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Innovation in the Teaching of Information Literacy in graduate courses : a scoping review

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ABSTRACT

Introduction Studies show that teaching information literacy (IL) enables access to quality scientific information and the use of information and communication technologies (ICTs), which are essential for professional teaching and research. During the recent covid-19 pandemic, the use of these technologies has taken on even greater importance and has become a trend in teaching activities. Objective Identify innovative practices in teaching IC in postgraduate courses. The study is based on the hypothesis that students' learning about IC can contribute to improving professionals' skills related to autonomy and efficiency in the process of searching, selecting, and retrieving scientific information. Methodology A literature scoping review was developed on innovations in CoInfo teaching in postgraduate programs in and outside Brazil. The search was carried out in the Medline, Lilacs, ERIC, Cinahl, Academic Search Premier, Scopus, Scielo databases and the Oasis.Br repository, focusing on scientific production, in English and Portuguese, produced between 2010 and 2022. Of the 632 articles found, after applying the inclusion and exclusion criteria, 14 were selected for analysis. Results Innovations in teaching CoInfo in higher education were identified, such as online tutorials, asynchronous courses using humor, virtual visits to libraries, as well as partnerships between teachers, librarians, pedagogues, and university staff. Conclusion The findings attest to innovations in CoInfo teaching that can be adapted to the contexts of postgraduate programs in the country, with the aim of increasing student access to quality scientific information, which is necessary for the development of teaching, research, and knowledge production activities.

KEYWORDS

Information literacy. Teaching. Graduate. Information and Communication Technology. Innovation.

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Inovação no Ensino da Competência em Informação na pós-graduação: uma revisão de escopo

RESUMO

Introdução Estudos revelam que o ensino da competência em informação (CoInfo) possibilita o acesso à informação científica de qualidade e manejo das tecnologias da informação e comunicação (TICs), indispensáveis ao exercício profissional do ensino e da pesquisa. Durante a pandemia da covid-19, o uso das tecnologias assumiu maior importância e se tornou uma tendência nas atividades de ensino. Objetivo Identificar inovações no ensino de CoInfo na pós-graduação, tendo como hipótese que a aprendizagem de discentes sobre CoInfo

pode contribuir para o incremento de habilidades profissionais relacionadas à autonomia e eficiência no processo de busca, seleção e recuperação da informação científica. Metodologia Revisão bibliográfica de escopo sobre inovações no ensino de CoInfo em programas de pós-graduação, dentro e fora do Brasil. A busca foi feita nas bases de dados Medline, Lilacs, ERIC, Cinahl, Academic Search Premier, Scopus, Scielo e o repositório Oasis.Br, focando a produção científica, em inglês, espanhol e português, produzida de 2010 a 2022. Dos 632 artigos encontrados, após aplicação dos critérios de inclusão e exclusão, foram selecionados 14 trabalhos para análise Resultado Foram identificadas inovações no ensino da CoInfo na educação superior, como: tutoriais online, cursos assíncronos com uso do humor, visitas virtuais a bibliotecas, parcerias entre docentes, bibliotecários, pedagogos e Universidades. Conclusão Os achados atestam inovações no ensino da CoInfo que podem ser adequadas aos contextos dos programas de pós-graduação no país, visando incrementar o acesso dos discentes à informação científica de qualidade, necessária para o desenvolvimento de atividades de ensino, pesquisa e produção do conhecimento.

PALAVRAS-CHAVE
Competência em informação. Ensino. Pós-graduação. Tecnologia de Informação e Comunicação. Inovação.

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1 INTRODUCTION

In 2020, the world was surprised by COVID-19, whose high lethality, transmission, and pandemic nature led the World Health Organization (PAHO, 2020) to establish protocols to contain the disease. Due to the lack of therapeutic procedures, in parallel with investments in vaccine production, global protection measures were established which included physical distance. In Brazil, unfortunately, the responses of the federal government at the time were characterized by denialism, under-recording of data, and lack of alignment with knowledge and successful international actions, resulting in a significant number of cases and deaths (National Council of Health Secretaries (Conselho Nacional de Secretários de Saúde - CONASS, 2020). After the development of a vaccine and access to immunization for the majority of the world's population, the WHO declared the end of the public health emergency of international concern related to COVID-19 in May 2023 (PAHO, 2023).

One of the consequences of the COVID-19 pandemic is the profound change in the work process and the overall functioning of public and private services. This scenario has necessitated an increase in the use of technological tools to allow communication and continuity of tasks previously performed through physical contact. In the academic field, universities, teaching and research institutions, and other formal and informal educational spaces have had to reinvent themselves and adopt distance learning through technology.

Even after the end of the pandemic, the use of ICT has become a trend in teaching activities through hybrid environments. This may have increased the use of resources available on the Internet and social networks, such as Academia.edu, ResearchGate, chatbots, as well as Facebook, Instagram, and podcasts. There has also been a greater incentive to share knowledge and information on digital platforms such as Google Meet, YouTube, Moodle, electronic bookstores, and databases (Silveira and Vieira Jr., 2019), which have been enhanced with information technologies such as videos, games, images, and animations (Fumian and Rodrigues, 2013; Oliveira and Dias Jr, 2012).

