

Learning objects in Distance Education: tools for technology-mediated teaching

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Abstract

Learning Objects are resources that promote more interaction, agility in the recovery of information, and communication between individuals in many different contexts. Considering this, this article aims to carry out an integrative review about the types of learning objects and how they are being used in distance teaching in the field of health. This is an integrative literature review. Databases used for the search were PubMed, SciELO, Scopus, and Science Direct. To locate relevant studies, that could answer to the research question, the descriptors indexed in Portuguese, English, and Spanish were used. The descriptors used were: "health" AND "learning object" AND "distance education" OR "e-learning". The final sample of this review included 13 articles selected according with inclusion criteria previously established. It was found that 77% of the articles selected were published by European (39.5%) and Asian (38.5%) countries. 46.2% of the publications were published in 2016, 2017, and 2018, while 2019 and 2020 alone had 53.8%. The main learning objects used in distance teaching in health, listed in the articles included, were video classes, podcasts, e-books, and interactive games. Medicine was the professional category with the greatest number of LOs for professional training and education, followed by nursing and dentistry. The use of LOs in distance education show that, in 76.9% of studies, their use improved the performance in the teaching-learning process. Therefore, we expect this virtual educational benefit to become consolidated, so new strategies and tools become available in teaching strategies.

Descriptors: distance education; learning object; virtual education; health professional.

1. Introduction

In-person education is the traditional teaching method, where teacher and student have direct communication. In this context, the role of the professor is to transmit information, while that of the student is merely to repeat it. This transmission of information by the professor is often direct and limited in regard to the participation of the students in the process (COSTA et al., 2014).

On the other hand, in the distance education modality, pedagogical mediation takes place through information and communication technologies, with the use of online platforms and visual resources. In this case, the professor is a mediator in the learning process, and has as an advantage the possibility of teaching

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the same discipline to a limitless number of students without being restricted to a physical space, as it happens, for example, in in-person teaching(Sardi et al., 2022).

Education using technologies is flexible, due to the fact that it attends to job market needs, that is, courses are elaborated to produce a qualified workforce. Therefore, in distance education, the student is an active subject in the process of forming a being responsible for their own learning(Sardi et al., 2022).

Digital technology enables independent, flexible study, capable of developing different abilities, contributing for autonomy in learning and for the association between theory and practice. Many resources can be used for the goal that is education(Davilla et al., 2012).

In concept, these resources are called Learning Objects (LOs) and defined as any digital resource, supplementary to the learning process, that can be used repeatedly to support learning. The LOs can be created in any media or format, and can be as simple as an animation or a slide presentation, or as complex as a simulation (Aguiar, Eliane Vigneron; Flores, 2014). Currently, there is a plethora of educational technologies, including games, applications, hypertext, hypermedia, high-fidelity manikins, virtual environment simulators, videos, complete courses, sites, blogs, forums, web conferences, and virtual learning objects(Davilla et al., 2012).

The LOs are, therefore, technological resources with multimedia support and hypermedia language, that can be used repeatedly for interactive learning through educational materials, with didactic content and animations, with an interdisciplinary, interactive nature, in addition to complements and exercises. The advantages of their use are in the possibility of carrying out at a distance, the flexibility, and the fact that they enable the student to manage their place and time of study according with their needs, in addition to favoring the independent access to the regional characteristics of urban centers or remote places(Davilla et al., 2012).

In the scope of teaching in the field of health, changes are necessary in the education process of the students to form professionals with abilities and competences for teamwork in partnership with health services and the community. They must also develop critical thought and the capacity to learn how to learn. It is a challenge for Educational Institutions to rethink their teaching processes and the practices of their professors. LOs are resources to facilitate the construction of knowledge, as they promote more interaction, fast recovery of information, and communication between individuals in the most diverse contexts(Trindade et al., 2014).

Considering this, this article aims to carry out an integrative review about the types of learning objects and how they are being used in distance teaching in the field of health.

2. Method

This is an integrative literature review. To minimize potential errors, this research used as a base the methodology known as PRISMA - *Preferred Reporting Items for Systematic Reviews and Meta-Analyses* -, to improve the consistency of the reports in this integrative review. The process of identification, triage, eligibility, and inclusion of studies in the revision is illustrated in the flowchart Prisma, in Figure 1, guided which was guided by the same instrument. The study aims to answer the following guiding question: "What

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are the most used types of learning objects in health education?"

Databases used for the search were PubMed, SciELO, Scopus, and Science Direct. To locate relevant studies, that could answer to the research question, the descriptors indexed in Portuguese, English, and Spanish were used. The descriptors were obtained from the *Medical Subject Headings* (MESH) and from the Health Sciences Descriptors (DeCS): "health" AND "learning object" AND "distance education" OR "e-learning".

