Compulsory Secondary Education, excluding Higher Education and centres exclusively dedicated to Early Childhood Education.

Sources of Information

For the identification of research studies, articles have been consulted by applying keywords in the Eric, Scopus, and WOS databases. The search and selection of articles runs from May 30, 2019 until December 2021.

Search Strategies

Regarding search strategies, terms included in Eric's Thesaurus are considered and specifically, as shown in **Table 3**, the following combinations and Boolean operators are used. It should be taken into account that quotation marks are used in searches with two or more keywords. The keywords established have been applied equally in the search of each database, as can be seen in the documents prepared for their management (Sosa-Díaz et al., 2022).

Table 4 describes the sequence of filters. In Scopus and WOS, the following filters were adopted: title-abs-key (subject); title-abs-key (subject) + pubyear + tipdoc (ar); and key + pubyear + tipdoc (ar). In the Eric database, the following sequence of filters was used: the search was initiated from

TABLE 1 | Systematic literature review research questions.

Scope	Investigation questions	Initial coding criteria
Conceptual framework	PI1. What is the conceptual network around the terms that is drawn from literature?	Co-occurrence map by keywords.
Documentary characteristics	PI2. What is the distribution of articles according to their position in the database and year of publication?	Quartile of the journal and year of publication of the article.
	PI3. What are the topics of the articles according to the journal's category in the databases?	Thematic categorisation of journals according to the database (Wos, Scopus and Eric).
	PI4. What is the geographical distribution of the publications?	Country of residence of the first author of the article.
Pedagogical dimension	PI5. What are the models or approaches used in the integration of ICT in primary and secondary schools?	ICT integration models
	P16. What tools do primary and secondary schools use to implement and evaluate the effectiveness of strategic planning for ICT integration at their schools?	Strategic planning Evaluation
	PI7. What role do the different educational agents–stakeholders–play in the strategic planning of ICT integration in primary and secondary schools?	Roles Leadership

TABLE 2 | Inclusion and exclusion criteria.

Characteristics	Category	Description	Observations
Documents	Type of document	Articles from Scientific Journals	"In press" articles are included.
			Exclusion of documents such as doctoral theses, book chapters, conference proceedings, etc.
	Language	English	At least the abstract must be in English or Spanish.
		Spanish	
	Period	January 2010–December 2021	
Content	Education level	Primary Education	Higher Education excluded.
		Secondary Education	Exclusion of centres exclusively dedicated to Early Childhood Education.
	Methodology	Empirical studies with quantitative and/or qualitative methods.	Theoretical studies are ruled out.
	Type of study	Research on digital technologies, from a general perspective.	Studies on specific technologies are not included.

TABLE 3 | Description of Boolean operators.

Keyword in Eric	Description
Organisation	Organisation (+educational technology) Organisation (+education) (+ICT)
Administration	Administration (+educational technology) Administration (+education) (+ICT)
Leadership	Leadership (+educational technology) Leadership (+education) (+ICT)
Principal	Principal (Director) (+educational technology) Principal (Director) (+education) (+ICT)
Vision	Vision (+educational technology) Vision (+education) (+ICT)
Models	Models (solo título) (+educational technology) Models (+education) (+ICT)

TABLE 4 | Database search description.

Database	Description
Sequence of filters in SCOPUS-WOS	1. TITLE-ABS-KEY (TEMA) 2. TITLE-ABS-KEY (TEMA) + PUBYEAR + TIPDOC (AR) 3. KEY + PUBYEAR + TIPDOC (AR)
Sequence of filters in ERIC	1. Start search from Thesaurus. 2. Date: from 2010 3. Type of publication: article. 4. Education Level: Primary Education//Secondary Education//Post-secondary 5. Identify most relevant authors/journals for each search term. Select the top 5.

Thesaurus; the date of publication was considered (from 2010 to 2021), the type of publication (article) and the educational level (Primary Education and Secondary Education) were taken into account; and the most relevant authors and journals were identified for each search term, selecting the five best ones.

Selection Process and Data Collection

For the collection of information, search strategies were applied in the different databases, identifying the studies by date (last 12 years) and type of document (journal articles). This study selection process was carried out independently by three reviewers acting in different phases (Sosa-Díaz et al., 2022). Specifically, these reviewers divided the document searches by database (Eric, Scopus, and WOS).

A total of 6,187 files were registered and uploaded to the CADIMA platform for proper management and selection of the final readings was made according to the established inclusion and exclusion criteria. In turn, two reviewers independently read the summary of all the articles found, through the CADIMA platform, applying the inclusion and exclusion criteria. Each reviewer evaluated the information found and where just one of the criteria was not met, the study was excluded. In the end, only studies for which the two reviewers agreed on a positive assessment were selected. As can be seen in **Figure 1**, after applying these criteria, a final sample of 42 articles was obtained, whose references were entered in the ZOTERO bibliographic manager, to facilitate the management of the references. In addition, the search files were stored in a shared Dropbox folder and the different documents were analysed according to the previously established coding, in an Excel table (Sosa-Díaz et al., 2022).

RESULTS

The results obtained in this SLR are presented in a manner consistent with the general objective and research questions described in the methodological section. Specifically and first of all, we analyse the advances that have been made in the thematic structure of publications on the planning and organisation of ICT in schools. Following this, we highlight the connections between the different authors who have worked and are currently working on the theoretical development of this topic, analysing the connections between them and the characteristics of the space where this type of publication is located. After exploring the document characteristics, we move on to the pedagogical dimension, where we answer questions of a more theoretical nature relating to the advancement of the corpus of ICT planning in the school environment.

The Structure and Characteristics of Information and Communication Technologies Planning Publications

The relationship between the keywords of the articles selected in this SLR shows a trend marked by the conceptual evolution of ICT planning in schools in the last decade. As can be seen in the central plane of **Figure 2**, the term Educational Technology is initially linked to an organisational approach, i.e., related to processes such as school organisation, teaching-learning processes, or technology transfer. This first large block is made up of articles published between 2011 and 2014. Parallel to the chronological and conceptual advancement of technology, there is also a new set of terms that, although they do not contradict the previous concepts, they do define a new set of independent terms related to the organisation and planning of ICT in schools. Specifically, we are talking about terms such as digital capabilities, school leadership, or maturity training models, which are all key elements of ICT policy.

