Review

The Use of Technology as an Instrument to Promote School Coexistence

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Abstract: The phenomenon of school coexistence has gained special relevance in recent years, mainly due to the increase in conflict situations among students. The main objective of this work has been to carry out a systematic review of the scientific literature on the impact of the application of technologies as a didactic resource for the improvement of school coexistence, as well as to find out the current and future lines of research in this field of investigation. For this purpose, a total of 14 scientific articles indexed in the Scopus, Web of Science and Google Scholar databases were selected following the principles of the PRISMA Declaration. The results show that, although the scientific literature on the implementation of technologies for school coexistence is limited, didactic strategies measured with technologies reduce cases of school conflict. Among the conclusions are that technologies are tools to be taken into account for the improvement of school coexistence; however, their misuse due to a lack of digital skills can lead to violent behaviour on the part of students.

Keywords: ICT; school climate; school climate; school climate; systematic review

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1. Introduction

The development and high penetration of Information and Communication Technologies (ICTs) in everyday life is generating changes in the way people develop in the social environment, restructuring the way they think, work, communicate, teach, and learn.

The phenomenon of school coexistence has gained special relevance in recent years, mainly due to the increase in conflict situations among students. These situations occur frequently in schools, which is an added problem. The incorporation of active and collaborative methodologies in the classroom, together with an appropriate variety of tools that adapt to the reality of the centres, allows the use of technologies not only in the teaching–learning process but also as tools that facilitate good school coexistence.

ICT is currently a challenge and an opportunity to contribute to the development of more inclusive societies and more equitable and quality education systems for all [1]. This approach has led education systems to consider very seriously the role of ICT in education and, to a lesser extent, the relationship of technology with Education for Coexistence and the Culture of Peace, which has given rise to challenges such as those posed by UNESCO [1]: learning to live together. In this sense, the prevention and improvement of school coexistence has become a priority objective for schools. Along these lines, and thanks to technological resources, it has now become an emerging field of study.

2. Conceptualisation

The concept of ICT has been referred to in the specialised literature from different perspectives. In this sense, from a technical point of view, authors such as Haag, Cummings and McCubbrey [2] considered information technologies to be composed of "any computer-based tool that people use to work with information, support information and process information needs". From an institutional perspective, the OECD [3] defined ICTs as those

devices that capture, transmit and display electronic data and information, and that support the economic growth and development of manufacturing and service industries. From an educational perspective, Luque Parra and Rodríguez Infante [4] define them as any means, resource, tool, technique, or device that favours and develops information, communication, and knowledge; they are also considered a didactic support for learning, an element for cooperative work and an element of management and administration.

More recently, authors such as Belloch [5] consider ICT as technologies for storing, retrieving, processing, and communicating information. There are a variety of electronic resources that fall within the concept of ICT, such as television, telephones, videos, and computers, among others. However, the most representative media in today's society are computers, which allow us to use different computer applications, such as presentations, multimedia applications, office software and communication networks.

In relation to the concept of school coexistence, we can describe it as the way in which the people who form part of the educational community interact and live together [6]. In this sense, coexistence in the school environment is a process that is produced by the interrelationship between the members of the educational community, which has a high impact on the dimensions of socio-affective, intellectual, and ethical development of students. According to Woolfolk [7], the concept of coexistence is a process under permanent construction in each educational centre and must be accepted and internalised by each of its members. It refers to a democratic coexistence and to the relationships between its members, considering the rules they share, especially those that arise from an agreement between the parties.

With regard to the concept of school climate, all the authors studied agree that it is a complex and multidimensional term. The multiplicity of definitions for school climate has generated confusion and hindered the progress of research [8,9]. This lack of definitional consensus has meant that school climate is inconsistently measured [10]. It has been described as the unscripted personality and atmosphere of a school, including its norms, values, and expectations [11]. In addition, it has been described as the "quality and character of school life" [12].

3. State of Research

International scientific research has not only provided many details of the extent, causes and forms that violence, bullying and conflict in education can take, but also knowledge about the key elements for preventing, detecting, and intervening in these cases [13,14]. In this sense, the international scientific community has proposed different lines of research in relation to school violence in which the central aspects that generate it are framed, as well as the interventions that have shown positive results for its prevention [10,15]. Among them, there is a tendency to move towards models that introduce a community perspective, understanding as such approaches in which it is the responsibility of the entire educational community, not only of professionals but also of students, families, and other socialising agents, to prevent, act and intervene in cases of violence or bullying [14,15].