We start from the premise that the use of ICTs at different levels of education and in knowledge production requires information literacy, here called CoInfo, for its users. CoInfo is understood as the ability to search, select, and retrieve scientific information and to critically analyze information to prepare the subject to better develop teaching and research activities.

It should be noted that, historically, the notion of information literacy was first described by the term information skill in 1974 in a document written by Paul Zurkowski, a North American educator and president of the Information Industries Association (IIA). The document focused on the use of information resources in work situations and problem-solving by learning techniques and skills in the use of information access tools (Sample, 2020; Dudziak, 2003; Callison, 2014; Zurkowski, 1974; Silva, Nunes and Teixeira, 2020; and Melo and Araújo, 2007). The literature points to Zurkowski's pioneering contribution in defining the concept of the information literate person, described as an individual trained in the use of information resources to solve problems with techniques and skills to use various information tools (Behrens, 1994).

The concept of information literacy instruction later emerged as a pedagogical approach aimed at teaching library users information use skills such as searching, quality assessment, critical and effective use, and knowledge production. Over the years, this process has come to be called Information Literacy (CoInfo). It can be practiced as part of the curriculum or in isolated subjects, through online tutorials, face-to-face, or asynchronous classes (Kasowitz-Scheer and Pasqualoni, 2002). In this regard, it is worth highlighting the role of the Association of College and Research Libraries (2016), which has defined a framework to support the implementation of CoInfo in schools, libraries, and universities. This framework includes a set of integrated skills that cover the reflexive discovery of information, the

understanding of how information is produced and valued, and the use of information in the creation of new knowledge and ethical participation in learning communities.
Within this approach, the development of skills and competences must consider the importance of evaluating reliable sources conveyed by science and critical thinking, capable of guiding decision-making based on the best evidence and reducing the damage caused by the spread of fake news on various topics. It is also necessary to consider its legal, social, and ethical use in line with the Sustainable Development Goals (UN, 2024) to ensure inclusive, equitable, and quality education and promote learning opportunities for all through social policies of continuous learning (Belluzzo, 2020).

An exploratory review of the literature revealed a preponderance of studies on CoInfo with librarians, information scientists, library science students, and, tentatively, university students. This finding, coupled with the first author's experience as a librarian and teacher of CoInfo in postgraduate courses, prompted a scoping review of the literature on teaching CoInfo. The aim of this review is to determine whether there are any innovative initiatives that can help to improve the teaching of CoInfo in the strict sense of Postgraduate Programs (PGP).

The proposed section is based on the hypothesis that student learning about CoInfo can contribute to increasing professional skills related to autonomy and efficiency in the process of searching, selecting, and retrieving scientific information. The review is part of a larger study (under development as a dissertation). The research is based on the articulation of the concept of CoInfo (information literacy) with CoInfo education (information literacy education) and media and information literacy (media and information literacy), focusing on training for higher education.

2 METHODOLOGY

The study aims to identify innovative CoInfo teaching practices in postgraduate courses through a review of national and international literature. Given the different models of literature review (Grant and Booth, 2009), we decided to conduct a scoping review, which is characterized by broad questions about the existence of research and knowledge gaps related to the topic of interest (Galvão and Pereira, 2022). A scoping review is also indicated for the following purposes: to investigate the types of evidence available in a particular area, to clarify concepts, to examine how research is conducted on a particular topic or area, and to identify the main characteristics or factors related to a concept (Munn *et al.* (2018).

The research question was structured using the mnemonic P (population) C (concept) C (context). Therefore, we chose to select only scholarly articles to answer the review question: What CoInfo teaching strategies have been developed in postgraduate courses. Therefore, the articles sought to identify how the concept of CoInfo has been alluded to, in addition to identifying innovations in teaching, considering aspects such as pedagogical and technological approaches.

Due to the multidisciplinary coverage, the searches were carried out in the following databases: Medline, Lilacs, ERIC, Cinahl, Academic Search Premier, Scopus, Scielo and Oasis.Br repository. Since this is a subject with extensive knowledge production, the period used was 2010 to 2022, justified by the increase in the number of publications on information literacy, with an emphasis on the expansion and use of ICTs (Farias *et al.*, 2021). According to Vincent (2011), in 2010, the term information literacy was included in the controlled vocabulary of the National Library of Medicine, the Medical Subject Headings.

The search strategy for terms that best represent the concepts of the research question was based on the Health Sciences descriptors (DeCS/MeSH), combined with the terminology of the Anísio Teixeira National Institute of Pedagogical Studies (Instituto Nacional de Estudos Pedagógicos Anísio Teixeira - INEP). The combination of descriptors according to the databases searched is described in Chart 1.

