

Adoption Of ICT By Basic Education Teachers: A Systematic Review

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Summary

The current study seeks to explore the current situation of the adoption of Information and Communication Technologies (ICT) in basic education schools, specifically at the primary level. For this purpose, a systematic review of scientific articles related to the topic published in 2023 was carried out. Three databases were used to find the articles (Scielo, Scopus, ScienceDirect), of which, of the 1169 articles found, 18 were chosen for analysis. examination. The results were obtained that the use of ICT in primary school has mixed effects on academic performance. Its adoption requires conditions such as equity in access to devices and the Internet, development of teaching and student digital skills, curricular adaptations and adequate infrastructure. Otherwise, instead of supporting learning, poor implementation can frustrate the educational community.

Keywords: Information technologies and communication, ICT, ICT adoption, Basic education, Systematic review.

Introduction

ICT in 21st century education has proven to be useful for pedagogical advancement, since it has facilitated the acquisition of knowledge and has fostered a collaborative culture in students (Saha & Dey, 2020; Cruz et al., 2019). The adoption of ICT in schools in Ghana is hindered by the lack of tools such as hardware and software, this happens in developing countries, where the effective integration of such tools is limited (Teye & Duah, 2022).

In South African schools, ICT adoption faces challenges such as lack of resources and infrastructure, limited internet access, and lack of software and hardware, which restricts the effective implementation of educational technologies and limits the development of advanced learning skills. (Zenda & Dlamini, 2023). During the pandemic, ICT in primary schools in Greece faced challenges due to teachers' reluctance to accept tools as e-learning platforms, despite being mandatory, revealing the need for adequate motivation, acquisition of skills and

training for their use (Aivazidi & Michalakelis, 2023). Furthermore, in Kenya, primary schools face challenges, from political barriers, poor planning, corruption and lack of infrastructure, that hinder the effective integration of these technologies (Mwadulo & Odoyo, 2020).

Peru understood that the adoption of such technologies had to be progressive due to sociocultural gaps and distrust of teachers (Vértiz et al., 2019). When measuring the digital competencies of teachers in a basic education institution, it was noted that 71.5 percent had not reached the high level, only 28.5 percent had reached such a category; Added to this, the communicative potential of ICT had not been fully exploited, since 65.3 percent did not reach the high level (Quispe & Huaman, 2021).

The events described around the adoption of ICT in schools lead to investigating in greater detail the diagnosis of the implementation of such tools in basic school, specifically in primary education. Therefore, the current study aimed to address the adoption of ICT by basic education teachers in their updated scenario of the year 2023 through a systematic review.

Methodology

The systematic review involved a first procedure, that of finding the keywords that covered the topic in the year analyzed (2023). Using three databases and filtering only scientific articles from open access journals. In Scielo the search strategy was used: ("Information and Communication Technologies" OR "ICT") AND ("education" OR "Primary education" OR "basic education") NOT ("high school" OR "secondary school" OR "secondary education" OR "higher education"). In Scopus, the search was determined with the strategy: (TITLE-ABS-KEY ("Information and Communication Technologies") OR TITLE-ABS-KEY (ict) AND TITLE-ABS-KEY (education) OR TITLE-ABS-KEY (" Primary education") OR TITLE-ABS-KEY ("basic education") AND NOT TITLE-ABS-KEY (high AND school) AND NOT ALL (secondary AND school) AND NOT TITLE-ABS-KEY (secondary AND education) AND NOT TITLE-ABS-KEY (higher AND education)) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (OA , "all")) AND (LIMIT-TO (PUBYEAR , 2023)). Finally, in ScienceDirect the strategy was used: ("Information and Communication Technologies" OR "ICT") AND ("education" OR "Primary education" OR "basic education") NOT ("high school" OR "secondary school" OR "secondary education" OR "higher education"), obtaining a total of 1169 between the three databases.

Subsequently, articles were excluded if they were not in English or Spanish, they were not open source, they were not related to the chosen topic, they did not include primary education, if they were qualitative in their approach or a systematic review, in addition, documents were excluded. where the sample did not consist of primary level teachers or students belonging to said school stage. After this filtering process, a total of 18 articles were included for analysis.