Moreover, there are many researchers who argue that ICTs contribute to the development of social competences and have even been used to work in educational institutions with deteriorating school coexistence as factors associated with student performance [16].

It is in this context where ICTs can play a key role, since violence, bullying and school conflict must be understood as a phenomenon that goes far beyond the spaces that have traditionally been considered. In this sense, one of the most convincing conclusions reached by studies that address measures to prevent bullying is the ineffectiveness of restricting access to digital media for minors [17]. Hence, ICT training should include both citizen participation skills, through responsible media use, and risk prevention skills. This line of research is aimed at both student and teacher training in digital skills. On the one hand, with regard to pupils, international recommendations recommend training pupils in both their rights on the Internet and their duties, thus encouraging active citizenship from an early age [6,18]. On the other hand, the digital training of teachers is another of

the challenges facing teachers in the 21st century, especially the control of students' use of these digital skills, as their negative practice can be associated with cyberbullying, whose social, emotional, academic, and social impact can be devastating both for students and for school coexistence [19].

Another problem faced by teachers is the management of coexistence. They must have strategies to manage coexistence and solve the conflicts they face at school and in the classroom. In this sense, due to the potential for violent behaviour that can arise from the inappropriate use of technology in the educational environment, teachers must take on the role of mediator in order to promote positive school coexistence. Teachers have a responsibility to play an important role in the prevention and management of bullying and other violent behaviour. In this way, they can provide students with tools and resources to recognise and avoid bullying and can also intervene when bullying occurs. In addition, they can work with students to foster empathy and understanding of others, which can help prevent bullying and other violent behaviour [20].

4. Purpose and Research Questions

There are essentially four reasons that justify this study: firstly, in relation to its relevance since ICTs are indispensable tools for a more equitable and quality education for all. Secondly, the relationship between technology and Education for Coexistence necessarily implies that the use of ICTs must contribute to making cultural diversity visible and valuing it from a human rights approach. Thirdly, its novelty, as there are few studies, both in Spain and internationally, that have developed this type of work in real contexts. Finally, its international demand, given that European and international organisations [1,10] are increasingly urging countries to implement programmes that favour school coexistence, favouring educational inclusion. The aim of this study was to carry out a systematic review of the scientific production on the application of technologies as didactic resources for the improvement of school coexistence, as well as to find out the current and future lines of research in this field. In this sense, the following research questions are explored:

RQ1. What is the general state of scientific production in this field of research between 2010 and 2022?

RQ2. What is the impact of the implementation of technologies as didactic resources for the improvement of school coexistence?

RQ3. What are the main lines of research that have been obtained in this field?

5. Method

5.1. Design

In order to determine what is known about the incorporation of technologies as teaching resources for improving school coexistence, a systematic review of the literature was carried out in accordance with the standards and recommendations of the PRISMA Statement (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) [21]. In addition, network analysis techniques were employed by [22] visually representing the different connections between descriptors using VOSViewer software version 1.6.15., in order to identify the lines and limitations in the available research, to inform future research.

5.2. Search Strategy

For this review, a literature search was conducted using the Scopus, Web of Science (WoS) and Google Scholar databases. The choice of these three databases is due to three main reasons: firstly, the prestige and international recognition of these databases, as they are currently the three main sources for locating high-impact publications. Secondly, and in relation to the sample, its representativeness is guaranteed by the international prestige of the databases and their requirement in the indexing protocols, but also by the specific specification of a series of search criteria and a definitive procedure. Thirdly, the fact that, although with a certain level of overlap in their coverage, and given the biases insistently

highlighted in certain disciplines, they can become complementary [23]. The aim is to provide a sufficiently comprehensive overview of research on this topic.

The following search terms delimited by the ERIC Thesaurus were used: "school coexistence", "school climate", "mediation", "ict", "technology" and "educational technology". To increase the rigour of the search, these descriptors were entered into the search equation with the Boolean operator "AND"/"OR" in the databases, in order to find documents that include these descriptors in the title, abstract and/or keywords. The search period was from January 2010 to December 2022. The initial search was conducted in January 2023.