The search strategy was developed in five stages: 1) studies were selected using the descriptors; 2) title and abstract reading; 3) checking for duplicates; 4) full reading of the articles; 5) analysis of the studies that were in accordance with the inclusion criteria, as described by Figure 1.

The inclusion criteria for this study were: studies about the use of learning objects in the modality health distance teaching; open-access articles fully available online in English or Portuguese and published from 2016 and 2020. Dissertations, theses, and editorials were excluded. Article selection was carried out in December 2021.

Considering inclusion and exclusion criteria of the study, 1,805 articles were found, 13 of which were selected for a descriptive analysis, as the flowchart in Figure 1 shows.

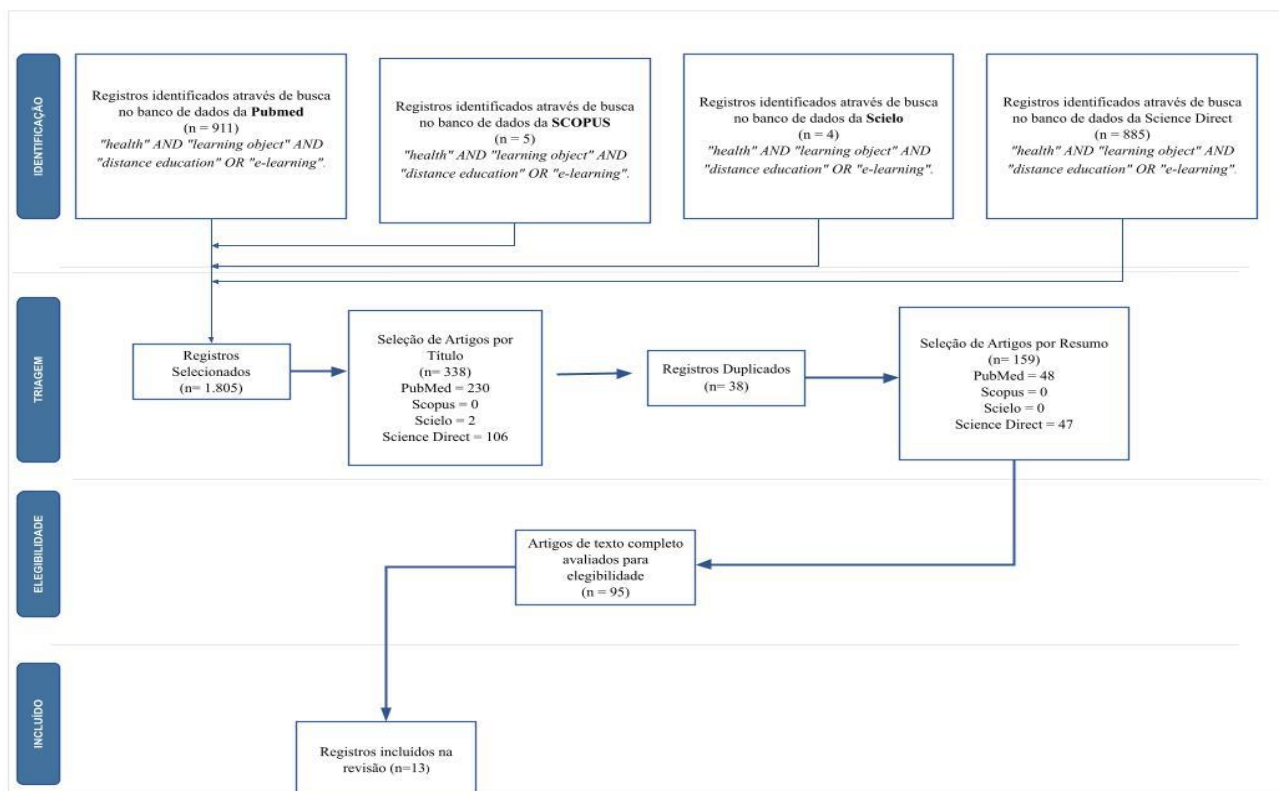


Figure 1: Study flowchart.

3. Results

The final sample of this review included 13 articles selected according with inclusion criteria previously established. Table 1 describes the general profile of the articles included in this review.

It was found that 77% of the articles selected were published by European (39.5%) and Asian

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(38.5%) countries. Two articles were published in Latin America (15.3%) and only one in the Oceania. 46.2% of the publications were published in 2016, 2017, and 2018, while 2019 and 2020 alone had 53.8%.