Chart 1. Final strategy and result by database

Databases	Search strategy	Total
Lilacs	("Health Postgraduate Program" OR "Postgraduate Strico Sensu" OR "Postgraduate Education" OR "Postgraduate" OR teaching OR "Continuing Education" OR "Distance Education" OR "Formal Education" OR "Non-Formal Education" OR "Higher Education" OR "Postgraduate Teaching" OR learning OR class OR course OR discipline OR workshop OR training OR teaching OR "Education, Continuing" OR "Education, Distance" OR "Education, Higher" OR "Education, Graduate" OR 'Health Postgraduate Programs' OR postgraduate) AND (""Information Competence" OR "Digital Literacy" OR "Informational Literacy" OR "Informational Literacy" OR "Information Literacy" OR "Academic Literacy" OR coinfo OR "Critical Information Competence" OR "Informational Competence" OR "Information Competence" OR "Informational Influence" OR "Informational Literacy" OR "Information Literacy" OR "Information Literacy Education" OR "Informational Literacy" OR "Computer Literacy" OR 'Digital Literacy' OR 'Academic Literacy' OR 'Critical Information Literacy') AND ("Virtual Learning Environment" OR 'Social Network' OR 'Social Media' OR 'Educational Technology' OR 'Information Technology' OR chatbots OR internet OR Instagram OR Facebook OR "Social Networks" OR "Educational Technologies" OR "Information and Communication Technologies" OR hybrid OR synchronous OR asynchronous OR tics OR YouTube OR "Social Networking" OR "Social Media" OR "Information Technology" OR "artificial intelligence") AND (db:("LILACS")) AND (type:("article")) AND (year cluster:[2010 TO 2022])	41
Medline	((("postgraduate"[Title/Abstract] OR ("postgraduate program"[Title/Abstract] OR "Teaching"[Title/Abstract] OR "Teaching"[MeSH Terms] OR "education, continuing"[MeSH Terms] OR "Education"[Title/Abstract] OR "education, distance"[MeSH Terms])) AND ("internet"[MeSH Terms] OR "facebook"[Title/Abstract] OR "social media"[MeSH Terms] OR "social networking"[MeSH Terms] OR "social networking"[Title/Abstract]) AND "information technology"[Title/Abstract]) OR "information technology"[MeSH Terms] OR (("information literacy"[MeSH Terms] OR "information literacy"[Title/Abstract] OR ("information literacy competencies"[Title/Abstract] OR "information literacy competency"[Title/Abstract]) OR "computer literacy"[Title/Abstract] OR "computer literacy"[MeSH Terms] OR "academic literacy"[Title/Abstract]) AND ("compete"[All Fields] OR "competed"[All Fields] OR "competences"[All Fields] OR "competencies"[All Fields] OR "competently"[All Fields] OR "competents"[All Fields] OR "competes"[All Fields] OR "competing"[All Fields] OR "mental competency"[MeSH Terms] OR ("mental"[All Fields] AND "competency"[All Fields]) OR "mental competency"[All Fields] OR "competence"[All Fields] OR "competency"[All Fields] OR "competent"[All Fields]))) AND ("inform"[All Fields] OR "informal"[All Fields] OR "informality"[All Fields] OR "informally"[All Fields] OR "informant"[All Fields] OR "informant s"[All Fields] OR "informants"[All Fields] OR "Information"[All Fields] OR "information s"[All Fields] OR "informational"[All Fields] OR "informations"[All Fields] OR "informative"[All Fields] OR "informatively"[All Fields] OR "informativeness"[All Fields] OR "informativity"[All Fields] OR "informed"[All Fields] OR "informer"[All Fields] OR "informers"[All Fields] OR "informing"[All Fields] OR "informs"[All Fields]) AND "Literacy"[Title/Abstract] AND ("humans"[MeSH Terms] AND 2010/01/01:2022/12/31[Date - Publication]) AND ("humans"[MeSH Terms] AND 2010/01/01:2022/12/31[Date - Publication])	783