5.3. Inclusion and Exclusion Criteria

To narrow the search, a series of inclusion and exclusion criteria were applied according to different variables: year of publication, with the aim of extracting the most current research; language, without making any exclusions or biases; type of document, in order to extract high-impact scientific literature and the connection of the descriptors with the field of study.

The inclusion criteria established were (a) articles published between 2010–2022, (b) articles published in any language, (c) scientific articles published in peer-reviewed journals and (d) the study evaluates and implements technology as a didactic resource for the improvement of school coexistence. On the other hand, we excluded studies that (a) did not address the use of technologies for school coexistence, (b) review articles, conference proceedings, book chapters, conference abstracts, technical reports, theses, etc., and (c) articles published before 2010. Conference presentations and doctoral theses were excluded, as we assume that high-quality research is published in the databases discussed here.

5.4. Selection of Studies

The research was carried out with an initial search using a combination of the different descriptors selected, initially identifying 101 articles from the three selected databases. The search was also completed with a manual review of the reference list of the selected articles, identifying 4 articles. After eliminating the 41 duplicate documents in the different databases, a first reading of the titles, abstracts and keywords was carried out according to the established inclusion and exclusion criteria. Thus, of the remaining 64 articles, 47 were eliminated due to inadequate context (19), type of document (24) and published outside the selected period (4). The remaining 20 articles were evaluated in full text to assess their methodological quality, excluding 1 article. Finally, 19 articles were obtained for this systematic review (Figure 1). Figure 1 summarises the search strategy and study selection.

5.5. Quality Assessment

The methodological quality of the 20 identified articles was assessed through a checklist based on questions suggested by Kitchenham et al. [24]. The checklist followed the following assessment questions:

- Is the purpose of the research clearly specified?
- Does it specify the type of technology applied in the study?
- Is the impact of the use of technology on school coexistence specified?
- Are the data extraction instruments appropriate?
- Are the results obtained useful for the scientific community?
- Are the authors' conclusions based on the data analysed?
- Are recommendations for future research made?