Regarding the document characteristics of the scientific literature analysed, it can be affirmed that the geographical locations of the most important publications on ICT planning in schools in the last decade, are widely spread throughout the world, with a predominance in Spain (30.9%), Belgium (16.7%) and to a lesser extent, the United States (4.8%). In this regard, as can be seen in **Figure 3**, the most relevant contributions on this subject have been published by the research team of Van Braak and Vanderlinde (16,7%), both authors being the main standard-bearers that unite the terminological positions we have identified in **Figure 2**.

The methodological approach used in the research is 45.2% quantitative, 33.3% qualitative, and 21.4% mixed, with research

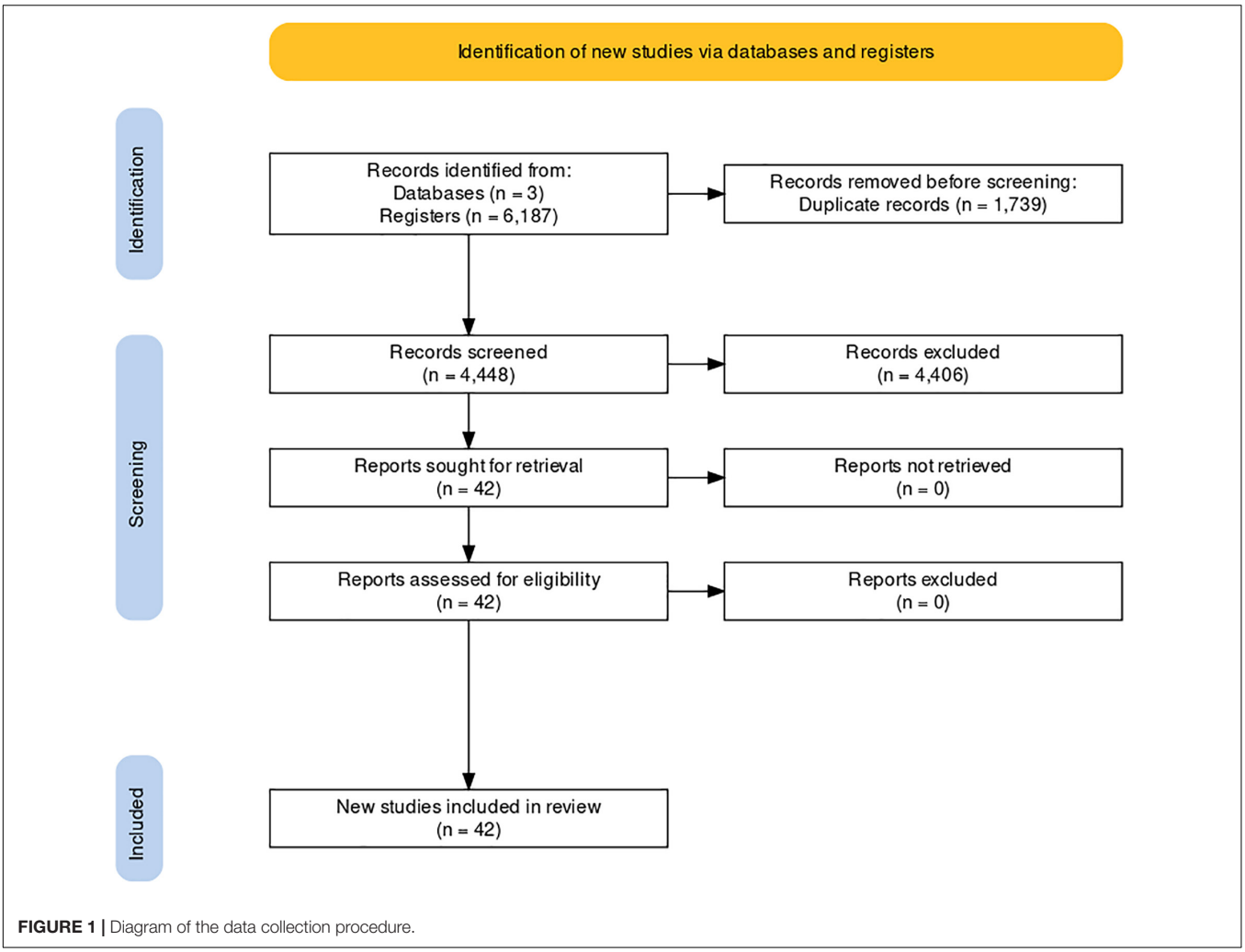

FIGURE 1 | Diagram of the data collection procedure.