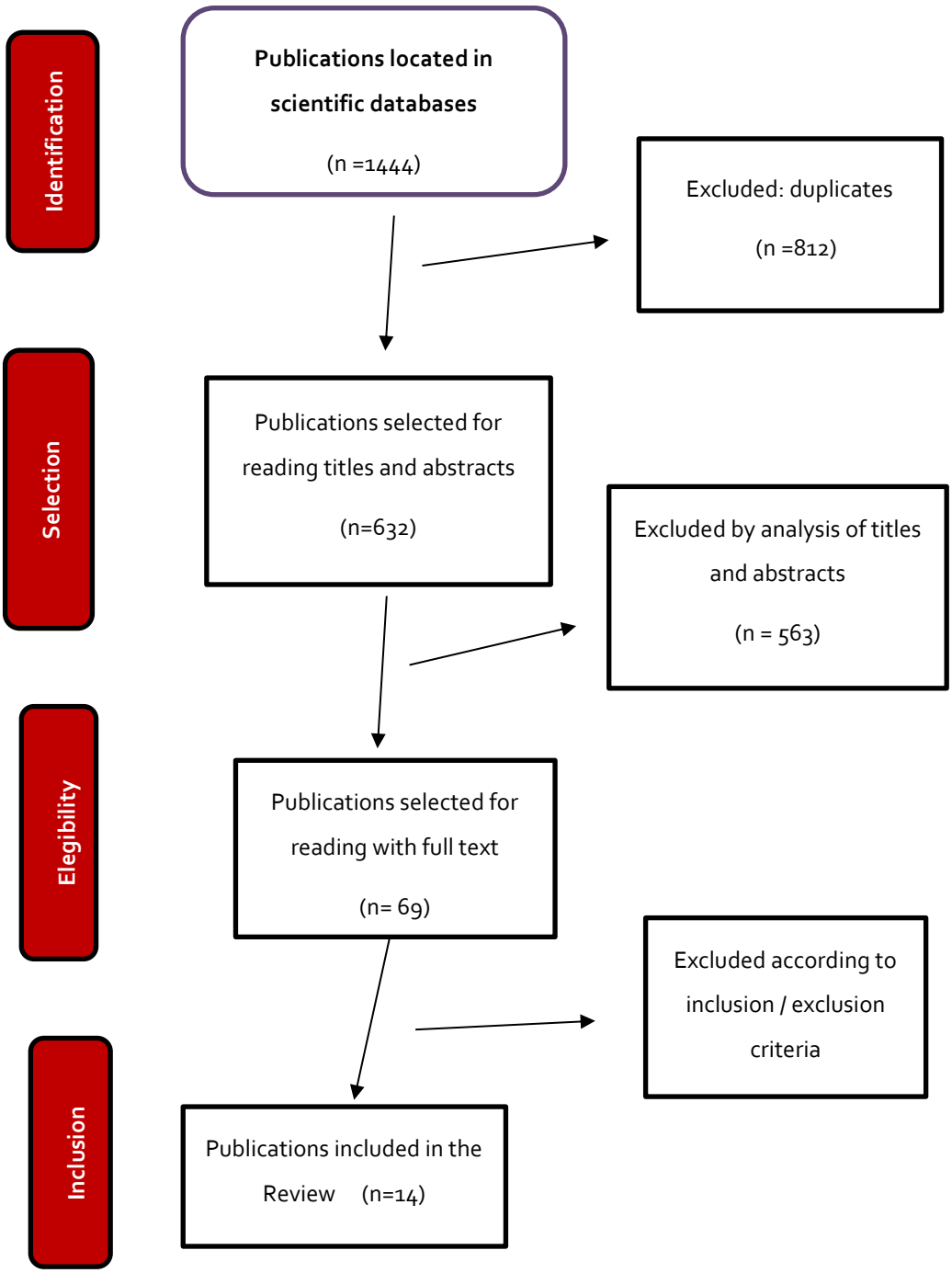
ERIC	("Postgraduate Programs" OR "Postgraduate" OR "Higher Education" OR "E-learning" OR "Education Continuing" OR "Education Distance" OR "Education Higher" OR "Education Graduate") AND ("Teaching" OR "learning") AND ("Information Literacy" OR "Information Literacy Education" OR "Digital Literacy" OR "Computer Literacy" OR "Academic Literacy" OR "Critical Information Literacy" OR "Digital Competence" OR "information Literacy Education") last 10 years and journal articles.	74
Scopus	(TITLE-ABS-KEY (("Postgraduate Programs" OR "Postgraduate" OR "Higher Education" OR "E-learning" OR "Education Continuing" OR "Education Distance" OR "Education Higher" OR "Education Graduate")) AND TITLE-ABS-KEY (("Teaching" OR "learning" OR "education")) AND TITLE-ABS-KEY (("Information Literacy" OR "Information Literacy Education" OR "Digital Literacy" OR "Computer Literacy" OR "Academic Literacy" OR "Critical Information Literacy" OR "Digital Competence" OR "Informational Literacy Education")	161
Ebsco	TX (("Postgraduate Programs" OR Postgraduate OR "E-learning" OR Education OR "Higher Education" OR "Education Continuing" OR "Education Distance" OR "Education Higher" OR "Education Graduate") AND TX (Teaching OR learning OR education) AND TI (("Information Literacy" OR "information literacy education" OR "Computer Literacy" OR "Digital Literacy" OR "Academic Literacy" OR "Critical Information Literacy" OR "Digital Competence" OR "Informational Literacy"))	22
Scielo	((postgraduate) OR (postgraduate) OR (graduate) OR ([graduation] AND (([education] (teaching) OR (learning) OR (continuing education) OR (education) OR (learning) OR (teaching) OR (continuing education)) AND ((information literacy) OR (information literacy education) OR (digital literacy) OR (information competence) OR (ICTs) OR (ICTs))	27
Oasis	(teaching OR learning OR distance learning OR virtual learning environment OR VLE OR ICTs) AND ("information literacy" OR "Information Competence" OR "information competence" OR "information literacy") AND ("post-graduation" OR "Stricto Sensu")	36
Total	Results in all databases	1444

Source: Research data

Inclusion criteria were scientific articles in Portuguese, English, and Spanish on CoInfo teaching for postgraduate students, of a qualitative or quantitative nature, which included innovations and teaching strategies. Although it was before the defined period (2010 to 2022), the studies by Boden (2007) were included since it was a pioneering article in proposing an online CoInfo tutorial model for graduate students, as well as Hepworth and Wema (2006), since it was one of the first online CoInfo courses. Excluded were studies on teaching CoInfo, computer literacy, or digital literacy to high school students, undergraduates, or health professionals; work on e-health, telemedicine, telehealth, and the use of applications aimed at care, health promotion, health policy, or health literacy. News, editorials, letters, opinion articles, book reviews and clinical trials, technical reports, news published in newspapers, and information from blogs were also excluded.