The checklist contains seven questions, each with three response options on a Likert scale: Yes/No/Partial, with scores of 1, 0 and 0.5, respectively. The cut-off point was set at a final score of 5, i.e., all studies with a score of 5 or more were included. Two studies that did not meet this condition were excluded. Finally, 19 studies were included in this systematic review.
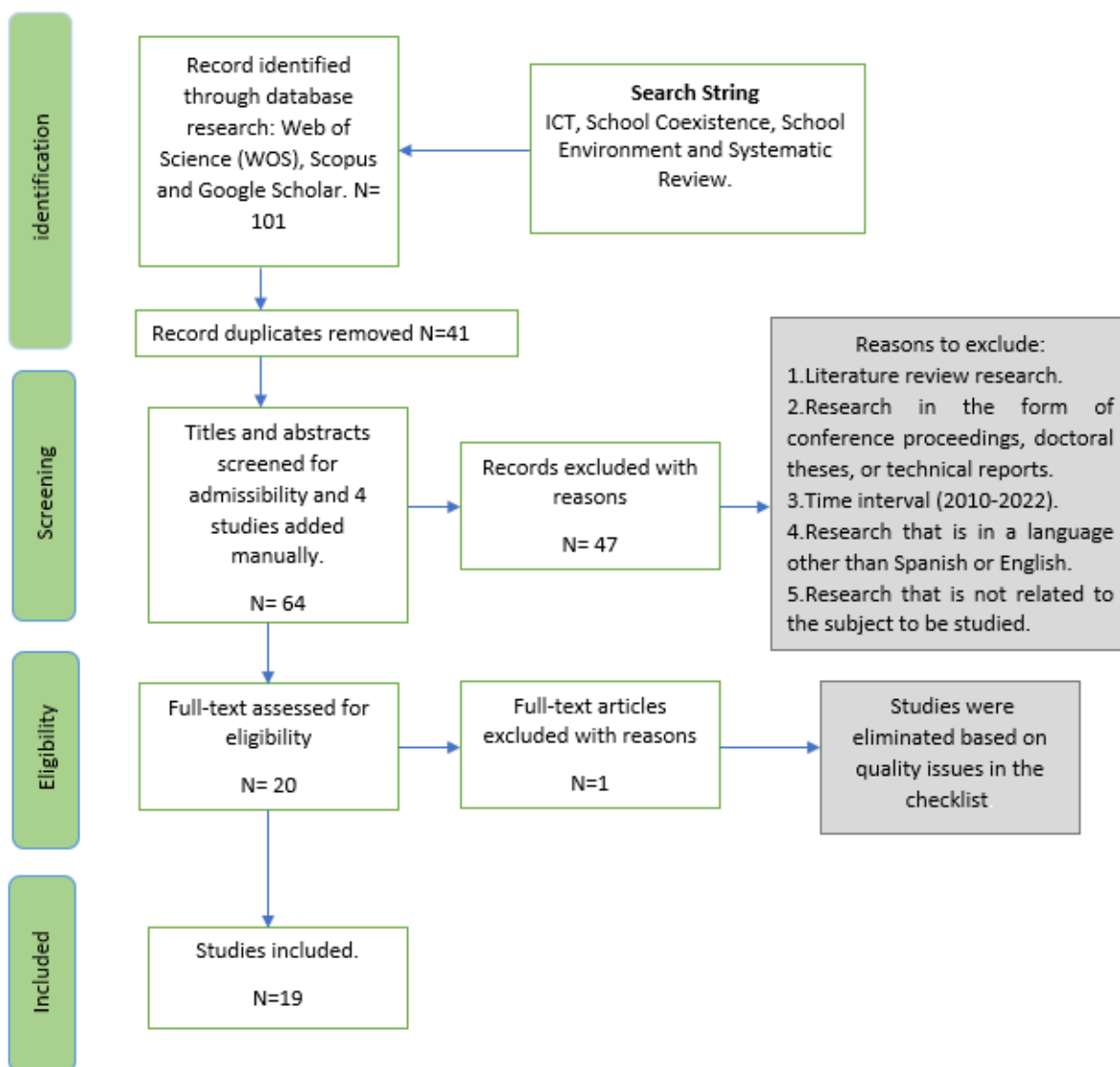
Figure 1. Flow chart of the systematic review process.

The researchers individually examined the retrieved records, and subsequently validated that they met the specific criteria. The researchers reached 100% agreement on the coding, after resolving disagreements by consensus.

5.6. Data Extraction and Analysis

For data extraction and subsequent analysis of the 16 selected studies, a corpus of documents was generated to facilitate the review [25]. Table 1 presents, in chronological order, the scientific articles selected for this review.

Table 1. Description of the studies included in the systematic review.

| Author(s)	Year	Country	Findings
Álvarez Araque et al. [26]	2022	Colombia	The use of multimedia resources allowed students to achieve improvements in their knowledge of ethical and social values.
González Sodis et al. [27]	2022	Spain	ICT promotes positive coexistence and prevents cyberbullying.
Gómez Hernández et al. [28]	2022	Spain	The educational use of mobile phones helps to reduce disruptive behaviour and exclusion.