Results

The 18 studies chosen were related to the search topic; above all, priority was given to working in the context of the primary level of basic education and maintaining a quantitative or mixed approach. The methodological aspects are detailed in table 1.

Table 1 *Methodological aspects of the articles included*

Author (year)	Approach, design and level	Sample	Data analysis procedure
Aivazidi y Michalakelis (2023)	Quantitative, non-experimental, descriptive	285 primary school teachers, simple random sampling.	Descriptive statistics, principal component analysis, correlations and regression models
Alam & Mohanty (2023)	Quantitative, experimental, explanatory.	122 randomly selected fifth grade students.	ANOVA, independent t tests, post-hoc analysis
Arnado y Aviles (2023)	Quantitative, non-experimental, exploratory.	63 teachers and 242 primary school students, probabilistic sampling.	Descriptive statistics, correlations, multiple linear regressions.
Bonifácio et al. (2023)	Quantitative, non-experimental, correlational.	73 basic education teachers, stratified random sampling	Descriptive statistics, chi-square test, Cramer's V correlation coefficient.
de Carvalho et al. (2023)	Mixed, non-experimental, explanatory	73 teachers, probabilistic sampling stratified by clusters	Statistical analysis (chi-square test, Cramer correlation coefficient,

Fuentes et al. (2023)	Quantitative, non-experimental and descriptive and correlational.	526 teachers, snowball sampling.	multiple linear regression) Student's T, ANOVA, correlations and chi-square.
Garzon & Inga (2023)	Mixed, non-experimental, exploratory.	Sixth grade primary school students, convenience sampling.	Descriptive statistics, graphs and qualitative analysis.
Holik et al. (2023)	Quantitative, non-experimental, correlational.	292 teachers from 9 European countries, simple random sampling.	Descriptive statistics, Spearman correlations and cluster analysis.
Horváth (2023)	Quantitative, non-experimental, descriptive	4028 teachers, stratified probability sampling.	Cluster analysis, analysis of variance, descriptive statistics.
Hoti y Shatri (2023)	Mixed, non-experimental and exploratory.	155 education students, convenience sampling.	Descriptive tests, linear regression, one-way ANOVA and qualitative analysis.
Lomos et al. (2023)	Quantitative, non-experimental, descriptive	809 teachers, non-probabilistic sampling	Multiple linear regression analysis.
Sanz et al. (2023)	Quantitative, non-experimental, descriptive.	119 primary school teachers, convenience sampling.	Frequencies, percentages, non-parametric tests such as Kruskal-Wallis, Mann-Whitney U and Spearman correlation.
Shyshak et al. (2023)	Quantitative, Non-experimental, Descriptive and exploratory.	184 teachers and 179 parents, does not mention sampling	Descriptive statistics with bar graphs.

Soto et al. (2023)	Quantitative, non-experimental, correlational	2852 educational centers	Hierarchical cluster analysis to group the Autonomous Communities, followed by a factor analysis
Szüts et al.	Quantitative, non-experimental and exploratory.	751 primary school teachers, non-probabilistic	Descriptive statistics, correlation tests, chi-square.
Tomczyk et al. (2023)	Quantitative, non-experimental correlational and explanatory.	1209 students, stratified sampling.	Mann-Whitney, correlations, multiple linear regression and cluster analysis.
Tulekenova et al.	Mixed, experimental, Descriptive.	80 students, It is not specified if the sampling is probabilistic.	Measures of central tendency and comparison between control and experimental groups.
Vargas et al. (2023)	Quantitative, non-experimental, comparative.	236 540 students from 44 countries, PISA 2018.	Hierarchical Linear Model (HLM).

Nota. Elaborado por el autor.

The 18 articles were also reviewed regarding the country where they were applied, the region or city where the study was carried out was specified if it was mentioned in the document. Such details are found in table 2.