As explained in Figure 1 (Scoping Review Flowchart, 20-24), articles were first selected by removing duplicates using the automatic feature of the Mendeley reference management software and then manually, based on reading the documents' data such as title, abstract, and year. Documents were then selected by applying the inclusion and exclusion criteria for the studies, based on the first author's reading of the titles and abstracts. Of the 632 studies identified, 14 articles were selected.

Figure 1. Flowchart of the scoping review on CoInfo teaching in postgraduate courses



Source: Research data

3 RESULTS

To help categorize the themes, the 14 articles were classified according to location, terminology on CoInfo, methodological aspects, study population, innovative practices in the use of ICT, and pedagogical approach (Chart 2).

Chart 2. Characterization of the location, type of study, population, and CoInfo innovation of the 14 articles

14 selected articles	Location	Type of Study	Population	Innovation in Co-Info
Adams *et al.* (2016)	University of Auckland, New Zealand	Case study	Undergraduate and postgraduate students	Research methodology course integrated into the curriculum, in online and face-to-face format, following reintegration and curriculum reassessment. Provides critical skills for analyzing and carrying out postgraduate health research.
An e Quail (2018)	York University, Canada	DA	Undergraduate and postgraduate students and Administration faculty	Student-centered toolkit (videos, PDF) integrated into the curriculum as e-learning support for a business course. Work developed by librarians using a curriculum mapping exercise, online surveys, and focus groups.
Boden (2007)	Imperial College London, England	Case study	Postgraduate and postdoctoral students	Game-like online tutorial with tasks that develop CoInfo skills
Clapsopoulos *et al.* (2014)	Portland State University, Greece	Case study	Graduate students, postgraduates, professors	It describes experiences of software and web pages developed in different contexts for teaching CoInfo. It contributes to the need to establish a CoInfo policy that integrates SL and can be followed by Greek universities.
Hepworth e Wema (2006)	Universidade de Dar Es Salaam, Tanzania	Case study	Postgraduate students (Masters Faculty of Education)	Online CoInfo training course in partnership with the university library
Hughes (2013)	Queensland University of Technology, Australia	Qualitative and exploratory in nature	Australia's international students reflect the cultural and linguistic diversity of the population	Use of online information resources (databases) offered to exchange students. The study reveals cultural differences, language barriers, and specific information needs of this group.
Kelt (2013)	Glasgow Caledonian University (GCU), England	Case study	Graduate researchers and CGU teaching staff	Online tutorial based on Boden (2007) and adapted to the needs of GCU postgraduates with distant campuses and vacancies in other locations outside the country

Mirriahi *et al.* (2015)	University of New South Wales, Australia,	Case study	Teaching staff	Training of teaching staff to enable them to design online learning training courses
Mune *et al.* (2015)	State University de San Jose (SJSU), São Francisco, California, USA	Case study	Master's students, Faculty of Education	Canvas CoInfo/IL Online course (librarians were enrolled as instructors before the start of the pilot period in 2013) features 15 CoInfo modules in Canvas, managed online through a Learning Management System.
Sample (2020)	Oral Roberts University, Oklahoma, EUA	Case study	Postgraduate international and traditional students	The 3600 virtual library visit is aimed at non-traditional postgraduate students and international students with various AVMR combinations[1]. Aims to reduce anxiety before visiting the library in person. Reposition the library as the learning center of the university. IL course and workshop with AVMR augmentation
Shaffer (2011)	State University of New York at Oswego, EUA	Quantitative study (pre- and post-test) citation analysis	Postgraduate students	It examined learning and confidence to perform CoInfo tasks among students in postgraduate programs, comparing those who study online tutorials with those who receive practical classroom instruction.
Stagg e Kimmins (2014)	University of Southern Queensland, Australia	Case study	Postgraduate students from a Faculty of Management and Law undergraduates from the same faculty.	Compares self-reported CoInfo by two groups of undergraduates and postgraduates who attended face-to-face CoInfo classes
Tomaszewski (2021)	State University of California, Fullerton, EUA	Case study	graduation students and post graduation	One-shot synchronous workshop on Information Competence
Wegener (2022)	Singapore University, Singapore	Quali- quanti (pre- and post-test)	Undergraduates and faculty wishing to review their IL competencies	Asynchronous online CoInfo course with humor as a way of reducing stress and anxiety, stimulating creativity, and facilitating memory.