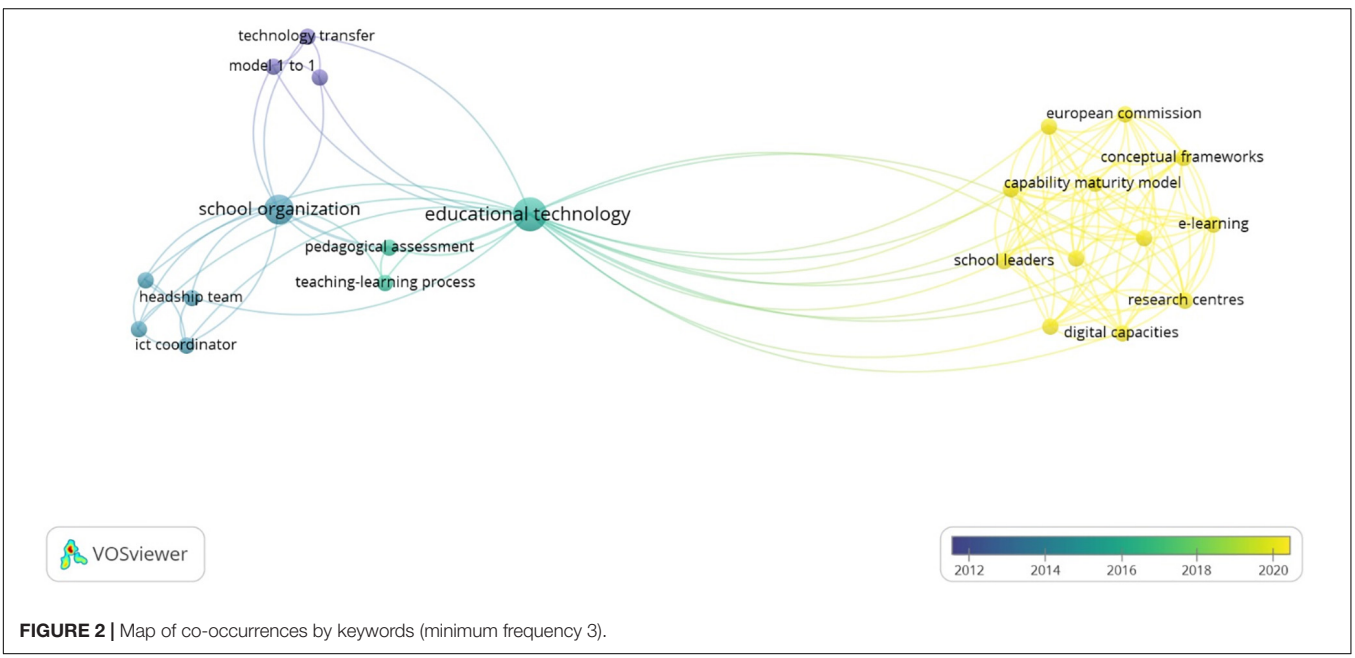

FIGURE 2 | Map of co-occurrences by keywords (minimum frequency 3).

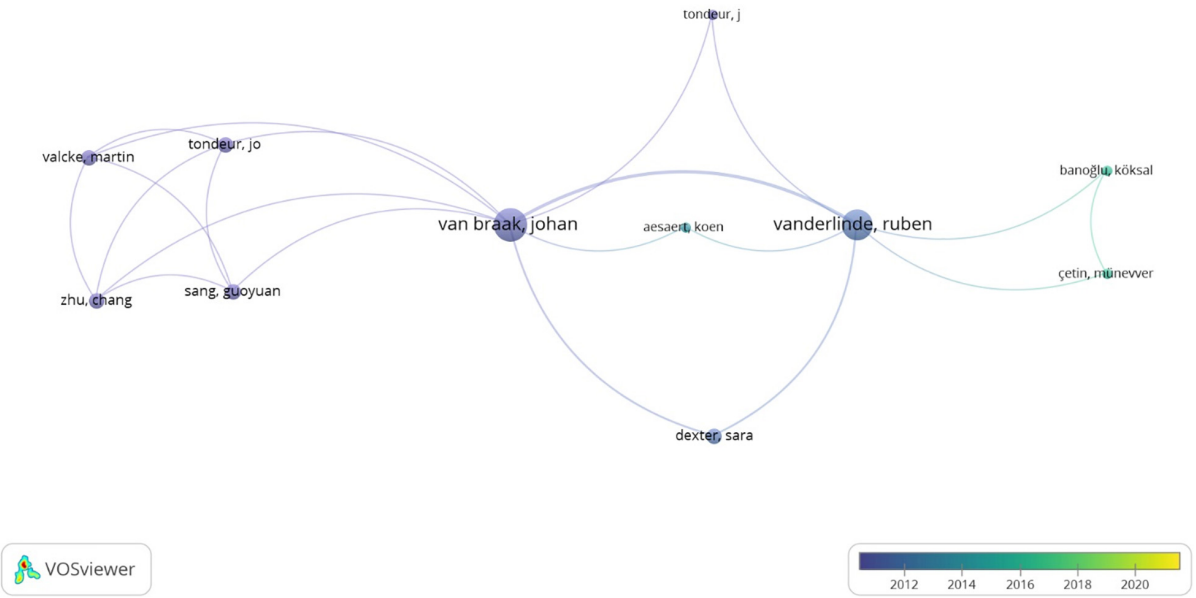

FIGURE 3 | Map of co-occurrences by author words (minimum frequency 2).

being composed predominantly of descriptive studies and case studies using the survey or questionnaire as the main data collection instrument (54%), the interview (31%), and to a lesser extent, research of an exploratory design or nature (7%), among others.

With respect to the type of participants; the studies conducted mainly rely on teachers (48%) to resolve their research questions and objectives and to a lesser extent on members of the management team (21%). Meanwhile, those studies that take into account students (12%), experts (4.8%), or institutional documents (4.8%) are almost non-existent. Considering the overall number of participants in all the research studies consulted, it is particularly relevant that the present SLR covers 2,531 educational centres, 19,636 teachers, 8,652 members of management teams, 467 students and 27 experts.

In turn, all the selected articles, with the exception of 1 found in WOS, are indexed in Scopus and are categorised with the SJR index (Scopus). In this sense, 19 of the selected publications are positioned in the first quartile (Q1), 7 in the second quartile (Q2), 6 in the third quartile (Q3), and 2 in the last quartile (Q4). The remaining 8 are not categorised by the SJR index, although they are in the Scopus database, which means that they have been published in journals recently included in the database.

Theoretical Corpus on Information and Communication Technologies Planning Publications

Information and Communication Technologies Integration Models

Most states have invested heavily to include technology in society, in particular, to integrate ICT use in education (Ruiz and Sánchez, 2012; Caro and Flores, 2018). However, the research reviewed points out that these investments have often not borne fruit in the actual use of technologies in educational centres (Hatlevik and Hatlevik, 2018) or in other words, the innovation that is taking place is slow and gradual (Rivero and Alonso, 2016).

There are many factors and elements that influence the successful process of ICT integration. Niemi et al. (2013) identify six keys to successful integration: (1) ICT included in strategic planning, as part of the school culture, (2) teaching and learning methods that facilitate participation and lead to empowerment, (3) flexible curricula, (4) high investments in communication, (5) optimal leadership and management, and (6) strong teacher capacity and commitment. On the contrary, other studies affirm that the integration and use of technologies depends on educational policies and social and organisational contexts (Blignaut et al., 2010; Valverde-Berrocoso et al., 2010; Matviichuk et al., 2017), above all, on the perception and expectations that teachers have of such (Inan and Lowther, 2010; Sang et al., 2011; Ruiz and Sánchez, 2012).