Table 2 *Origin of the investigations*

Autor (año)	Ciudad o región	País	Continente
Aivazidi & Michalakelis (2023)	No city or region specified	Greece	Greece
Alam & Mohanty (2023)	Mindanao Island	Philippines	Asia
Arnado y Aviles (2023)	Hyderabad	India	Asia
Bonifácio et al. (2023)	Regions of Bragança and Portalegre.	Portugal	Europe

de Carvalho et al. (2023)	Brazilian public schools in general.	Brazil	America
Fuentes et al. (2023)	It was applied to the autonomous communities of Spain.	Spain	Europe
Garzon & Inga (2023)	It does not specify the name of the city, province or school.	Ecuador	America
Holik et al. (2023)	It involved several countries.	Hungary, Bulgaria, Cyprus, Greece, Malta, Italy, Portugal, Spain and Albania	Europe
Horváth (2023)	All regions of the country	Hungary	Europe
Hoti y Shatri (2023)	Pristina	Kosovo	Europe
Lomos et al. (2023)	Applied at country level	Luxembourg	Europe
Sanz et al. (2023)	It is not specified, since the sample was of convenience.	Spain	Europe
Shyshak et al. (2023)	Rivne, kyiv, Lviv, Khmelnyskyi and Cherkasy regions	Ukraine	Europe
Soto et al. (2023)	Spanish Autonomous Communities	Spain	Europe
Szüts et al.	It is applied in Hungarian primary schools in general.	Hungary	Europe
Tomczyk et al. (2023)	8 universities located in different regions of the countries.	Poland and Italy.	Europe
Tulekeno va et al.	Almaty	Kazakhstan	Asia
Vargas et al. (2023)	It was carried out	44 countries	Global

considering
countries.

Among the studies carried out during the context of the pandemic is that of Bonifácio et al. (2023), who tried to diagnose how early basic education teachers and their students perceived distance education. 83.1 percent of teachers indicated that distance education contributed to their development as professionals, 16.9 percent disagreed. 94.5 percent of the total that participated considered that the transformations implied challenges to modify the teaching and learning process. It was the teachers with a lower academic degree who valued this educational modality the most due to the professional development it meant for them.

In the past pandemic context, the progressiveness of adherence to technological tools was studied Holik et al. (2023) talk about that situation. During the pandemic, 95 percent of teachers managed to teach classes digitally and online. 80 percent provided their students with the necessary teaching materials in this period. 37 percent used digital study plans from the Internet, while 32 percent created their own plans. The biggest disadvantage identified was the lack of social interaction and isolation. Subsequently, 36 percent of teachers began to use ICT tools more frequently in face-to-face education. In short, online education fostered innovation and highlighted the importance of creativity, digital competence, and problem solving for effective digital education.

In the pandemic, teaching professionals capable of quickly adapting to change stood out due to their digital skills. Horváth (2023) showed that The reaction of primary school teachers can be subdivided into four clusters of pedagogical strategies through cluster analysis. Group 1 adopted a more flexible learning approach and provided greater support and feedback. On the other hand, group 2 adhered to a more rigid structure, with stricter control and final evaluations. Teachers in groups 1 and 3 demonstrated higher digital competence, with average scores of 91.1 and 93.5 respectively, compared to groups 2 and 4, which had lower scores of 88.1 and 84.2. Teachers with adequate digital skills adjusted their teaching methods, leading to an increase in flexibility and the frequency of feedback provided. These adaptations turned out to be essential to effectively engage students in the digital learning process during distance education.

To insert a post-pandemic view, Szűts et al. (2023) conducted their research to find out which channels or

platforms were most effective in such a context. Teachers found self-created video tutorials and real-time chats to be the most effective tools to transform education. Only 21 percent considered blogs effective, with 48 percent unable to evaluate their effectiveness, and 31 percent holding a neutral or negative opinion. Online collaboration tools were considered effective by only 25 percent of teachers, while more than half (56 percent) could not determine their efficiency. The educational videos were rated by 76 percent as useful, in contrast to only 11 percent who approved of the podcasts. The majority of teachers (72 percent for real-time written chat and 70 percent for video conferencing) preferred visual channels of synchronous communication.