Table 1 - Characterization of the articles according with the journal where they were published. Manaus-AM

Author	Country	Year	Journal	Impact Factor
	Japan	2016	EBioMedicine	8,143
Riaño, David, Real, Francis; Alonso, Jose Ramon	Spain	2018	International Journal of Medical Informatics	4,046
Chao et al.	Taiwan	2017	Nurse Education Today	3,442
Back et al.	Germany	2017	Journal of Surgical Education	2,891
Barisone et al.	Italy	2019	Nurse Education in Practice	2,281
Tubelo et al.	Brazil	2016	International Journal of Medical Informatics	4,046
Aghababaeian et al.	Iran	2019	African Journal of Emergency Medicine	1,370
Park et al.	South Korea	2020	Nurse Education Today	3,442
Burns et al.	United Kingdom	2019	Midwifery	2,372
Rebecca Donkin et al.	Australia	2019	BMC Medical Education	2,37
Jaime Carrizosa et al.	Uruguay	2018	The Educational Journal of the ILAE	1,81
Mel E. Major, Stephan P. et al.	The Netherlands	2020	BMC Medical Education	2,37
Yu-Ting Hsiao, Hsuan-Yin Liu, Chih-Cheng Hsiao	Taiwan	2020	Healthcare	2.64

Source: The authors, 2022

The main learning objects used in distance teaching in health, listed in the articles included, were video classes, podcasts, e-books, and interactive games (Table 2). Medicine was the professional category with the greatest number of LOs for professional training and education, followed by nursing and dentistry.

Regarding the results of the use of LOs in distance education, in 76.9% of studies, their use improved the performance in the teaching-learning process.

Table 2 - Learning objects and their use in distance teaching

Author	Study design	Study participants	Learning object	Outcome
	Randomized Clinical Trial	Endoscopy physicians	E-learning system in web browser: use of images, video classes, exercises with images.	The mean improvement rate (standard deviation) for the e-learning and non-e-learning groups were 1.24 (0.26) and 1.00 (0.16), respectively ($p < 0.001$).
Riaño, David, Real, Francis ; Alonso, Jose Ramon	Randomized Clinical Trial	Urgency and intensive care residents	Shock-Instructor (e-learning web browser system) with a data base of clinical interactive cases that can be modified according with changes in scientific evidence.	No significant differences were found in the level of ability of the intervention group (IG) and the control group (CG) before learning. However, we found that the IG clinicians were more able to stabilize shock patients in better clinical conditions (5% improvement, $p = 0.004$) and reduce the risk of death in 19.52% ($p = 0.004$), after training.
	Control case	Nursing students	Animated videos and interactive decision-making exercises	After controlling the factors that influenced the effects of learning, the students in the experimental group showed better results than those in the control group in their ability to "perceive differences". The students in the experimental group report that the course encouraged them to search and collect the necessary information to solve the ethical dilemma.
	Randomized Clinical Trial	Medicine students	Podcasts	There was a significant increase in the general knowledge for both groups ($p < 0.001$). The users of the podcast had a significantly higher score in the post-test ($p < 0.021$) and gained significantly more knowledge when compared to the

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				users of text ($p < 0.001$). The evaluation also showed that the podcasts were significantly more voted as understandable, efficient, and fun forms of learning ($p < 0.05$).
	Descriptive Qualitative Study	Nursing students	Videos with the respective checklist of nursing techniques.	Web-based learning can be used effectively to reduce the gap between theory and practice, and even as a form to refresh the knowledge of trained nurses.
Tubelo et al.	Randomized Clinical Trial	Dentistry students	Narrated illustrations, video demonstration, and virtual simulation of the manipulation of cement	Pre- and post- theoretical knowledge tests and two lab ability tests were about the handling of zinc phosphate cements were applied to all groups and evaluated by blinded examiners. The students that used the OVL showed better results in all tests than the control students did.
Aghababaeian et al.	Control case	Nursing students	Podcasts and videos	There were no significant differences between the types of teaching in the knowledge or in the performance, whether at the time or one month after training.
Park et al.	Quasi-experimental research with a control group	Nursing students	E-learning web browser system: educational content in videos and images, interactive games.	The results showed that the web-based experience education strategies were efficient and improved significantly the score of knowledge and abilities in the EBP ($F = 12.29, p = 0.001$) and the score of the confidence to make clinical questions ($F = 12.14, p = 0.001$). The attitudes regarding EBP ($F = 0.75, p = 0.389$) and the score in practice ($F = 3.22, p = 0.076$) showed no significant differences between the experimental group and the control one.
Burns et al.	Mixed methods	Midwives experienced in caring for	Short video simulations in random order	The findings indicated the need to develop interventions to improve the precision of the midwives regarding the

