

# Effects of information and communication technology use in nursing and obstetric learning in low- and middle-income countries: a systematic review

Arzouma Hermann Pilabré (✉ [hpilabr@yahoo.com](mailto:hpilabr@yahoo.com))

Institut de Formation et de Recherche Interdisciplinaires en Sciences de la Santé et de l'Éducation

Patrice Ngangué

Institut de Formation et de Recherche Interdisciplinaires en Sciences de la Santé et de l'Éducation

Nestor Bationo

Institut de Formation et de Recherche Interdisciplinaires en Sciences de la Santé et de l'Éducation

Issouf Tassembédo

Institut de Formation et de Recherche Interdisciplinaires en Sciences de la Santé et de l'Éducation

Doulaye Traoré

Institut de Formation et de Recherche Interdisciplinaires en Sciences de la Santé et de l'Éducation

Abel Kinda

Institut de Formation et de Recherche Interdisciplinaires en Sciences de la Santé et de l'Éducation

Dieudonné Soubeiga

Institut de Formation et de Recherche Interdisciplinaires en Sciences de la Santé et de l'Éducation

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## Research Article

**Keywords:** ICT, E-learning, Systematic review, Nursing and obstetrics, Low and middle-income countries

**Posted Date:** May 28th, 2021

**DOI:** <https://doi.org/10.21203/rs.3.rs-563305/v1>

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# **Abstract**

## **Background**

The use of ICT in learning has become commonplace in higher education and, consequently, in nurses, midwives, and other health professionals worldwide. This use has become widespread and intensified since the advent of the COVID-19 pandemic. Despite growing evidence that e-learning has positive effects, studies on the effects of ICT use in nursing and midwifery learning in low- and middle-income countries are limited.

## **Objectives**

This systematic review aims to identify and synthesize the effects of information and communication technologies utilization in nursing and obstetric learning in low- and middle-income countries.

## **Methods**

A search of articles published from 2016 to 2020 on the effects of ICT use in nursing and obstetric learning was conducted in PubMed, CINAHL, Epistemonikos and ERIC using free and controlled vocabularies. All original articles meeting the predefined criteria were included. Following the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) guidelines, searches were performed among published and unpublished articles. Data were extracted and assessed for quality using the Mixed Methods Analysis Tool (MMAT).

## **Results**

Of 483 articles identified, eleven were reviewed, and eight were found to be relevant. The included articles were synthesized into a narrative synthesis. The effects of using ICT in learning are related to student motivation, autonomy in learning, meaningful acquisition of knowledge and skills. Furthermore, students have a positive perception of the use of ICT in learning.

## **Conclusion**

The results of this study on the use of ICTs in nursing and midwifery learning in low- and middle-income countries show that ICTs are used primarily as a medium for distance learning. In addition, it was found that e-learning has several advantages or positive effects. However, many students do not have a personal computer, and they have low or average skills in the use of computer tools, and access to the Internet is low. A limitation of this study is the lack of primary data on the effects of ICT use in midwifery learning in low- and middle-income countries.

# Background

The rapid evolution of information and communication technologies (ICT) has led to the development of applications used in everyday life and all sectors of activity [1]. In facing this development, the integration of ICT has been imposed on educational systems [2]. The use of ICT in learning has become commonplace in higher education and, consequently, in nurses, midwives, and other health professionals worldwide [3]. The benefits of ICT in education are well known. ICT improves the quality of teaching and learning in several ways. It facilitates the acquisition and appropriation of knowledge through better access to educational resources, enrichment of these resources, stimulating pedagogical relationships, and greater involvement of learners in the learning process [4]. Automatically, the integration of ICT in teaching induces students to use ICT in their learning. Currently, ICT tools are used as a support in online teaching/learning. As a result, the use of ICT in teaching/learning is often reduced to online distance learning by some users. There are different models or designs of e-learning that are used in practice. The most common are: the enhanced model, the blended e-learning model, and the fully online model. The latter model can be divided into two categories: synchronous and asynchronous [5]

In response to the COVID-19 pandemic, many governments worldwide decided to close educational institutions to contain the disease [1,6-24]. Colleges and universities were forced to convert all face-to-face courses to an online learning format [11,6-24]. Indeed, most universities have moved to online learning in a synchronous and/or asynchronous environment [1,6-24]. E-learning has been defined as an educational method that facilitates learning by applying information and communication technologies, offering learners access to all required educational programs [5].