Table 1. *Cont.*

Author(s)	Year	Country	Findings
Becerra et al. [29]	2019	Colombia	Technologies facilitate the development of communication skills, improving interpersonal relations.
Smolyaninova & Popova [30]	2019	Russia	The use of technology to prevent conflict situations is insufficient, mainly due to gaps in teachers' digital competence.
Deutsch et al. [31]	2018	United States	Digital media can be used in the education system to support social-emotional learning interventions in schools, including the promotion of positive behaviours and healthy relationships.
Florian Rodríguez et al. [32]	2018	Colombia	Through different learning environments supported with ICT tools, learning, citizenship training and school coexistence are enhanced.
Haigh & Tully [33]	2018	United Kingdom	Digital technologies can be used to promote positive social behaviours and respectful relationships in primary schools.
Hinduja & Patchin [34]	2018	United States	They work on bullying prevention and how it can be used to foster a safer and more positive school culture through the appropriate use of technologies.
Camacho Amaya et al. [35]	2018	Colombia	Through ICTs, spaces for participation were created that allowed for better school coexistence based on conflict resolution.
Navarro Angarita et al. [36]	2018	Colombia	The teaching staff show a favourable attitude towards the use of ICT-assisted learning strategies to promote school coexistence. These favour social interactions.
Areepattamannil & Khine [37]	2017	United Arab Emirates	Technologies improve social communication between students, motivation, and encourage more positive student behaviour. However, their inappropriate (addictive or pathological) use can negatively affect students.
Mormah [38]	2017	Nigeria	The ICT resources available promote a positive school climate and increase teaching innovation.
Rodríguez Villanueva et al. [39]	2017	Colombia	ICTs reduce school conflict, improving social relations.
Vargas Sánchez & Veloza Chamucero [40]	2017	Colombia	ICTs allow conflict resolution techniques to be applied. Importance of training teachers in cross-cutting areas.
Li et al. [41]	2016	China	The role of teachers is fundamental for the proper implementation of ICT. Inappropriate use of ICT affects the school climate.
López Hernáez and Sabater Fernández [42]	2014	Spain	Misuse of ICTs encourages violent behaviour. In this sense, a correct and pedagogical use of them prevents bullying and promotes social coexistence.
Pariente Fragoso & Perochena González [43]	2013	Mexico	The use of ICT is favourable for values education in students.
Correa & Hernández Pineda [44]	2010	Colombia	Technology is a tool for dealing with school conflicts between peers, favouring communication and active participation.

6. Results

The results of this study are presented, in order to respond to the proposed objectives, in two phases. In the first phase, the quantitative results are shown after the analysis of the extracted data, and then, in the second phase, the qualitative results are presented by means of the graphical representation of the keyword nodes.

6.1. Quantitative Results

The search determined in the aforementioned databases resulted in a combination of scientific papers, ranging from 2010 to 2022. The analysis of the selected articles (16) made it possible to determine that the productivity over this period of time shows the progressive emergence of technology in the field of school coexistence in recent years. This increase occurs especially from 2017 onwards, where the production in this field increases considerably compared to previous years. Analysing these results, it can be seen that at the beginning of the last decade, there is practically no research on the subject, highlighting a reduction in the publication of articles during the years 2020 and 2021, as we can see in Figure 2. This aspect may be due to the COVID-19 pandemic, where academic activity was slowed down due to the closure of educational institutions.
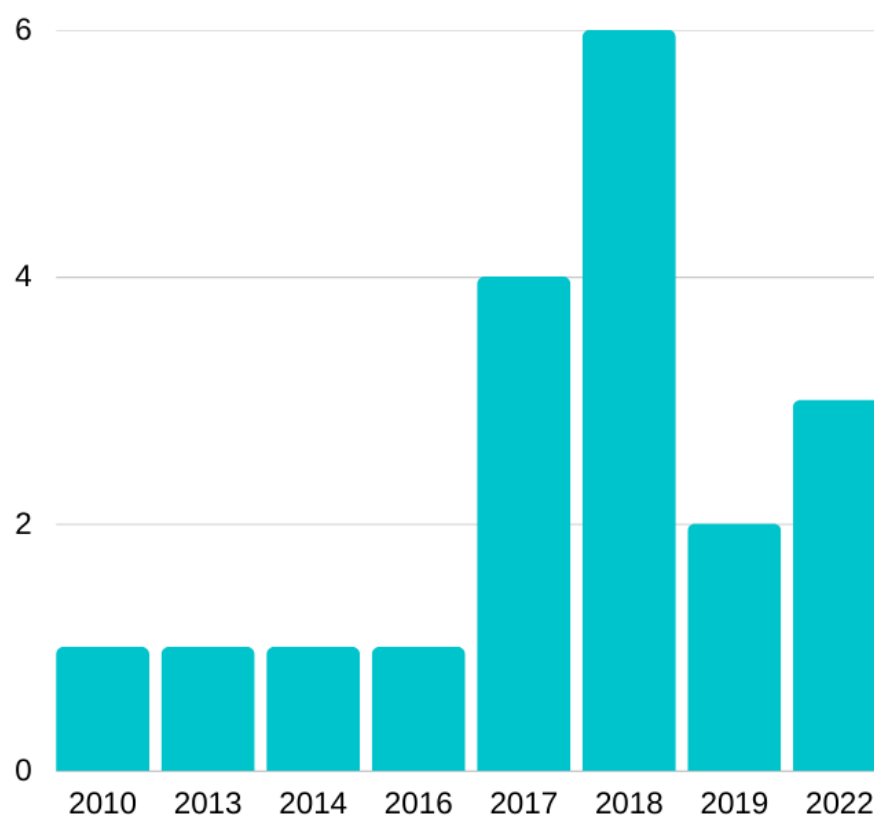
Figure 2. Distribution of articles according to year of publication.