Source: Research data

As the chart above shows, the classification of the 14 articles selected indicated that the studies were mainly carried out in the United States (4), followed by Australia (3), Canada (1),

[1] Augmented, Virtual and Mixed Reality (AVMR) Learning Technologies, Sample (2020).

Greece (1), England (2), New Zealand (1), the Republic of Singapore (1), and Tanzania (1). These findings suggest that the discussion is more pressing in countries with a high HDI (Human Development Index) that invest in education, and less present in Latin American countries.

Regarding CoInfo terminology, half of the 14 articles studied mentioned the term Information Competence. The others mentioned Scientific Literacy; Academic Information Literacy; Information Literacy Instruction; online information sources; digital literacy; information skills focused on aspects of research and academic learning and teaching in information literacy. Although there is a diversity of terminology, there are common aspects regarding the appreciation of the need to qualify the search, location, and critical analysis of information and to contribute to scientific production in a specific area of knowledge.

About methodological aspects, case studies predominate (11), followed by one qualitative, one qualitative-quantitative, and one quantitative study, suggesting the predominance of qualitative analysis in this discussion. Regarding the population, there are three articles with undergraduate and postgraduate students; six also include faculty members, researchers, professors, and postdocs. Only one deals with faculty, and four only with graduate students. The presence of faculty in the papers suggests a concern with the CoInfo education process of students.

Regarding innovative CoInfo practices, the following were identified: online tutorials (Boden, 2007; Kelt, 2013); teaching toolkit for business students integrated into the curriculum (An and Quail, 2018); asynchronous course using humor (Wegener, 2022); course integrated into the face-to-face and online curriculum Adams *et al.* (2016); use of software and web pages for teaching Clapsopoulos *et al.* (2014); online information resources for international students (Hughes, 2013); 360o virtual library tour (Sample, 2020); synchronous "one-shot" information literacy workshop (Tomaszewski, 2021); training course for lecturers on online learning Mirriahi *et al.* (2014) and courses on CoInfo for postgraduate students (Hepworth, and Wema, 2006) and Mune *et al.* (2015). Two studies compare the learning outcomes of the target population of the study - Shaffer (2011) and Stagg and Kimmins (2014).

In terms of pedagogical approaches, only one of the 14 studies did not report on them, Kelt (2013). Five emphasized the importance of active, problem-based, and inquiry-based learning that focuses on the student as the protagonist of the teaching and learning process: Boden (2007), Stagg and Kimmins (2014), Shaffer (2011), Tomaszewski (2021), and Wegener (2022). For Stagg and Kimmins (2014), students are increasingly demanding a quality learning experience with adequate and appropriate resources. For Hepworth and Wema (2006), the constructivist approach and problem-based learning reflect the value placed on the involvement of the people targeted by the educational action in the creation of meaning, mediated through communication.

The other approaches mentioned have other names, such as andragogy An and Quail (2018); flexible learning Clapsopoulos *et al.* (2014); inquiry-based learning (Hughes, 2013); student-centered learning Adams *et al.* (2016); library as a center of learning sample (2020). However, there are common aspects regarding the valorization of teacher-student dialogue, critical analysis, and the role of students in the learning process.

In short, it is possible to identify specificities between the 14 papers in terms of innovations in CoInfo teaching. However, the similarities predominate about the privileged populations, the pedagogical approach, and the search to meet the demands and challenges related to the training and use of CoInfo, identified in the contexts of teaching and research institutions, detailed in the following point.

4 DISCUSSION

Firstly, it should be noted that most of the research analyzed was motivated by the needs and demands related to CoInfo teaching among postgraduate students and lecturers at universities in different countries. The search for solutions to the situations identified involved a team of professionals from libraries and other fields. Of the 14 articles, 5, Boden (2007), Kelt (2013), An and Quail (2018), Adams *et al.* (2016) and Tomaszewski (2021), addressed the importance of collaboration and teamwork, composed of librarians, curriculum specialists, academic and pedagogical staff, IT consultants (webmasters), and administrators, to identify unmet needs to improve CoInfo learning experiences.

In this sense, Adams *et al.*(2016) and Tomaszewski (2021) reported problems that motivated the proposal of changes, namely: the need to accommodate and manage many students, the existence of scheduling conflicts, logistical problems, and time constraints to offer training that took place several times a day and created an excessive and oppressive effort for information professionals. Identifying these obstacles allowed adjustments to be made to the work dynamic, such as grouping students in classrooms, allocating more time for laboratory practice, and creating instructional videos that allowed librarians to devote more time to individual assistance and the development of new projects.

Still in this direction, other articles point out that the reduction of librarian teams due to university budget constraints compromises the ability to meet the demands of student training and increases the number of publications by Boden (2007) and Mune *et al.* (2015). These reports converge with the situation experienced by the first author as a librarian in a teaching and research institution, making it difficult to carry out evaluation activities that improve training performance and update the increase in ICT use.