Studies and systematic reviews have been conducted to identify the effects of ICT use in teaching/learning in the health sciences and nursing. However, to the best of our knowledge, few systematic reviews have been conducted to identify the effects of ICT use, as it appears, in nursing and obstetrical learning in low- and middle-income countries.

In the context of the West African Health Organization (WAHO) member countries, which are all low and middle-income countries, nursing and obstetrics students are trained in the same school. Better yet, they take standard core courses in the first and second semesters of their studies [25].

A systematic review type of research deserves to be done to identify the effects of using ICT in learning, especially in the current context where the use of ICT in higher education and training institutions is widespread and intensifying since the advent of the COVID-19 pandemic [6].

This review will focus on the effects of information and communication technologies in the learning of nursing and midwifery students in low and middle-income countries. The systematic review question is: What are the effects of ICT use in nursing and midwifery learning in low- and middle-income countries?

The main objective of this study is to examine the effects of ICT use in the learning of nursing and midwifery students in low and middle-income countries. Specifically, the objectives are to (1) identify

patterns of ICT use and (2) synthesize the effects of ICT use in the learning of nursing and midwifery students in low and middle-income countries.

The results of this systematic review will provide educational institutions in low- and middle-income countries with evidence of the effects of using ICTs in nursing and obstetrical education and the conditions to achieve these effects.

E-learning is used interchangeably with the terms e-learning, teaching, or online education.

## Methodology

The methodology followed the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) [26]. Due to the diversity of methods used in the studies, a narrative synthesis was performed. The systematic review protocol was registered at the International prospective register of systematic reviews under the number CRD42020219619.

### Research strategy

A systematic search for articles on the effects of ICT use in nursing and obstetric learning published from 2016 to 2020 was performed on PubMed, CINAHL, Epistemonikos and ERIC databases. Relevant studies were searched based on the terms and terminologies derived from the predefined conceptual groups.

The search strategy for the PudMed database was as follows : ("Students" [MeSH] OR "Learners" OR "Teachers" OR "Trainers" OR "Campus managers" OR "Directors" OR "Education, Graduate" [MeSH] OR "Universities" [MeSH] OR "Faculty" [MeSH] OR "Africa" [MeSH]) **AND** ("Information and communication technologies for education" OR "ICT for education" OR "Web-based learning" OR "E-learning" OR "Distance education" OR "Distance Learning" [MeSH] OR "Learning, Distance" [MeSH] OR "Computerized technological resources" OR "Online Learning" [MeSH] OR "Learning, Online" [MeSH] OR "Online Education" [MeSH] OR "Remote Education" OR "Remote instruction" OR "Virtual classes" OR "Virtual classroom" OR "Integration of ICT" OR "ICT" OR "Internet use" [MeSH] OR "Computer User Training" [MeSH]) **AND** ("Access to ICT" OR "Use of ICT" OR "Capacity of use" OR "Perceived usefulness" OR "Confirmation of expectations" OR "Student satisfaction" OR "Health knowledge, attitudes, practice" OR "Health Knowledge, Attitudes, Practice" [MeSH] OR "Student engagement" OR "Academic Success" [MeSH] OR "Learning" OR "Professional Competence" [MeSH] OR "mental competency" [MeSH] OR "Skills").

This strategy was adapted for use in the Epistemonikos, ERIC and CINAHL bibliographic databases. The last search on the databases was performed on October 30, 2020.

### Inclusion and exclusion criteria

All original research articles on the effects of ICT use that met the following eligibility criteria were included:

- the use of ICT in nursing and/or obstetrical education in low and middle-income countries;
- articles published in English or French journals from 2016 to 2020.