The review of the scientific literature through the analysis of the fundamental impact indicators gives us the opportunity to learn about the influence of ICT on school coexistence. In this way, the most prolific countries and institutions are highlighted, i.e., those with the highest number of scientific publications:

Figure 3 shows that the main country where these studies have been carried out is Colombia (42.1%), followed by Spain (15.6%), the United States (10.5%) and other countries such as Russia, the United Kingdom, the United Arab Emirates, Mexico, China, and Nigeria (6.3%).

Regarding the design of the study, it should be noted that most articles have been carried out using a quantitative methodology, as several authors have considered it necessary to use a deductive, empirical and positivist approach when collecting and analysing the data obtained [45].
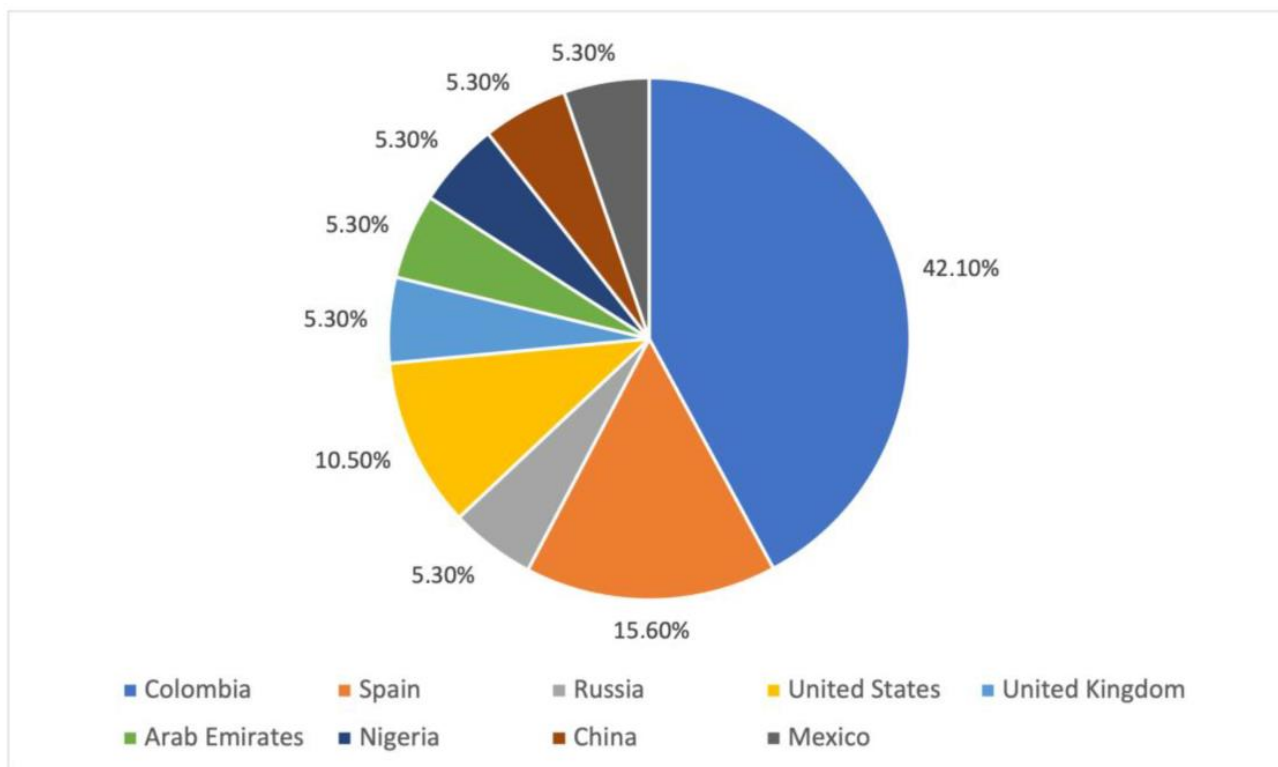
Figure 3. Distribution of articles by country.