Another aspect that has been pointed out is that students have less access to campus libraries due to geographical distance, as described by Kelt (2013), Mune *et al.* (2015), Adams *et al.* (2016), and An and Quail (2018). This type of barrier has encouraged the provision of hybrid, online, and distance learning courses. A factor that also constitutes a barrier is the lack of English proficiency among non-native English-speaking researchers and postgraduate students. Based on their experience with Greek students, Clapsopoulos *et al.* (2014) point out that this gap is a challenge for the publication of scientific articles and, consequently, for CoInfo. Hughes (2013) also addresses the information needs of international postgraduate students on exchange in Australia. In addition to their lack of proficiency in English, the author highlights difficulties in using online information resources and points to the need for librarians to provide specific support to this audience.

As described in the results, the teaching of CoInfo uses ICT and pedagogical approaches that aim to increase student autonomy through active methodologies such as problem-based learning, flipped classrooms, among others. Among the innovations related to the teaching of CoInfo in postgraduate courses, the creation of online tutorials stands out. Boden (2007) discusses the pioneering work of Imperial College, called PILOT (Postdoctoral information literacy online tutorial), and developed with the aim of supporting researchers in the face of new developments in the publication process, funding, open access, and institutional repositories. The tutorial simulates situations with fun activities through a resource that provides an overview of information sources and can simulate learning by doing. Based on the tutorials described by Boden (2007), Kelt (2013) describes the development of an online tutorial on CoInfo, adapted and improved for the needs of postgraduate students at Glasgow Caledonian University (GCU) in England, whose campus units are far apart and there were vacancies in locations outside the country. The goal of the course was to improve the library's online and face-to-face instructional activities for students and researchers to support the research process and publication of articles.

Also focusing on relaxation-based learning, Wegener (2022) describes the experience of the University of Singapore Library, in partnership with the local Institute of Technology, in creating an asynchronous online course that incorporates elements of humor. This approach views humor as a positive emotional response to reduce stress and anxiety in library classes. Most of the students who completed the course reported that the humor helped to keep their attention and memorize the learning points; the students felt encouraged to learn; and there was a rapport with the librarians.

Still concerning innovation, Sample (2020) proposes a 3600 virtual tour of the library using augmented, virtual, and mixed reality (AVMR) learning technologies for postgraduate students. The proposal aims to minimize students' fears and anxieties, which can be affective barriers to CoInfo, by promoting safety and support in using the library. Feelings of inadequacy can be exacerbated by the perception that others have library skills that they do not, a lack of knowledge about where books are (how and where to start), and difficulty asking staff for help in using physical and technological resources. The article points out those international students may experience higher levels of anxiety about the library. In this sense, attentive listening, welcoming, and empathy are necessary elements to develop a relationship of trust that will enable the student to learn more.

Mune *et al.* (2015), on the other hand, present a proposal for integrated librarianship. Based on a partnership with faculty, CoInfo instructional modules were created in online and hybrid modes with the support and use of an integrated student learning management system. The article highlights the increased participation and support of the library in course implementation in online programs, such as the delivery of the Doctoral Program in Nursing Practice and Massive Open Online Courses (MOOCs). Mirriahi *et al.* (2015) emphasize the great international pressure to use active methods in online learning. He notes that there is an increasing demand for student-centered online learning, given the continuous and accelerated growth of Massive Open Online Courses (MOOCs) in all areas of higher education. For the author, the challenge lies in the development of digital literacy among faculty members, which is often an obstacle to the creation of new courses using ICT.

Another innovation concerns the integration of CoInfo activities into the curriculum. The study by Adams *et al.* (2016) presents the curricular integration of two research methodology courses for undergraduate and graduate students, offered face-to-face and online. The course resulted from the collaboration of faculty, library and academic learning support staff, and educators to integrate AIL academic information literacy skills into the curriculum, as well as the responses of librarians, researchers, and faculty participants.

In a similar direction, An and Quail (2018) describe an online toolkit with open educational resources for undergraduate and graduate business students that integrates CoInfo into the university curriculum. The aim was to help students learn how to use databases to conduct business research. This approach is in line with the study by Clapsoupoulo *et al.* (2014) on a series of initiatives to teach CoInfo in postgraduate courses, using online tools, software, workshops, web pages, and teaching platforms such as ILSEAB. The author recommends the formalization of a CoInfo policy in line with a scientific information policy, to facilitate the process of publication and dissemination of academic activities and to promote the curricular integration of CoInfo teaching in Greece.

One issue addressed in the studies is the evaluation of student performance in online and face-to-face teaching activities. For example, Shaffer's (2011) work focuses on comparing the CoInfo learning of students in postgraduate programs who were trained through online tutorials and those who received face-to-face instruction. According to the findings, there was no difference in learning between online and face-to-face teaching, but students trained in face-to-face teaching were more satisfied than those who used online tutorials.