The exclusion criteria were:

- articles on the use of ICT in pre-licensure learning;
- commentaries, review papers, case studies, letters, discussion papers, posters, conference abstracts, conference reports and dissertations;
- full text not available.

In addition, manual searches were conducted in articles references and peer-reviewed journals. All articles identified through database searches were exported to Zotero

## **Data extraction and analysis**

Data were extracted using a form designed on Microsoft Excel. This form has cells to collect data on the scope of the study, design, participants, study duration, data collection, methods of analysis, intervention, control, and primary outcomes. Data were extracted and tabulated by one review author and verified by another author. Disagreements were resolved by discussion between the two authors. The main findings of the studies were analyzed and summarized narratively.

## **Assessment of study quality**

The methodological quality of the eight studies included in this synthesis was assessed using the Mixed Methods Appraisal Tool (MMAT). The MMAT is a critical appraisal tool designed for mixed systematic reviews, i.e., reviews that include studies using qualitative, quantitative, and mixed methods. It assesses the methodological quality of five categories of studies: qualitative research, randomized trials, quantitative descriptive studies, and mixed-methods studies [27]. The MMART criteria list includes two triage questions and five questions per study category. In addition, the document includes indicators that explain and illustrate some criteria. For each question, the authors responded by checking "Yes," "Don't know," or "No." One author evaluated six articles, and another evaluated two articles. The authors discussed the results of the assessment for all included articles with particular attention to questions that were checked "Don't know" or "No." In terms of the methodological quality of the articles, one was of low quality, three of medium quality, and four of good quality.

## **Results**

## Search results

The flow and number of studies examined at each stage of this systematic review are presented in Figure 1. A total of 486 articles were retrieved through various searches. After removing duplicates, 436 remained, and eight met the inclusion and exclusion criteria.

## Characteristics of the studies

The included articles were published in English between 2016 and 2020. One study was conducted in a low-income country [3], and seven studies were conducted in four middle-income countries [28–34]. Five studies focused on teaching and learning of specific subjects such as ethics and deontology [28], research course [34], clinical ear examination [29], health information management, gerontology nursing [30], international classification of nursing practice [32]. The other three studies evaluated, in a global way, the effects of the use of ICT, more particularly e-learning in learning and the realization of certain pedagogical activities such as learning assessment [3,31,34].

The modes of intervention examined by the eight studies involved synchronous and/or asynchronous online learning. Of the eight studies, four used quantitative methods [28,30,31,34], one used qualitative methods [29] and three used mixed methods [3,32,33]. Almost all studies specified the methodological approach used. Of the eight included studies, two used the quasi-experimental approach [28,30], two used the descriptive approach [31,34], two used the sequential mixed approach [29,33], one used the qualitative descriptive approach, and one used the convergent mixed approach [3].

Seven included studies focused exclusively on nursing students as participants [28–32,34]. One study included faculty, information and communication technology managers, and campus managers [3].

## Individual results of the included studies

In the article by Chao et al. [28], a quasi-experimental study was conducted to develop and implement an interactive situational e-learning system, integrate ethical nursing decisions into a nursing ethics course, and evaluate the effects of this course on nursing students' ethical decision-making competence. Comparing the experimental and control groups before and immediately after each aspect of ethical decision-making indicated that the experimental group showed significant growth in all six dimensions. The control group showed significant growth in four aspects of competence, including "comparing differences," "talking about oneself," "acting," and "identifying implications." Regarding the impact of the experimental intervention on students' ethical decision making ability and assessment of the

effectiveness of the online course, the results show that only two dimensions, "raising ethical questions" and "recognizing differences," showed significant differences between the groups, with the experimental group showing more significant growth in these areas than the control group.