6.2. Qualitative Results

The network map shows the connections that exist between the different descriptors extracted automatically from the studies analysed using the VOSViewer programme version 1.6.15.

The bibliometric map shown is composed of networks of nodes that show the keywords of the documents in the total sample, in this case a total of three KeyWord Plus (KW+) or keywords. In Figure 4, we can observe the different descriptors analysed, and through their size and distance we can know the existing connections between them. The colours of each node differentiate types of clusters or groups generated according to the degree of similarity between the different keywords. In this case, looking at the image, we can distinguish three groups or thematic clusters of differentiated descriptors, which indicate the main lines of research on which this study focuses.

Cluster 1: identified in blue, highlights how technology has opened up new opportunities for social interaction among students, but can also be addictive and detrimental. Terms that appear in this cluster include technology, student and interaction.

Cluster 2: appears in red and is related to technological resources and their benefits, and the promotion of values for school coexistence. The most prominent descriptors are school coexistence, formation, skill and information technology.

Cluster 3: shown in green, and this line focuses on the digital competence that teachers must have in order to apply ICT to improve the social climate and conflict resolution. Among the terms that appear are ICT, teacher, conflict resolution, school climate and mediation.
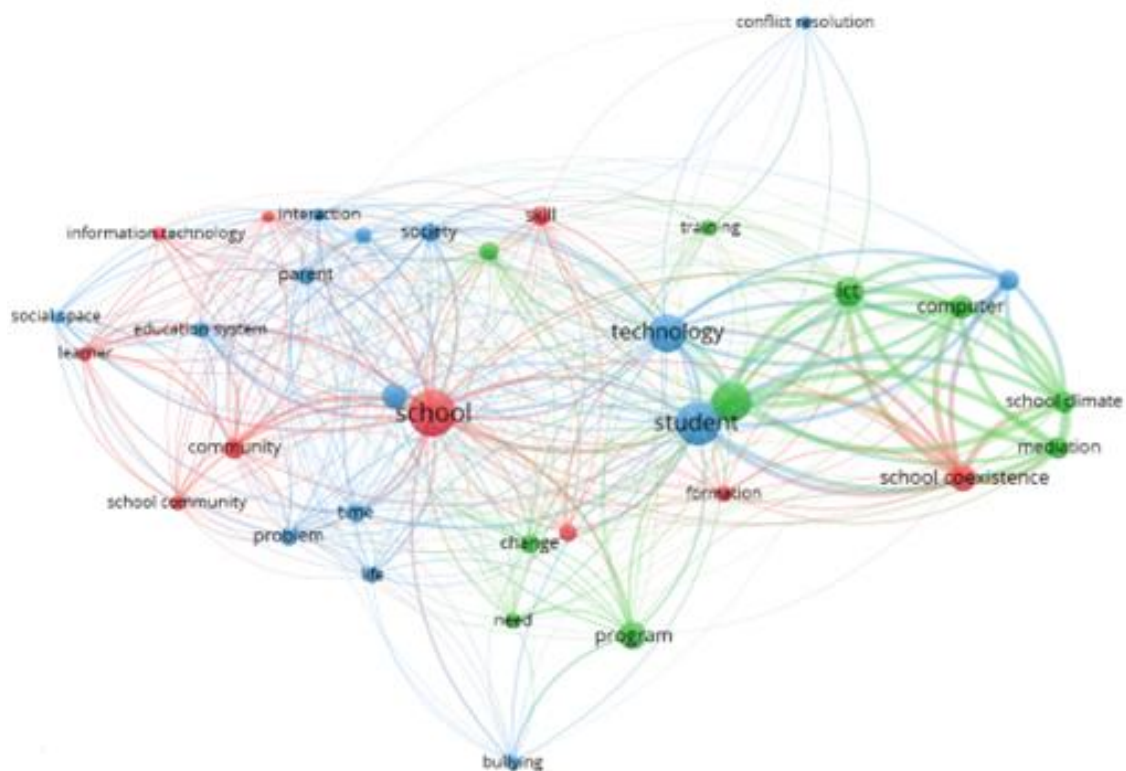
Figure 4. Labelled bibliometric map.