Another study that analyzes the aftermath of the pandemic and the legacy it leaves in relation to ICT in schools is the one carried out by de Carvalho et al. (2023). In 2019, before the pandemic, Brazilian public schools had limited access to technological resources, with only 67.1 percent of them having internet access and less than half with student computers. After the pandemic, in 2021, an increase in the availability of these resources was observed, reaching 74.7 percent of schools with internet access and modest increases in the availability of computers for students. During the suspension of in-person classes, the majority of schools (94.4 percent) resorted to printed educational materials, and only 8.26 percent were able to offer technological equipment to students. Despite these advances, the study concludes that a sustainable legacy of ICT resources in schools is still missing, underscoring the need for lasting government policies to improve education.

The studies by Bonifácio et al. (2023), Holik et al., Horváth (2023), Szűts et al. (2023), and de Carvalho et al. (2023). They offer a comprehensive view of ICT adoption during the pandemic. Although they differ in focus, they all highlight the importance of teachers' development and adaptability towards ICT. Bonifácio et al. and de Carvalho et al. focus on teachers' perception and adaptation, Holik et al. and Horváth on practical implementation and pedagogical strategies, and Szűts et al. on the effectiveness of specific tools. They all converge on the need for greater development of digital skills and the positive impact of ICT in teaching, underlining the importance of sustainable policies for the effective integration of ICT in education.

Authors such as Hoti and Shatri (2023) establish that primary school student teachers already rely heavily on ICT for their university activities, which predicts an increasingly inclusive trend towards its adoption in school

classrooms. In this study, it was found that 31.0 percent of students learned technology out of interest in acquiring new knowledge and 19.4 percent out of the need to complete specific tasks. Previous experience in using technology and its contribution to learning in other subjects was low, at only 2.4 percent and 2.6 percent respectively. 25.6 percent of the increase in efficiency when using ICT in other subjects was due to previous experience and the ease of solving problems ($p=0.000$). The vast majority of students (95.5 percent) support the use of ICT, believing that these skills will be valuable in their future teaching career. Furthermore, attending ICT courses and developing skills in these has helped improve their academic results in other areas.

The optimistic outlook is also supported by Tomczyk et al. (2023), while, in their comparative study, Polish student teachers showed greater theoretical knowledge about the digital world than their Italian peers, with 62.66 percent versus 58.50 percent in knowledge about digital threats. However, Italian preservice teachers rated their digital skills higher than Polish ones, with 53.81 percent of Italians and 38.68 percent of Poles scoring low on competency tests. Both groups primarily used word processors and presentation tools, but rarely software for web creation, visual material, or video editing. Frequent ICT integration was correlated with a more positive evaluation of the effectiveness of educational software in both countries.

Both Hoti and Shatri (2023) and Tomczyk et al. (2023) explore the skills and use of ICT among student teachers, envisioning its growing adoption in the educational field. Hoti and Shatri find that most students learned technology out of interest or need to complete tasks. Their previous experience using ICT was low, but it had a positive influence on their performance in other subjects, along with the ease of solving technological problems. Almost all believed that these skills would be valuable as teachers and that ICT courses improved their academic performance. Tomczyk et al. They add that Polish students showed greater theoretical knowledge about the digital world, while Italian students declared they had greater skills. Both primarily used word processors and presentation tools. Their digital competence predicted a more positive evaluation of educational software. A base of knowledge and habits is thus inferred growing technological skills among future teachers, which could facilitate the integration of ICT into their pedagogical practices. However, it is key to strengthen more advanced skills on specific educational applications and not just everyday tools. Initial teacher training is an opportunity to

close potential digital gaps between countries and prepare technology-competent teachers from the beginning of their careers.

To know how primary education teachers handle ICT, it is relevant to look at the research by Sanz et al. (2023). No significant correlation was found between knowledge, usefulness and use of ICT, with Spearman correlation coefficients ranging between 0.065 and 0.154. Men indicated having greater knowledge of ICT than women, according to the Mann-Whitney U test. Teachers from public schools or with experience from 0 to 5 years showed the greatest knowledge in ICT. On the other hand, teachers from subsidized or private centers were the ones who used them the most and valued their usefulness. Public school teachers have a deeper knowledge of ICT compared to their colleagues in charter schools, who use it more intensively. However, the increase in the use of ICT during the pandemic does not necessarily translate into greater knowledge about it on the part of teachers. This underlines the importance of improving the digital competencies of educators and the need to provide specialized ICT training.