Harerimana et al [3] used a mixed-method with a convergent design to analyze e-learning in selected nursing campuses in Rwanda. Most students reported that they have good or very good ability to use the Internet. Furthermore, they said that they use ICT tools for various reasons such as: accessing learning resources, following the course at any time without necessarily being in school, searching for information on diseases even when they are on clinical placement. The majority of the nurse educators indicated that students understand what they are learning more easily and feel more independent. In addition, the nurse educators reported a somewhat positive impact of the use of ICT on student learning by indicating that ICT improves the classroom climate, students focus more on their learning, students try more challenging to learn, ICT makes it much easier for students to work collaboratively, and students remember what they have learned more easily. In addition, the study indicates that students have a positive perception of the results of e-learning. Participants in this study revealed that online learning promotes self-directed learning. Students who participated in the study revealed that online learning saves time in travelling and attending regular classes. They say they can also receive messages from peers and teachers without necessarily being in school. In addition, they can access resources without being limited by time and space.

The qualitative study by Willemse et al. [29] explored the experiences of undergraduate nursing students who participated in an authentic act of mobile learning to enhance their learning experiences. The study reports that student engagement improved with mobile learning. Besides the mobile learning experience, students are perceived as a modern, informative, and easily accessible method of communication that provided a "clear understanding of how to do a clinical examination." Students indicated that mobile learning facilitates group work and that group work facilitates and enhances their learning. The online mobile learning initiative improved communication between group members, and students completed their tasks without face-to-face contact.

Kawther et al. [30] undertook a quasi-experimental study to evaluate the impact of online distance education on the learning process of nursing students through the study of two courses: health information management in the 6th semester and gerontology nursing in the 4th semester. The majority of students rated themselves as incompetent or having poor skills in using the Internet. More than half of the students found that the online learning interaction made them motivated, also more than two-thirds found that group participation in completing tasks was better than individualized tasks. The effectiveness of the respective teacher-student relationship and rapport was reported by over three-

quarters of the students. While more than half of the students reported that the system is contemporary, their responses regarding whether the online system can replace traditional face-to-face learning were distributed in approximately equal percentages on both sides of the scale.

Irinoye et al. [31] conducted a descriptive survey-type study to examine nursing students' attitudes and perceptions toward using information and communication technology tools in distance education. Many respondents reported fair or poor skills in the use of ICT. In response to the question about how often they surf the Internet, most students said they sometimes surf the Internet. In terms of owning a personal desktop or laptop computer, most reported not owning a personal desktop or laptop computer. More than half had no formal computer training. The majority of respondents agreed/strongly agreed that face-to-face classes improve student understanding than the online virtual classroom.

Avelino et al. [32] used a mixed-method research design to evaluate the teaching-learning process of undergraduate students and nursing professionals on the International Classification of Nursing Practice (ICNP®) through a course Moodle platform. Participants rated their level of knowledge obtained high after completing the course. In addition, the majority of students would like to use the virtual learning environment as a teaching and learning strategy in other courses. Even at a distance, the forum resource allowed interaction between students, enabling a collective construction of knowledge about the nursing process and the CPCI. However, for some participants in the study, mainly undergraduate students, the distance learning modality is still a new experience, causing some apprehension at first contact.

Using a mixed-methods research design, Luo et al. [33] examined nursing students' responses and learning based on their participation in an online research course across two technology-enhanced tasks. Students reported that the assignments were helpful in their learning and their research skills met the expected learning outcomes of the course. After completing the assignments, participants felt more confident in using different forms of technology.

Bello et al. [34] conducted a descriptive cross-sectional study to assess the pattern and use of information and communication technologies among undergraduate nursing students at Tanta University, Egypt. The majority of the sample used a desktop or laptop computer and the Internet, respectively. Few students had access to medical journals or online learning resources. In terms of the number of times they accessed the Internet, the study found that slightly more than half of the students accessed the Internet 1 to 3 times per day. About half of the respondents spend an average of 1 to 3 hours on the Internet per day. In addition, just under half of the students reported that they only used the



computer/Internet once a week for scientific research. About half of the students reported having good computer skills.