Tomaszewski (2021), on the other hand, compared synchronous face-to-face instruction with asynchronous instruction using video modules during a lab session and pre-lab

assignment in a first-semester introductory biology course. Student survey responses indicated that online instructional videos have unique advantages and are comparable to face-to-face instruction. For the author, translating the unique structure of face-to-face instruction into asynchronous online instruction can free up librarian time to help individual students. In addition, librarians can take on new roles such as research, grant writing, bibliometric, data management, exhibition curation, curriculum mapping, and the creation of courses and workshops aimed at developing students' information literacy skills.

The study by Hepworth and Wema (2006) analyzed the implementation of a CoInfo course taught by librarians at the University of Tanzania. The course was found to be effective for the learning of Masters in Education students based on a pre- and post-test evaluation. In terms of motivational elements, the author highlights barriers such as inadequate training, lack of enthusiasm among some library staff to provide training, and the challenge of using the technologies by library users and staff. The study identified the importance of addressing students' feelings of insecurity and expectations, which could lead to frustration and uncertainty at the beginning of the process and consequently threaten the continuity of the course. According to the author, it is necessary to deconstruct the belief that finding and accessing information unfolds in a linear sequence, resulting in the process: consultation-research-result, when in fact it is a broader and highly interactive process.]

Stagg and Kimmins (2014) also refer to the affective domain, which focuses on emotions that affect students' ability to learn. This aspect has attracted the attention of researchers in the field of youth work education, as evidenced by the emergence of studies on the correlation between anxiety and reduced use of library resources. Students feel that the university labels them as inadequate, and they lose their self-confidence, which affects and jeopardizes their admission to the university. This process prevents students from continuing their studies and is a factor in dropout, when it should be a driving force to overcome difficulties with specialized support in partnership with teachers and librarians.

In short, a theme running through all 14 papers refers to the challenges of teaching CoInfo in postgraduate courses, arising from heterogeneous demand among postgraduate students, budget constraints, reduced number of professionals in libraries, increased demand in postgraduate programs, geographical and technological barriers, work overload, lack of time, and the need for engagement and partnership between teaching and libraries in a way that is integrated into the curriculum.

Faced with these obstacles, innovations such as tutorials and online courses, virtual visits, workshops, and toolkits have been developed to improve CoInfo teaching in postgraduate programs. In general, these initiatives considered the subjective dimension of learning, referring to the value of listening, the demands and needs of students, including affective barriers and anxiety related to teaching in libraries. In this direction, innovations and pedagogical approaches to CoInfo have sought to use motivational elements such as humor, support networks, among others.

It should be noted that, given the lack of studies in Brazil on CoInfo teaching in higher education, a complementary review was carried out. This search revealed that most of the national literature on the subject is found in theses, dissertations, and conference papers. The few articles found generally deal with theoretical and conceptual aspects of CoInfo and the evaluation of training activities on CoInfo among students Vincent (2011), Ramos and Faria (2012), Vincent *et al.* (2014), Serafim and Araújo Freire (2016), Kanitar and Loureiro (2018) and Farias *et al.* (2021); there is a lack of work on online open educational courses or resources for postgraduate students.

In this sense, it is worth mentioning the study by Jacobsen, Miletto and Loureiro (2022) on the offer of a CoInfo course for postgraduates, which deals with the process of searching, storing, creating, providing, and analyzing information, with the aim of supporting all stages of scientific preparation and research. Another initiative, developed by Vincent (2011), evaluates

CoInfo among postgraduate students in public health who participated in face-to-face training on the subject. On the other hand, Carvalho's (2016) thesis analyzes the impact of a distance learning specialization course called "Informational Literacy: Education for Information" on the development of CoInfo among professors and librarians. These national experiences point to the need to broaden access to CoInfo education, taking advantage of the multiple opportunities offered by ICT.

5 CONCLUSION

The health crisis caused by COVID-19 in 2020-2022 has highlighted the urgency of access to relevant and reliable information, driving the use of information and communication technologies (ICT) to enable professional and academic practice. This trend has become commonplace in the teaching and research environment, even after the end of the pandemic in May 2023. In this scenario, the teaching of information literacy (CoInfo), defined as an educational approach to information use skills, has gained greater visibility and importance. These skills include searching for information, evaluating its quality, using information critically and effectively, and producing knowledge based on academic and scientific literature.

The results of the scoping review point to the recognition and systematization of factors that limit the teaching of CoInfo in postgraduate courses in the international context. These needs and demands have motivated the creation of pedagogical innovations in the online modality, as well as adjustments to the organization and institutional dynamics, based on teamwork involving professionals from different specialties. The description of these innovations and their impact on the promotion and improvement of CoInfo teaching in higher education can guide the development of similar initiatives in the national context, which are still not very significant.

In this regard, it is important to point out that the results of this review will be added to the data from the broader study, which includes interviews with a group of postgraduate librarianship students and faculty (not named due to the author's confidentiality), as well as the first author's work as a teaching librarian. From this body of information, we set out to develop an educational technology characterized by an open-access online course on CoInfo for graduate students and faculty. The course aims to contribute to learning how to select, retrieve, critically analyze, and produce scientific information, to promote global, critical, humane, and autonomous training in the practice of scientific research and production in Brazil.

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