There are elementary aspects that cooperate for the use of ICT in schools, among them, the self-efficacy of teachers is highlighted. Aivazidi and Michalakelis (2023) discovered that in their article. It was observed that teachers' self-efficacy significantly influenced the use of ICT in the educational process (regression coefficient of 0.215, $p < 0.01$), with greater self-efficacy associated with greater use of ICT. The perceived effectiveness of ICT also positively impacted its use (coefficient of 0.235, $p < 0.05$). Emotions towards ICT, its perceived impact on society and its contribution to productivity were positive factors (coefficients of 0.997, 0.279 and 0.458, $p < 0.05$). Furthermore, age and the type of educational unit (public/private) affected the use of ICT, being more frequent among young teachers and in private units. In conclusion, the self-efficacy, perceptions and demographics of teachers in Greece are key predictors of ICT use in education. primary education.

Both Sanz et al. (2023) and Aivazidi and Michalakelis (2023) explored factors associated with the use of ICT among primary school teachers, although with some nuances. Sanz et al. They found no correlation between knowledge, usefulness and use of ICT (coefficients from 0.065 to 0.154). Teachers from public schools showed greater knowledge about ICT, while those from private or subsidized centers used them more, highlighting a gap between theoretical mastery of technology and its practical application. For their part, Aivazidi and

Michalakelis did find significant links between the use of ICT and teacher self-efficacy, the perceived effectiveness of ICT (0.235) and the emotions, impact and contribution to the productivity of ICT. Age and type of educational unit were also predictors. They emphasize self-efficacy as a crucial factor in ICT use, indicating that personal confidence and perceived efficacy can be as influential as technical knowledge. HE It then breaks down the relevance of multiple personal and contextual factors to understand the integration of ICT by teachers. Their digital knowledge must be complemented by perceptions, beliefs, work context and institutional support to translate into effective pedagogical use. It is clear that it is not enough to just provide the technology; Specialized teacher training is required in its educational application.

When it comes to inserting a new technological platform, there may be innovative teachers who immediately adopt its use, others who are early and late adopters. This was extended by Lomos et al. (2023) in their results, showing that teachers classified as Innovators (who joined the platform in 2017) were more active in remote education, with a significant positive impact (beta coefficient of 0.16), in contrast to Early adopters. and Late adopters, whose activity was lower (coefficients of -0.21 and -0.19, respectively). Furthermore, teachers who used information and communication technologies (ICT) primarily for substitution and augmentation tasks, rather than redefinition, spent less time active, with significant negative coefficients (up to -0.72). Previous experience with technology also positively influenced its use during the pandemic, with those involved in incentive events such as MathleTIC showing greater activity (coefficient of 0.37), demonstrating the importance of integrating ICT in a more innovative and creative way in teaching.

Other professional learning opportunities can be seen for teachers who choose to use ICT in their preparation process. This was demonstrated with the research of Tulekenova et al. (2023). At the beginning, the majority of students (72.5 percent in the experimental group and 62.5 percent in the control group) showed a low level of ICT-based professional cognitive-communicative competencies. Subsequently, the experimental group experienced notable progress: 75 percent achieved a high level in the use and development of interactive tasks, 77.5 percent in the creation of online presentations, 82.5 percent in the use of animated ICT tools, and 85 percent in organization of online chats for language teaching. The level of use of information and communication technologies of the experimental group during the experiment was significantly higher by 15 percent than

that of the control group. It was concluded that ICT significantly improves the skills of future teachers in creating interactive tasks, online presentations, and the organization of online chats and forums for teaching foreign languages in primary education.