**Table 1 : Individual study characteristics and outcomes**

Author, Year, and Country of Origin	Methods	Participants	Modality of use of ICT	Main results
Al-Sayid, 2017 Iraq	Quasi-experimental study	Nursing students (n=100)	Blended e-learning	<ol style="list-style-type: none"> <li>- The control group showed significant growth in four aspects of competence</li> <li>- The experimental group showed greater growth in two areas than the control group.</li> </ol>
Al-Sayid, 2016 Iraq	Parallel mixed method of convergence	Nursing students (n=227), Nurse educators (n=44), ICT managers and Campus managers (n=17).	E-learning	<ol style="list-style-type: none"> <li>- Students understand what they are learning more easily and feel more empowered in their learning.</li> <li>- ICT improves the classroom climate; students are more focused on their learning, they try harder to learn.</li> <li>- ICT greatly facilitates collaborative work among students</li> <li>- Students are more likely to remember what they have learned a lot.</li> <li>- Students have a positive perception of the results of e-learning.</li> <li>- E-learning promotes self-directed learning.</li> <li>- E-learning saves time in terms of travel and attending regular classes.</li> <li>- Students can receive messages from their peers and teachers without necessarily being in school.</li> <li>- Students can access resources without being limited by time and space.</li> </ol>

Author, Year, and Country of Origin	Methods	Participants	Modality of use of ICT	Main results
Emmerson, 2017 South Africa	Contextual qualitative method	Undergraduate nursing students (n=101)	Blended e-learning with smartphone	<p>Student engagement has improved with mobile learning.</p> <ol style="list-style-type: none"> <li>Students perceive the mobile learning experience as a modern, informative, and easily accessible method of communication that provided a "clear understanding of how to take an exam."</li> <li>Mobile learning facilitates group work, and that group work facilitates and enhances their learning.</li> <li>The online mobile learning initiative improved communication among group members, and students completed their tasks without face-to-face contact.</li> </ol>
Alzahr, 2010 Egypt	Quasi-experimental study	Nursing students (n=224)	Synchronized and asynchronous distance learning	<ol style="list-style-type: none"> <li>Students rated themselves as incompetent or having poor skills in using the Internet.</li> <li>More than half of the students found that the online learning interaction made them feel motivated,</li> <li>More than two-thirds found that group participation in task completion is better than individualized tasks.</li> <li>The effectiveness of the respective teacher-student relationship and rapport was reported by over three-quarters of the students. While more than half of the students reported that the system is contemporary, their responses regarding whether the online system can replace traditional face-to-face learning were distributed in approximately equal percentages on both sides of the scale.</li> </ol>

Author, Year, and Country of origin	Methods	Participants	Modality of use of ICT	Main results
Oyebode, 2016 Nigeria	Descriptive study of survey type	Nursing students (n=305)	Online distance learning	<ol style="list-style-type: none"> <li>1. - Students reported having fair or poor skills in using ICT.</li> <li>2. - The majority of students sometimes surf the Internet.</li> <li>3. - Most reported not owning a personal desktop or laptop computer. More than half had no formal computer training.</li> <li>4. - The majority of respondents agreed/strongly agreed that face-to-face classes improve student understanding than the online virtual classroom.</li> </ol>
Alino, 2018 Brazil	Mixed method	Nursing students (n=51)	Blended e-learning	<ol style="list-style-type: none"> <li>1. - Participants rated their knowledge level as high after completing the course.</li> <li>2. - The majority of students would like to use online learning as a teaching and learning strategy in other courses and subjects.</li> <li>3. - Even at a distance, the forum resource allowed interaction between the students, allowing for collective construction of knowledge on the nursing process and the CPCI.</li> <li>4. - The distance modality is still a new experience for undergraduate students, which causes some apprehension at first contact.</li> </ol>
Alino, 2018 Brazil	Integrated explanatory sequential mixed method	Nursing students (n=9)	Asynchronous e-learning	<ol style="list-style-type: none"> <li>1. - The assignments were helpful for student learning, and their research skills met the expected learning outcomes of the course.</li> <li>2. - After completing the assignments, participants felt more confident in using different forms of technology.</li> </ol>