In this sense, Rikkerink et al. (2016) model called "Multi-level Organisational Learning Framework," understands educational centres to be "learning schools." Their organisational training capacity is highlighted as the backbone in the development of educational innovation and in the use of digital technologies in a specific way. There is special emphasis on distributed and transformational leadership, and the shaping of a joint and collective vision of the process as prerequisites. Banoğlu et al. (2016) also point out the importance of the "learning organisation culture," where the main components of this organisational vision are team learning, shared vision, and systems thinking disciplines.

The Vanderlinde and Van Braak (2010b) model also argues that every educational centre, like any other organisation, has the capacity to improve itself and coined the concept of "e-capacity"

as the ability to create and optimise resources and achieve the introduction of technologies in the centre. Vanderlinde et al. (2014) develop this model of e-capacity, and further conclude that the process of ICT integration in the classroom is not an individual phenomenon at the teacher level but a social phenomenon at the school level, placing more emphasis on the ecology of the process as advocated by Judge (2013). Therefore, the main differences found between centres are due to the idiosyncrasies of the school and the underlying internal policy.

The e-skills model is composed of five concentric circles of mediation toward the implementation of ICT in the curriculum and in educational change, in which the importance of school climate and ICT aspects in the school is highlighted.

- ICT aspects in the school: this refers to the influence of all those school agents related to the planning and programming of ICT micro-policies, such as the joint vision of ICT integration of the entire educational community, as well as the amount, type, location, and access of infrastructure and technological resources, or the methods and materials to be used in the teaching-learning process, in addition to the technical support for their use.
- Aspects of school climate: this level includes aspects related to the different roles and leadership assumed by the different agents in the ICT integration process, especially ICT coordinators and management teams, as well as participation in the decision-making process of the entire educational community and collegiality, collaborative attitudes and collective practices.

Therefore, taking into account this series of theoretical contributions, it can be stated that the integration of ICT in educational centres is a complex, systemic and ecological process, where legislative and organisational structures, such as leadership, strategic planning, and collaboration among professionals, are essential elements, fostering or preventing ICT tools from being explored and pedagogically appropriate (Valverde-Berrocoso et al., 2010; Judge, 2013).

Information and Communication Technologies Strategic Planning

Having clear strategic planning of ICT in the classroom is essential for the good use of digital tools in schools (Vanderlinde and Van Braak, 2010b; Prokopiadou, 2012; Goktas et al., 2013; Niemi et al., 2013; Vanderlinde et al., 2014; Volungeviciene et al., 2014). Technology planning is a continuous process and characteristic to each educational centre (Vanderlinde and Van Braak, 2010a), where the vision of ICT and the policy at school level, are essential elements for strategic planning and for generating a school culture related to technology. In this sense, authors such as Niemi et al. (2013), working on how to strengthen this element to promote technological practices, find it necessary to develop a vision of technological planning in centres, ICT policy funding and budget management, ICT policy on infrastructure (practical organisation of ICT infrastructure software issues, hardware), and training policy and teacher professional development in ICT. In the same vein, as indicated by Vanderlinde et al. (2012b), primary schools in Flanders carry out ICT planning focussed on what a curricular reform entails, so that it is considered to be a multifaceted phenomenon based on school culture.

As a result, schools are increasingly encouraged to write a school-based ICT policy plan. In such a plan, hereafter Digital Education Plan (DEP), a school describes its expectations, goals, content, and actions related to the future role of ICT in teaching and learning, in addition to the existing and future technical and infrastructure specifications of the school (Vanderlinde et al., 2012a). In this sense, the authors indicate that ICT policy planning is the process and the SDP is the product. To this end, according to the literature on the subject, there are three different types of documents that can serve as instruments for implementing ICT in schools and that can be classified according to the aspects to which they pay most attention (Vanderlinde et al., 2012a):

- ICT policy plan, as a vision model: only pays attention to issues related to management configuration.
- ICT policy plan, as a technical inventory: is related to organisational development and infrastructure analysis.
- Comprehensive ICT policy plan, focussing on ICT leadership practices that favour the integration of technologies.

In order to promote an adequate achievement of ICT strategic planning, the literature speaks of three important elements. It is considered that the DEP should detail the list of activities and opportunities for teachers and administrative staff to acquire the digital competencies deemed appropriate, as well as the indication of who will manage and deliver these activities (Vanderlinde et al., 2012a,b). It is also considered necessary to properly manage the economic budget of that which is involved in the implementation of ICT at the centre, where decisions are made about how to invest money, in addition to establishing the necessary funding mechanisms to develop such ICT policy (Vanderlinde et al., 2012b; Goktas et al., 2013). To execute budgets effectively, planning must go into where and how to spend the money (Goktas et al., 2013). Finally, a focus on evaluation, planning, monitoring and continuous updating is also thought to be essential. Consequently, the DEP must provide both "strategic" and "operational" elements to guide the process of ICT integration in schools (Vanderlinde et al., 2010, 2012b).

To accompany the process and facilitate the creation of the DEP in the literature reviewed, we found two instruments. One such tool was the PICTOS (Planning ICT in School) software developed by the Belgian educational administration (Vanderlinde et al., 2010). PICTOS establishes the process as cyclical and includes a five-step development: (a) perception of the teachers' educational vision; (b) creation of an inventory of the current use of technologies, (c) establishment of priorities and objectives; (d) creation of new activities; (e) elaboration of an action plan. Research shows that PICTOS has been very positive for the integration of ICT in schools and provides an opportunity for teachers to develop a process of reflection on their own educational practice and beliefs in relation to ICT, which undoubtedly improves the introduction of technologies in

the classroom (Vanderlinde and Van Braak, 2010a; Vanderlinde et al., 2010).