But students can also benefit from technological tools, such as virtual reality (VR). The work of Alam & Mohanty (2023) accounts for this; the results indicate that textual cues and summary scaffolding significantly improve mental models and learning performance. Incorporating textual cues significantly improved both learning performance (with an F-score of 15.924 and p-value of 0.000) and mental model development (with an identical F-score and p-value of 0.000). Furthermore, using scaffolding to summarize also markedly increased the quality of the mental models, with an F-score of 4.701 and a p-value of 0.029. In particular, the group that applied both techniques, textual cues and scaffolding to summarize, recorded the highest scores in the formation of mental models. The textual cues had a positive effect on the overall scores of the learning, retention and transfer. Scaffolding to summarize showed a positive impact particularly on retention. No negative effects on cognitive load were observed. This study demonstrates how VR, combined with specific pedagogical strategies, can enhance students' educational experience.

Parents are also voices interested in the use of ICT in their children's primary education. This is a consensus they reached with their teachers according to the Shyshak et al. study. (2023). In their study, it was mentioned that 47 percent of teachers and 43 percent of parents consider that ICT positively influences motivation for literary competence. The most effective activities include creating literary covers and making illustrations with ICT tools. In addition, 54 percent of teachers and 49 percent of parents suggest improving the use of tools such as Internet research and participation in youth magazines. 52 percent of both groups value the use of multimedia software in teaching literature, while 53 percent of parents and 42 percent of teachers recommend a more active use of online resources and audiovisual materials. Therefore, the participants agreed that ICT represents a tool effective to form the literary competence of primary level students, both in its communicative, cognitive and motivational components.

The idea behind adhering more to ICT is to use it in a useful way to serve educational processes. On the subject, Garzon and Inga (2023) argue that it can improve the student performance of sixth grade students. Initially, students expressed a need for more knowledge and

access to technological tools for school research. After applying a new methodology, they reported an increase in their digital skills, improving in information management and processing, and in communication with classmates and teachers. His academic performance improved markedly, raising his grade point average from 7.9 to 8.9. Furthermore, 77.1 percent of students highlighted that the use of interactive tools increased their motivation to acquire more knowledge. In conclusion, active methodologies with Digital tools turned out to be an effective method to encourage research and improve academic performance.

Teachers show various levels of adoption of new technologies according to their innovative profile. Lomos et al. (2023) found that those classified as innovators were more active during remote education, while early and late adopters showed lower participation. Furthermore, the use of ICT for substitution and augmentation tasks, rather than redefinition, was associated with less active time for teachers. Previous experience with technology and integrating it more creatively also predicted greater activity. Therefore, it is necessary to go beyond just inserting technology, towards a more innovative incorporation of its educational potential.

There are opportunities for professional development through ICT, as evidenced by Tulekenova et al. (2023). Initially, the majority of future teachers had low cognitive-communicative skills based on ICT, but after a pedagogical intervention, 75 percent achieved high performance in tasks. interactive. ICT then makes it possible to significantly improve teaching skills. Students can also benefit from innovative technological tools according to Alam & Mohanty (2023), who found improvements in mental models and learning through virtual reality. Well-implemented technology with effective pedagogical strategies optimizes the educational experience. Teachers and parents value the contribution of ICT to motivation and literary competence in primary school, according to Shyshak et al. (2023). Both groups positively highlight its use in covers and literary illustrations, as well as research and online youth magazines. They recognize their potential to develop communicative, cognitive and motivational skills at this level. Finally, Garzon & Inga (2023) demonstrate that adhering to ICT through active methodologies can effectively improve student performance. Sixth graders initially required more technological knowledge, and after applying the methodology they reported greater digital competence.

One of the attempts to include ICT in education was presented in Spain through innovation projects, seeking

to associate this with the performance demonstrated by students in their academic area. Regarding this, Soto et al. (2023) assumed that the Autonomous Communities of Spain were classified into three clusters based on educational variables. The first cluster showed low percentages of centers with ICT projects and repeat students, but the highest in promoted students. A significant positive correlation was observed between the presence of ICT projects and the percentage of repeat students (coefficient of 0.752), while the correlation with the percentage of promoted students was negative (coefficient of -0.858). The implementation of ICT projects in primary schools was linked to a higher rate of repeat students and a lower number of promoted students. Repeating students are those who must repeat a course in which they already were previously enrolled, while those promoted are those who advance to the next educational level. This result suggests that, contrary to expectations, the inclusion of technology does not necessarily improve academic performance and could have adverse effects.