Author, Year, and Country of origin	Methods	Participants	Modality of use of ICT	Main results
Alotaibi et al., 2017 Saudi Arabia	Descriptive cross-sectional study	Nursing students (n=504)	Blended e-learning	<ol style="list-style-type: none"> <li>1. - The majority of students respectively a desktop or laptop computer and the Internet.</li> <li>2. - Few students had access to medical journals or online learning resources.</li> <li>3. - Just over half of students accessed the Internet 1-3 times per day.</li> <li>4. - About half of students spend an average of 1 to 3 hours on the Internet per day.</li> <li>5. - Slightly less than half of the students reported that they only used the computer/Internet once a week to search for scientific knowledge.</li> <li>6. - About half of the students reported having good computer skills.</li> </ol>

## Narrative synthesis

### How are information and communication technologies used in learning?

Information and communication technologies (ICTs) are used in various ways in teaching/learning generally and in nursing teaching/learning specifically. All eight articles included in this systematic review address the use of information and communication technologies as a medium for distance or online teaching/learning [3,28-34]. These articles describe different models of online learning. Four articles describe the blended e-learning modality, i.e., integrating face-to-face learning experiences with online learning [28,29,32,33]. One article described the blended online learning model using a smartphone [32]. One article described the e-learning model in a synchronized and asynchronized environment [30], and another article described the e-learning model in an asynchronized environment [34]. Two articles discussed online learning without further details [3,31].

#### 1. Access to ICT

Access to a computer and connection is the first requirement for using information and communication technology in learning [3]. In terms of owning a desktop or laptop computer, most nursing students reported not owning a personal desktop or laptop computer [31]. However, most students report using a desktop or laptop computer and the Internet for learning [29]. In terms of Internet access, slightly more than half of the students accessed the Internet 1 to 3 times per day [29]. In addition, about half of the students spent 1-3 hours on the Internet per day [29].

## **2. Capacity to use ICT**

Most students have poor or lacking skills in using the Internet [30]. Some have moderate or no computer skills [29]. This could be because many nursing students do not receive formal computer training. Therefore, many cannot use computer application software very well [31].

## **3. Student motivation**

The use of ICT in teaching and learning motivates nursing students [30]. This motivation is reflected in an improved classroom climate, increased student focus on learning, etc. [33]. Several factors could explain students' motivation to use ICT in their learning. Indeed, students find that they save time in travel, especially when they have to attend classes regularly. In addition, students indicate that they can receive messages from their peers and teachers without necessarily being at school. They also mention that the use of ICT in learning facilitates collaborative work among students [3].

## **4. Autonomy in learning**

The use of ICT in learning promotes autonomy in learning. Indeed, the use of ICT allows students to take courses at any time without necessarily being at school. In addition, students have access to learning resources anywhere and anytime [3]. However, few students had access to online medical journals or other online learning resources [29].

## **5. Meaningful acquisition of knowledge and skills**

The use of ICT in learning improves the acquisition of knowledge and skills. It promotes the improvement of students' performance and professional skills [31]. Indeed, the use of ICT promotes a clear understanding of the course [32], makes it easy to understand the learning object [28], and the level of knowledge acquisition high [33]. Moreover, the forum resource allows, even at a distance, an interaction between students favouring a collective construction of knowledge [33].

## 6. Perception of usefulness

Nursing students have a positive perception of the outcomes of using online learning. Respondents' perceptions of the outcomes of online learning were broken down into 12 items, which are: online peer support was helpful; the course project is in line with their expectations; they gained more knowledge about technology; they gained skills in using the Internet; developed new ICT skills, changed their attitude; be able to use the new skill throughout their career; applied the new knowledge in their life; initiated new ideas from the new knowledge; interactive exchanges were essential in the course [3]. In addition, students have a sense of confidence in using different forms of technology [34]. However, some students, mainly undergraduates, find the distance modality still a new experience, which causes some apprehension [33]. Teachers believe that online learning improves the quality of memorization. Indeed, students easily remember what they have learned [3].

## Discussion

This study systematically examined the effects of ICT use in nursing and obstetrics learning. The results indicate that information and communication technologies are used as a medium for online learning [3,28–34]. Most students do not have a personal desktop or laptop computer. However, for online learning, they use desktop or laptop computers with an Internet connection. The articles included in this study show that most students have low skills or lack of skills in using the Internet [30]. Some have average or moderate computer skills [29].