At the same time, Rodríguez et al. (2011) propose the "Evolutionary Development Model" (EDM), which conceptually combines the design, implementation and evaluation of ICT-based programmes. This model aims to help build and plan ICT programmes characterised by their efficacy, effectiveness and efficiency. The EDM establishes a roadmap for creating and validating ICT-based pedagogical innovations for the classroom, incorporating their cost-effectiveness to make them both technically and financially feasible.

It is important to note that these tools emphasise that strategic planning should be the result of school culture and climate in the educational community with respect to technologies (Vanderlinde et al., 2010, 2012b). For this reason, although the document is written by one person, who may be the ICT coordinator, the creation process must be a collaborative work where the entire educational community participates (Vanderlinde et al., 2014). Along these lines, research points to the fact that any educational planning is more likely to be carried out if the entire faculty has participated jointly in decision-making and the construction of a shared vision with regards to the role of ICT (Vanderlinde and Van Braak, 2010b; Vanderlinde et al., 2010, 2012a; Hadjithoma-Garstka, 2011; Volungeviciene et al., 2014; Rikkerink et al., 2016; Blau and Shamir-Inbal, 2017). Therefore, educational policy is decentralising in favour of school autonomy and toward accountability for educational reform with its implementation in the curriculum.

Notwithstanding, the reality is that most schools do not have a "Digital Education Plan" that implies, at least, some vision concerning the use of ICTs or the modification of dominant teaching practices (Vanderlinde et al., 2012a). Some reasons why schools do not have this important element in the process of integrating technologies are, fundamentally, the lack of time during professional practice of both teachers and management teams and the absence of governmental pressure and support (Vanderlinde et al., 2012a).

Information and Communication Technologies Leadership

In the joint decision-making process, a fundamental and essential precondition for ICT policy planning, is transformational leadership that generates a climate of acceptance of technologies as an element of educational innovation (Hadjithoma-Garstka, 2011; Vanderlinde et al., 2012a,b; Martín et al., 2013; Niemi et al., 2013; Valverde-Berrocoso and Sosa-Díaz, 2014; Fernández-Cruz et al., 2018). Therefore, authors such as Vanderlinde et al. (2012a), identify three leadership functions that a leader has to develop within a school to promote the use of ICT among teachers:

- Defining direction: to foster the development of a shared vision of the organisation's purpose and objectives, involving teachers in decision-making.
- People development: provide well-designed professional development to establish desired patterns of knowledge and behaviours.
- Doing the work of organisation: understanding and facilitating change processes and modifying the use of time and other resources to assist successful change.

The scientific literature therefore emphasises the importance of two leadership figures for the achievement of these functions. The management team stands as an empowering element, a driver of innovation and change within the school and at the same time, an ICT coordinator adds a dynamizing and guiding element to the process (Papaioannou and Charalambous, 2011; Vanderlinde et al., 2012a,b, 2014; Martín et al., 2013).

Management Team

The management team and mainly principals have a leading role in ICT integration, as they are the main agents of change in schools (Blignaut et al., 2010; Papaioannou and Charalambous, 2011; Martín et al., 2013; Banoğlu et al., 2016; Larosiliere et al., 2016; Fernández-Miravete and Prendes-Espinosa, 2021a,b). Two models of leadership performance within management teams have been identified: "e-competent" and "laissez faire" (Valverde-Berrocoso and Sosa-Díaz, 2014). Some research shows the relationship between the implementation of innovative initiatives and projects with the presence of dynamic management teams that are aware of the use of technologies (Papaioannou and Charalambous, 2011; Martín et al., 2013). Along these lines, there is research that concludes that the management leadership work performed by school principals is a determining factor in the success of the ICT integration process (Hadjithoma-Garstka, 2011; Martín et al., 2013), since it is the principal who provides the vision and ICT objectives shared by the entire teaching staff, which are essential for the construction of the DEP and its implementation. Thus, in schools with principals who exercise strong leadership and ICT vision, the integration of technologies is more likely to be successful (Vanderlinde et al., 2010; Hadjithoma-Garstka, 2011; Martín et al., 2013).

The leadership of school management teams is essential in the ICT integration process (Larosiliere et al., 2016). This integration is based on facilitating and enhancing capacities to develop a policy that acts as a catalyst and facilitator of the process (Sang et al., 2011). Likewise, this process of ICT incorporation will be more successful in those centres where ICT infrastructure, meaning the availability of equipment, software, Internet access, and other similar resources in schools, are not common barriers, and where the principal's role as leader actively encourages a climate of collaboration and experimentation among the teaching staff. In addition, one must also take into account the encouragement of motivation toward the use of technologies in the classroom through training measures and recognition of the teaching work within centres.

Within this analysis it is important to highlight the existence of studies that conclude that those ICT projects that receive the support of the principal are more prone to teacher participation and motivation (García-Valcarcel and Tejedor, 2010). Moreover, principals' support to teachers in using ICT is essential, not only with words but with action and model use of ICT, thus changing the culture

of the school (Hadjithoma-Garstka, 2011; Moses et al., 2012). Therefore, the principal's leadership is essential for channelling the administration's proposals for change and transmitting to the teaching staff the enthusiasm and dedication necessary for change, actions that become essential elements and which facilitate the process of creating a technological culture within the centre (Hadjithoma-Garstka, 2011).

However, it is necessary to note that some studies point out cases where leaders in practice do not actively engage in innovative projects with ICT. There is a claim that many leaders feel overwhelmed by the task of technology implementation, as they often lack formal training or experience with ICT. Thus we can understand that there is a need for management teams to develop positive beliefs and attitudes toward ICT, and for managers to learn ICT leadership and visionary knowledge and skills (Papaioannou and Charalambous, 2011). Supporting management teams in the development of pedagogical innovation projects with ICT and promoting the training of their members should be a priority (Bocconi et al., 2020). It is particularly important to have technical staff and administrative support, such as an ICT coordinator, to support and sustain the work of principals in using ICT to change the school's culture (Moses et al., 2012).