One of the challenges of adopting ICT in classes is the digital divide between sociocultural levels. Something with which Fuentes et al. (2023) in their research. The study showed that differences in the use of ICT between teachers, based on their age, gender and other sociodemographic and occupational factors, were not significant, with the notable exception in the area of formative assessment. Teachers who used a wider variety of ICT tools tended to conduct more formative assessments ($p=0.000$). Among the most used applications were institutional email (66.9 percent), cloud storage (62.4 percent), word processors (59.7 percent) and YouTube (56.7 percent). Furthermore, a correlation was noted between the sociocultural level of the families and the connectivity of the students, being greater in families of higher levels ($p=0.000$).

Challenges of the use of ICT in schools that had adopted Education for indigenous peoples were found through the study by Arnado and Aviles (2023). They found that teachers had moderate confidence in technological operations and concepts, but high confidence in planning and designing learning environments. The students, for their part, showed low confidence in creativity, innovation, communication, collaboration and critical thinking. Both groups perceived the external challenges as moderately difficult. There was a weak ($r=-0.337$) but significant ($p=0.007$) negative correlation between the technological skills of teachers and students. It was

concluded that both need more training in the use and understanding of technological devices and concepts.

There were also authors who detected disadvantages with the greater use of ICT, it is worth reviewing the work of Vargas et al. (2023). The study revealed that the use of ICT in school education has a negative relationship with students' academic results, measured by PISA scores in reading, mathematics and science. This negative relationship was more pronounced in developing countries, where a one standard deviation increase in ICT use resulted in an average reduction in PISA scores 0.06 standard deviations greater than in high-income countries ($p < 0.01$). The findings remained consistent when using different measures of countries' development level, such as GDP per capita and the Human Development Index, and even after imputing missing values. In conclusion, the relationship between the use of ICT in school education and academic results varies depending on the level of development of the country, being more unfavorable in developing countries.

The studies by Soto et al. (2023), Fuentes et al. (2023), Arnado and Aviles (2023) and Vargas et al. (2023) explore various challenges in the implementation of ICT in education primary. Soto et al. and Vargas et al. They agree in pointing out adverse effects of the use of ICT on academic performance. Soto et al. link its adoption with more repeating and less promoted students in Spain. Vargas et al. They find a negative correlation between ICT and academic results, more pronounced in developing countries. For their part, Fuentes et al. and Arnado and Aviles highlight contextual challenges that hinder the effective integration of ICT. Fuentes et al. reveal a digital divide according to the family sociocultural level. Arnado and Aviles point out infrastructure limitations and inadequate teacher and student training on ICT. It is recognized that the mere insertion of technology in classrooms is not effective on its own. It requires enabling conditions in terms of equity of access to devices and the Internet, digital skills of the educational community, curricular adaptation and school infrastructure. Otherwise far from working As a learning support tool, its poor use can lead to frustration and dissatisfaction.

Conclusion

During the pandemic, teachers successfully adopted distance education, facing challenges in the teaching and learning process and positively valuing the professional development that this entailed. Student teachers are strongly inclined towards the use of ICT, improving their

digital skills and academic results, which predicts greater adoption of ICT in future classrooms.

Teachers showed variable knowledge of ICT, with a non-significant correlation between knowledge, usefulness and use, highlighting differences according to the type of institution and experience. Innovative teachers showed greater activity in remote education, highlighting the importance of previous experience and creativity in the use of ICT.

The adoption of ICT presents challenges, including a negative relationship between the use of ICT and academic results in developing countries asserted in one of the studies reviewed, and the digital divide according to levels sociocultural.

The systematic review reveals that, although the pandemic boosted the adoption of ICT among teachers and students, there are significant challenges, such as the digital divide and variability in the use of ICT. Training future teachers in ICT is promising, but it is necessary to address differences in knowledge and effective use of technologies to improve academic performance and educational innovation.

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