On the other hand, studies have reported that using ICT has advantages or beneficial effects in learning nursing and obstetrics. Indeed, the use of ICT in teaching/learning makes students motivated, promotes autonomy in learning, and improves the acquisition of knowledge and skills [3,30,31]. In addition, nursing students have positive perceptions of the outcomes of using e-learning [3]. No study has presented a theoretical framework used to assess the effects of ICT use in learning.

Most students reported not owning a personal desktop or laptop computer [31]. However, the majority of students use a desktop or laptop computer and the Internet [29]. This result implies that these students do not use smartphones but use the laptops or desktops of their relatives for their online learning. Similar to this review, a previous review reported that ICT access, technical issues, and internal support are concerns for both students and faculty [5]. The problem of ICT accessibility could be explained by the lack of appropriate institutional strategies to promote ICT use [5]. It could also be explained by the unfavourable socio-economic situation of the students' parents [35]. This lack of access to ICT negatively affects its use in learning, as the computer and the Internet connection are the primary resource for online learning [3].

Most students have poor or lacking skills in using the Internet [30]. Some have average or no computer skills [29]. These results must be considered because they were obtained based on self-reporting and not

based on an assessment. A previous systematic review highlights a lack of technical skills among students as a problem related to ICT use in teaching/learning [5]. The results of another systematic review indicate that a lack of computer skills was identified as a major barrier to students using computer-based learning methods, rather than a lack of preference for new technologies [2]. Students' inadequate preparation explains the lack of computer and Internet skills. Students rarely receive any significant computer and Internet use training before moving on to use ICT in their learning [5]. This lack of skills leads to the loss of resources and demotivation of students to use ICT in their learning [5].

The use of ICT in teaching/learning motivates students [30]. This motivation results in an improved classroom climate increased student focus on learning [3]. Webb et al. found significantly higher engagement online than in the classroom [5]. Improved student engagement was a feature of online learning [5]. However, studies reviewed in a systematic review report problems with student motivation and a general lack of educational technology enthusiasm [5]. This difference could be explained by how universities prepare their students for e-learning, the accessibility of ICT, and the educational levels of the participants in the study. Indeed, studies have shown that undergraduate students are apprehensive about using ICT in learning [32]. Therefore, the effectiveness of student learning depends on the timing and quality of student preparation for online learning.

The results of this systematic review show that the use of ICT in learning promotes autonomy in learning. Indeed, the use of ICT allows students to take courses at any time without necessarily being at school. Many studies have found advantages to asynchronous learning, particularly time-saving and self-paced learning [5]. This advantage could be related to the fact that students have access to resources at any time and place for their learning. If the conditions are met, the adult learner can initiate initiative, autonomy, and engagement in the learning process. This suggests that autonomy in online learning requires well-designed and accessible learning resources. Hence, it is essential to have quality equipment and train teachers and students accordingly to use ICT in teaching and learning. The development of autonomy allows students to become aware of their responsibility in the learning process. This will increase their motivation. Motivation is a prerequisite for successful learning [36].

The use of ICT in learning improves the acquisition of knowledge and skills. It enhances students' performance and professional skills [31]. Previous studies have found similar results, revealing a significant improvement in clinical skills or knowledge of students accessing online material [5]. This improvement in knowledge or skill acquisition is thought to be because students can use the learning resources as many times as they wish to understand the course better. These effects are often observed in blended learning, where there is an integration of face-to-face learning experiences with online learning [5].

Moreover, in online learning, the forum resource allows, even at a distance, an interaction between students favouring a collective construction of knowledge [34]. Indeed, adult learning is easy in an atmosphere that promotes collaboration through participation. In addition, collaborative online learning has eight advantages that have been identified by a study [37]. However, to achieve beneficial effects of



online learning, an emphasis must be placed on the availability of infrastructure and equipment, the availability of human resources, and teachers and students training. The improvement of students' performance through e-learning depends on their motivation and ability to use ICT tools [38].