Information and Communication Technologies Coordinator

Schools should try to achieve a pedagogical leadership perspective that helps in the planning of ICT policies (Larosiliere et al., 2016). Authors such as Martín et al. (2013), highlight the pedagogical leadership role of the ICT coordinator. Their study analyses strategic planning as an indication that the coordinator's presence is a critical factor in the dynamics of Spanish schools and institutes. Thus, studies agree that one of the success variables of ICT in the classroom is the existence of an innovative or enterprising teacher who drags the entire faculty to continuously use technologies (Valverde-Berrocoso and Sosa-Díaz, 2014). Although the figure of the principal is the one who sets the tone for innovation in the school, it is equally important to have a pedagogical leader or ICT coordinator who has sufficient digital skills and knowledge of the didactic use of technologies (Area, 2010; Papaioannou and Charalambous, 2011).

This pedagogical leader, due to his or her digital knowledge and skills, is the most suitable figure for the dynamization of ICT in schools (Hadjithoma-Garstka, 2011; Vanderlinde et al., 2014). It is also understood to be a primary reference in the promotion, support and training of teachers (Papaioannou and Charalambous, 2011; Moses et al., 2012; Valverde-Berrocoso and Sosa-Díaz, 2014). This approach is supported by studies that investigate the perception of the ICT coordinator in the implementation of technologies, where it is concluded that normally ICT initiatives are proposed by a group of teachers, led by an ICT coordinator, who is the one who dynamizes, disseminates, and propagates different actions (Moses et al., 2012; Rivero and Alonso, 2016). In this sense, the ICT coordinator has great responsibility, since he/she is the one who must often promote a shared vision of ICT that not only focuses on the purely technical aspects of the technologies but also on their pedagogical use and improvement in the teaching-learning processes (Vanderlinde et al., 2014). As such, ICT coordinators help with flexible education as an option to promote a more just, equitable, accessible, and creative educational system (Peirats and San Martín, 2012; Valverde-Berrocoso et al., 2021).

Furthermore, the technical assistance usually provided by an ICT coordinator has a stimulating impact on the educators' own uses of ICT, since the lack of it can create difficulties with the use of computers (Moses et al., 2012; Peirats and San Martín, 2012). However, the functions of such coordinators in educational centres are not entirely clear, and they fulfil many different roles, given that the work of the ICT coordinator is complex and demanding. Therefore, some research studies have tried to define and identify the functions that ICT coordinators should be and indeed are developing (Vanderlinde et al., 2010, 2012b):

- Dynamiser of ICT and didactic innovation processes in the centre, such as managing and coordinating all classroom activities or ICT projects.
- ICT Planner, performing tasks related to strategic planning, development of the ICT vision, and control of the process of creating the "Digital Education Plan."
- ICT Secretary/Accountant, as he/she must manage, spend, and administer the budget, seeking to optimise the integration of ICT in the school.
- ICT trainer, providing didactic support and advice to teachers in the implementation of ICT in the classroom.
- ICT technician, assuming responsibility for the management and maintenance of ICT equipment.

Despite these recommendations, coordinators continue to focus on the functions of technology review, editing and maintenance of a centre's digital spaces, as well as on communication with technical services for equipment maintenance (Vanderlinde and Van Braak, 2010a; Valverde-Berrocoso and Sosa-Díaz, 2014). As for the tasks related to the role of dynamizer, planner, secretary, or educator, which could contribute more effectively to facilitate educational change, we see this role being taken on less by ICT coordinators when compared with technical functions (Vanderlinde and Van Braak, 2010a). Very often, ICT coordinators do not have enough time to deal with each and every one of the tasks entrusted to them and therefore, that they cannot perform their functions with total effectiveness (Valverde-Berrocoso and Sosa-Díaz, 2014).

Information and Communication Technologies Team

Vanderlinde and Van Braak (2010a) relate the coordination of ICT as favouring teaching-learning processes with ICT and do not focus only on technical issues. These authors investigate the importance of the successful integration of ICT in schools, to facilitate the ability to develop a school-based ICT policy to establish a plan (Vanderlinde et al., 2010). Some studies, state that schools which have an ICT team, consider it a basic pillar for the successful integration of ICT in their centre, as it allows networking, coordination and channelling of decisions (Espuny et al., 2012; Valverde-Berrocoso and Sosa-Díaz, 2014). This highlights the importance of generating a vision of ICT

integration among all agents in schools and the ability to create technology-specific "learning communities" who work in groups and reduce anxiety and lack of confidence among teachers (Wachira and Keengwe, 2011). In this way, the expansion of technology-related learning networks among teachers can help manage the ICT integration process more effectively (Banoğlu et al., 2016; Boronenko et al., 2018). The work of the ICT coordinator is very important in promoting collegial faculty collaboration, as a positive association has been made between teachers' use of ICT in their practice and an increase in the overall self-efficacy perception of ICT for instructional purposes (Hatlevik and Hatlevik, 2018). Thus, it is necessary for pedagogical leaders or ICT coordinators to focus their work on fostering work teams or learning communities, which facilitate the development of ICT strategic planning and policies.

Information and Communication Technologies Evaluation Tools

Training evaluations are an essential tool for improving strategic planning (Vanderlinde et al., 2012a). From the outset, it is necessary to assess needs and oversee previous conditions, as well as analyse results obtained in the development of the process, so that we achieve a plan that varies accordingly (Vanderlinde et al., 2010, 2012a,b). There are numerous instruments that evaluate the integration of technologies in schools. To this end, Caro and Flores (2018) promote the evaluation of ICT integration and use *via* a model which is holistic in nature. It is supported by three fundamental aspects: pedagogical, didactic, and technological.

Summak et al. (2010), for their part, select and analyse the most relevant tools at an international level, drawing comparisons in relation to their characteristics and the content to be evaluated:

- "*The level of Technology Implementation Framework and Questionnaire*" (LOTI), is a questionnaire-type instrument that surveys variables such as higher education teachers, school administrators, media specialists, instructional specialists, and educators-in-training.
- "*Observation Protocol for Technology Integration in the Classroom*" (OPTIC), is a qualitative tool that, through observation and the completion of a rubric, assesses all the components of the school institution.
- "*Profiling Educational Technology Integration*" (PETI), is a questionnaire that evaluates the performance of teachers, school principals, and the educational administration.
- "*Taking A Good Look at Instructional Technology*" (TAGLIT), is a survey that evaluates the teachers, students, and the person who manages the centre.