7. Discussion and Conclusions

This review examines the impact of scientific production related to the use of technology for the improvement of school coexistence in the last decade (2010–2022). Considering the results obtained in this review, ICTs emerge as an ideal instrument for the promotion of values for the improvement of school coexistence [39].

The results obtained allow us to answer the research questions posed in the research. Firstly, addressing the first question on the general state of scientific production over the last decade (RQ1), we can highlight that there is evidence of a significant increase in publications between 2016 and 2019 that address the issue of technologies for school coexistence in recent years, where the increase is greater. However, no research has been carried out on the subject during 2020 and 2021, possibly due to the arrival of the COVID-19 pandemic, forcing educational institutions to abandon the classroom in order to opt for an online methodology. On the other hand, the country that stands out significantly, concentrating the greatest scientific production in this field, is Colombia, followed by the rest of the selected countries, although their production is less significant. It is worth noting that in recent years, this field of study has been generating international interest, which is why research is beginning to be carried out in different countries around the world.

Thus, in response to the second research question (RQ2), regarding the impact caused by ICT as an element of improvement for school coexistence, it is highlighted that technological resources help us to connect with each other, favouring communication, but this is not always a harmonious encounter [46]. This aspect coincides with previous studies, which address the possible positive effects that these tools can have on improving well-being, social interaction and classroom climate [47], but to a lesser extent there are those that have investigated the negative impact that technological resources can have on students' violent behaviour, such as aggression or addiction, generating a harmful classroom climate [48]. They can favour the deterioration of social bonds by creating the social alarm of cyberbullying among peers [49].

On the other hand, the opportunities presented by technologies to improve school coexistence through the promotion of values are highlighted. These values have made it

possible to reduce cases of school conflict in the classroom [39], creating a positive climate through different technologies, such as mobile phones or computers [38]. The classroom climate is often related to young people's addiction to technology [41]. In summary, technologies have a positive impact on students' academic success [50], on adolescents' development [51], on the improvement of social communication, as well as on students' motivation [37].

In response to the third research question (RQ3), three main lines of research have been highlighted when studying the impact of Information and Communication Technologies. The first is related to teachers' lack of digital competence to be able to apply ICT to improve the social climate in the classroom and conflict resolution [33,40].

The second line of research is closely related to the potential of ICT to improve school coexistence, as long as we take into account the problems it can cause, such as violent behaviour due to a lack of digital skills and bullying of other classmates [45].

Finally, we find the line that reflects the benefits and promotion of values for school coexistence. In this sense, various potentialities are highlighted, such as the creation of a warm and pleasant climate in the classroom, improved academic performance or improved communication between students themselves in a respectful way [37,39].

In conclusion, technologies, and with it the Internet, are fully integrated and popular in the lives of generally younger people. However, they lack the necessary skills to ensure the effective use of these tools. The misuse of these tools is the main enabler of violent behaviour by pupils at school [42].

Therefore, teachers must reflect on and improve their content in order to improve the digital safety of their students [52], thus becoming the technological mediator for conflict resolution [30,40,44], proposing educational strategies to prevent bullying and promoting school coexistence through technologies. Despite the risks associated with violent behaviours that students may present through the use of Information and Communication Technologies, there are many benefits that have been demonstrated as a tool for improving school coexistence. Thus, the study by Kwon, Park, and Park [53] found that the use of online tools such as discussion forums can increase participation and interaction among students, which can improve school coexistence. Others that are related to the use of social networking can improve communication among students, foster collaboration and increase the feeling of belonging to the school community [54]. In this sense, it is important for educators to promote a responsible use of technologies and to implement strategies to prevent and address violent behaviour, being essential to promote a culture of respect among students in order to avoid such behaviours and take advantage of the enormous potential of these digital tools.

Limitations and Implications for Future Research

The main limitation found in this research is restricted to the choice of only scientific articles which, although they include the publications with the greatest impact in the field of Education, for future research it would be advisable to extend the study by selecting other types of documents, in order to be able to carry out a study with a broader and more diverse scope.

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