Nursing students have a positive perception of the outcomes of using online learning. This positive perception is expressed through positive attitudes. A previous systematic review reports that many of the studies reviewed found positive student attitudes toward online and electronic learning media [5]. This positive perception is thought to be due to the many benefits that online learning offers. This suggests that students are willing to do their learning online. However, studies report that the majority of students do not want exclusively online learning [30]. This student desire is evidence that blended online learning is the best model for using ICT in teaching/learning. Blended learning has several advantages: the successful fusion of face-to-face and online aspects by making resources more accessible. It promotes the student-centred approach, provides various materials, increases participation, and promotes student-student/teacher-student interaction. In addition, it allows for timely feedback and creates a ground for synchronous and asynchronous discussions [30].

## Study Limitations

The systematic review includes a sample of eight articles because a limited number of articles met the criteria. The small number of relevant articles included in this systematic review suggests a conservative interpretation of the results. In addition, we initially chose to include articles in which the participants were nursing and obstetrics students. We were unable to find articles with obstetrical students as participants. Therefore, applying the results of this study to obstetrical science students must be done with caution.

## Conclusion

The results of this systematic review indicate that ICT is used primarily as a support for online learning. These results support the findings of other studies on the effects or benefits of ICT use in general and nursing learning in particular. However, this review shows that many students do not have personal computers, access to the Internet is low, and most students have low to moderate skills in using computer tools. In addition, this study highlighted the lack of primary data on the effects of ICT use in obstetric science learning in low- and middle-income countries. We suggest that research be conducted on the effects of ICT use in midwifery learning in low- and middle-income countries.

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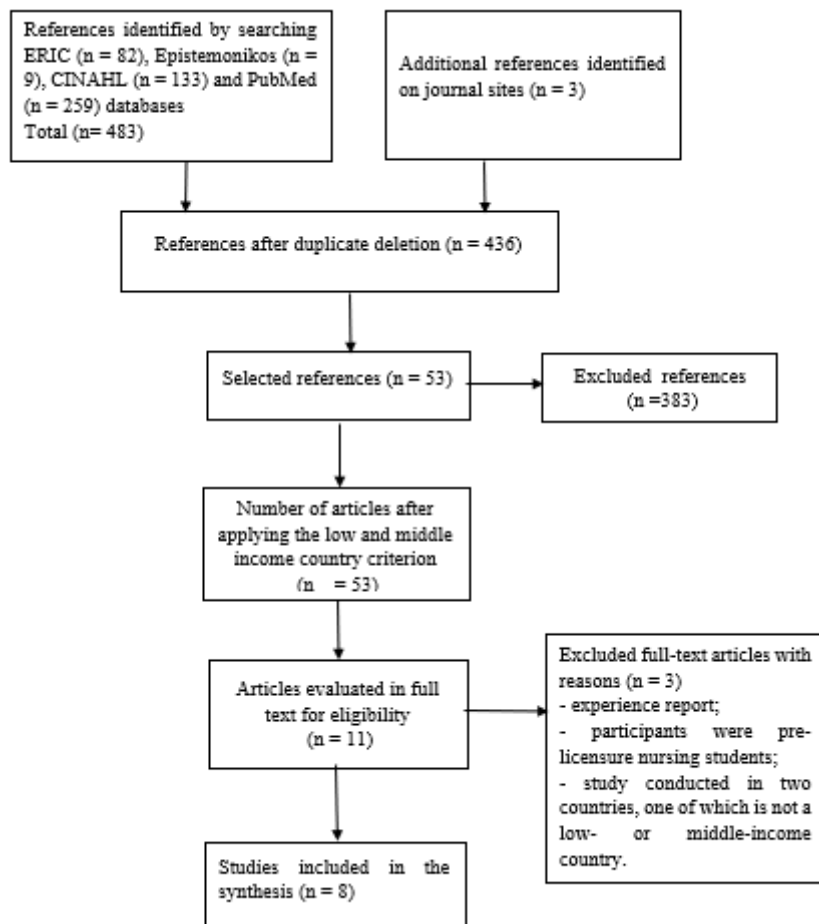
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## Figures



**Figure 1**

Adapted PRISMA flow chart

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