Pour et al. (2017) analyse the "Balanced scorecard" (BSC) as a strategic method of measuring ICT integration in schools, using pedagogical principles and organisational techniques, helping educational institutions to identify weaknesses and strengths in e-learning projects and guide them towards selecting appropriate strategies for the process. Similarly, other research uses the "Conceptual Framework for Digitally Competent Educational Organisations" (DigCompOrg), which aims to help schools reflect on their digital capacity in a systematic and strategic way (Bocconi et al., 2020; Fernández-Miravete and Prendes-Espinosa, 2021a,b). Considering the evaluation tools analysed by the various research studies, it is interesting to note the importance placed on the reflective, holistic, and systemic character of evaluations in the process of ICT integration in schools.

DISCUSSION

"EdTech Integration Framework in Schools"

Although it is not one of the most commonly studied elements, when conducting the SLR with the objective of understanding how strategic planning influences ICT introduction process and the organisational dynamics of an educational centre, a strong body of high impact research has been found. The information obtained from the different studies consulted has made it possible to draw up an explanatory proposal called "EdTech Integration Framework in Schools" (ETIFS). As shown in **Figure 4**, the aim is to show the results obtained in the SLR in a visual way, regarding how the ICT integration process behaves in educational centres and how the different foundational elements are related.

As has been seen in the scientific literature, this theoretical proposal with a pyramidal structure intends to reflect that the process of ICT integration in schools responds to the following:

Firstly it responds to systemic, holistic and ecological approaches represented by the container circle, where factors are diverse and interrelated with each other (Judge, 2013; Niemi et al., 2013; Vanderlinde et al., 2014).

Secondly, it responds to organisational learning models, interpreting educational change and transformation as continuous and cyclical, where formative evaluation has a central place and is an essential element in the process (Banoğlu et al., 2016; Rikkerink et al., 2016; Caro and Flores, 2018).

The ETIFS reflects how ICT policy at the school level, as well as school culture relating to technology, are essential elements for strategic planning (Blignaut et al., 2010; Valverde-Berrocoso et al., 2010; Vanderlinde and Van Braak, 2010a; Goktas et al., 2013; Niemi et al., 2013; Vanderlinde et al., 2014; Volungeviciene et al., 2014). As such, ICT strategic planning is established as the process and the Digital Education Plan (DEP) becomes the tool to carry it out. The DEP should provide both "strategic" and "operational" elements to guide the process of ICT integration in schools, so it must refer to goals, content and actions related to the future role of ICT in teaching and learning, in addition to the existing and future technical and infrastructure specifications of the school (Vanderlinde et al., 2012a,b; Goktas et al., 2013).

It is important in the elaboration of the DEP, to analyse the results obtained in the development of the process, so that we get a plan that varies in accordance with circumstances, needs and results obtained (Vanderlinde et al., 2010, 2012a,b). Some of the evaluation tools identified and analysed in the scientific literature are: "*Balanced scorecard*" (BSC), "The level of Technology Implementation Framework and Questionnaire" (LOTI), "Observation Protocol for Technology Integration in the Classroom" (OPTIC), "Profiling Educational Technology

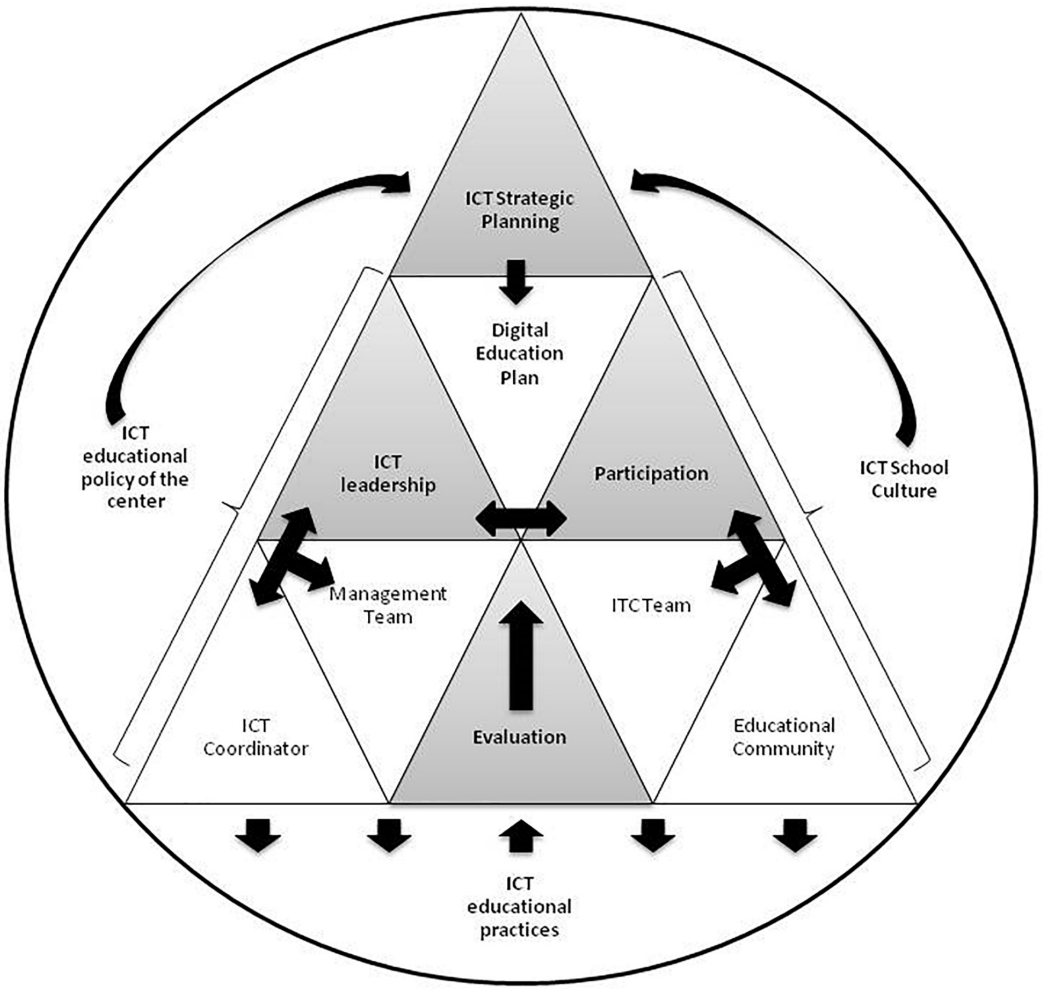

FIGURE 4 | "EdTech Integration Framework in Schools" (ETIFS).

Integration" (PETI), and "Taking A Good Look at Instructional Technology" (TAGLIT) (Summak et al., 2010; Pour et al., 2017).

As can be seen in the ETIFS, the decision-making process for the development of the DEP requires two fundamental and essential preconditions for ICT strategic planning. Firstly, it is necessary to have strong leadership that generates a coherent ICT vision and policy at the centre and secondly, a climate of acceptance of technologies as an element of educational innovation, in which two main agents are involved.

The management team in a distributed and transformational leadership, is an empowering element, an engine of innovation and change within the school; it supplies the vision and ICT objectives to be shared by the entire teaching staff, essential for the construction of the DEP and its implementation (Blignaut et al., 2010; Hadjithoma-Garstka, 2011; Papaioannou and Charalambous, 2011; Martín et al., 2013; Valverde-Berrocoso and Sosa-Díaz, 2014; Banoğlu et al., 2016; Fernández-Miravete and Prendes-Espinosa, 2021a,b).

The ICT coordinator in a pedagogical leadership role, acts as a dynamiser and guide for the process and helps in the planning of ICT policies; provides sufficient digital skills and knowledge of the didactic use of technologies and improves teaching-learning processes (Area, 2010; Hadjithoma-Garstka, 2011; Papaioannou and Charalambous, 2011; Moses et al., 2012; Valverde-Berrocoso and Sosa-Díaz, 2014; Vanderlinde et al., 2014).

The participation of the educational community and specifically the teaching staff is also fundamental in the process (Vanderlinde et al., 2010, 2012a,b, 2014; Hadjithoma-Garstka, 2011; Volungeviciene et al., 2014; Rikkerink et al., 2016; Blau and Shamir-Inbal, 2017). In this sense, the creation of an ICT team favours the success of ICT integration, as it allows for networking, coordination and channelling of decisions, as well as reducing teachers' anxiety and lack of confidence (Wachira and Keengwe, 2011; Espuny et al., 2012; Valverde-Berrocoso and Sosa-Díaz, 2014).

Therefore, taking into account this series of theoretical contributions, it can be stated that the integration of ICT in educational centres is a complex, systemic and ecological process, where legislative and organisational structures, such as leadership, strategic planning, and collaboration between

professionals, are essential elements, promoting or impeding the development of educational practices, where ICT tools are explored and pedagogically appropriate (Valverde-Berrocoso et al., 2010; Judge, 2013).

CONCLUSION

The development of this SLR, concerned with the strategic planning of technology in primary and secondary schools, has made it possible to elaborate a theoretical, visual, and explanatory proposal for the phenomenon of ICT integration, which has been called "EdTech Integration Framework in Schools" (ETIFS).

Taking into account the different themes, dimensions, and theoretical approaches presented above, one of the main conclusions that can be drawn from the SLR is that the incorporation of technology in the classroom requires a redefinition of the organisational culture in schools. As ETIFS theoretical model shows, it is undoubtedly a complex and systematic process that responds to a wide range of singularities and where legislative and organisational structures, along with collaboration among professionals, are essential elements for success. Technological educational practices require an organisational base that extends across different levels and strata and which is embodied in examples such as the DEP or the PICTOS programme mentioned above.

Within this new work culture, it is essential to get to know and recognise the importance of the agents in charge of the design and implementation of technological organisational issues. Therefore, it is worth focussing on the systemic model of ICT strategic planning, which highlights the importance of the relationship between management, ICT coordination and school leadership in the process, as well as that within the educational community, the ICT team and the active participation of teachers for the sake of implementation and proper planning and educational practices with ICT.

The research published so far, coincides in pointing out the importance of the human factor, especially in issues related to leadership and the usefulness of technology in the classroom. One of the main challenges faced by ICT planning today, lies in precisely this area. The problem lies in trying to promote a solid leadership by the school's management teams that is embodied in different strategies and carried out by the ICT coordinator. By demonstrating the sense and importance of learning with and through technology we can motivate, encourage, and ultimately incorporate each and every one of the professionals and agents involved in the educational process.

Limitations

It should be noted that one of the main limitations of this study involves the screening carried out on the selection of the 6,187 scientific journal articles that were initially available and which later, after the aforementioned screening, was reduced to a total of 42 articles that support the basis of the research. For future works, the intention is to broaden the criteria on which this research was based: including studies with teachers and students in the educational stages of Primary and Secondary Education, excluding Higher Education and thus increasing the number of articles in the selection.

Among the various articles selected, theoretical studies were eliminated. This may be considered a limitation to the work, and it may have contributed to the foresight of this study to have had some of this research to reference which offers new lines of work and inquiry.

At the same time, research on digital technologies from a general perspective has been considered fundamental, excluding studies on specific technologies. It would be interesting to be able to review this limitation again, considering the possibility of making a new selection, thus expanding the research and including articles related to specific technologies in order to have access to additional points for new lines of study.

Finally, it should be emphasised that a new systematic review with a larger number of authors would be essential to elaborate new, more complete and complex co-occurrence maps.

DATA AVAILABILITY STATEMENT

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found at Sosa-Díaz et al. (2022).

AUTHOR CONTRIBUTIONS

MJS-D, MCS-D, and RA-M contributed to conception and design of the study and selected the articles. MCS-D and RA-M organised the database. RA-M performed the statistical analysis. MJS-D, MCS-D, and ND-R read and categorised the data. MJS-D wrote the first draft of the manuscript. FL-S, MCS-D, and RA-M wrote sections of the manuscript. ND-R reviewed and organised the references. All authors contributed to manuscript revision, read, and approved the submitted version.

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