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		women in labor and labor in water	about the loss of blood in a pool for baby delivery in real time, and a tutorial with verbal and visual guidance about how to make precise estimates of blood loss in water.	visual estimation of blood loss in water, and show the potential for an online approach. Most women who give birth and/or give birth in the water do so in environments whose leaders are midwives, with no immediate access to medical support.
Rebecca Donkin et al.	Mixed methods	Students in the first year of a Histology graduation course.	Videos	The students in the "video" group had better grades than those in the "control" group.
Jaime Carriso sa et al.	Pilot test of an online course	143 physicians from many fields.	Videos	68% of participants who evaluated the course found the methodology easy to access, 77% classified the content as moderately complex.
Mel E. Major et al.	Mixed methods	14 students in the last year of an international curriculum, and 5 specialists in the didactic and clinical fields.	Videos	The module allowed participants to anticipate clinical situation and tasks, but one cannot reach only advanced clinical reasoning, handling of lines and wires, and the ability to deal with situations outside of the didactic environment.
Yu-Ting Hsiao et al.	Case control study	96 medicine students.	E-books with interactive multimedia.	OSCE use to evaluate for competences. The group who used the e-book showed higher OSCE means than the group that only went through conventional teaching.

Source: The authors, 2022.

4. Discussion

Research carried out in a school of Medical Emergencies and Nursing in Iran aimed to evaluate the effects of the podcast in the training of pre-hospital care in situations of disaster, comparing it with the traditional exposition teaching method (PowerPoint slides). They counted on the participation of 60 (sixty) students who were randomly distributed in two groups: control and intervention. With a confidence level of 95%, there was a significant difference between the groups regarding the memorization and performance due to the use of the podcast, showing its efficiency for learning, memory, and in the performance of applying the theoretical knowledge in practice(Aghababaeian et al., 2019).

Another study, carried out in a medicine school in Germany, aimed to compare the learning results and the satisfaction of students who used podcasts with the results and satisfaction of students reading books on subjects related with orthopedics. The results of this study showed that the students who used the podcasts gained significantly more knowledge than those who read textbooks. Regarding the topic "user satisfaction", the podcast received significantly more positive votes than the texts in regard to the ease to understand the content, efficient transmission of knowledge, informative content, and preparation for the final test or fun while learning with the tool and design(Back et al., 2017).

According to research carried out in the Oxford University hospital, in the United Kingdom, which aimed to test the efficacy of an online learning tool that used videos to improve the precision of midwives in their estimates of blood loss in pools where births were performed, the online learning tool improved the ability of the midwives to estimate the blood loss. Although their precision decreased in the following six weeks, it remained better than in the pre-test. Furthermore, the methodology was well-accepted and efficient for teaching(Burns et al., 2019).

In a medicine university in Australia, a study was carried out using audiovisual media resources to investigate whether video resources in an online course would improve performance, perception, and promote interactive and involving experiences for histology students. Results suggested that students were engaged and motivated as they were taught in a combined learning format. They showed a positive response to the use of video recordings with the feedback of specialists for the initial learning of practices and techniques. For the student, the process of mixed learning, including commented virtual microscopy, video demonstrations, and online interactive activities, is an effective and low-cost approach for teaching and learning(Donkin et al., 2019).

A study carried out in Colombia aimed to improve the handling of diagnoses and therapies of epilepsy patients by forming physicians in the primary health care in a regional, virtual, and low-cost course, using the Moodle platform. The teaching was based on a textbook, videos, and interactive discussions. Results showed that the online course and the educational technologies in it had a good cost-benefit ratio, with good retention and excellent approval rates(Carrizosa et al., 2018). Corroborating this result, the study that address the teaching of the technique and the evaluation of endoscopies in an online course with video resources also showed successfully that a teaching system based on video classes was efficient for health professionals around the world to improve their knowledge and experience in the diagnosis of endoscopic

results(Yao et al., 2016).

Research carried out in the European Physiotherapy school, in Amsterdam, aimed to investigate whether online teaching using videos is a viable method to prepare students for clinical work in complex ICU environments, from the perspective of students and specialists. Results indicated that the online teaching module allowed students to deal with clinical situations in the ICU. However, high-level clinical abilities and situations that were not in the textbook could not be taught only through videos, meaning that these could be effective as long as they are integrated or intimately tied to the clinical internship of the students(Major et al., 2020). In the same context, a study carried out in Italy showed that students must talk with a professor or tutor as a form of aiding in video classes, especially when they discuss a new subject (Barisone et al., 2019).

On the other hand, two studies aimed at providing an online course with video resources, mentioned issues that could present difficulties for students during the course, which can be affected by several factors, including informatics knowledge, whether the students understand the syllabus, the network environment, degree of participation, learning attitude, motivation, familiarity with the system used for the teaching method, characteristics, and self-efficacy of the network, in addition to computer access and technical issues that can influence the adoption of virtual modalities by the students(Chao et al., 2017; Tubelo et al., 2015).

Two studies in this review produced courses whose modules were based on interactive animations. One of them presented a plot about some of the clinical issues nurses find in clinical practice, while the other was about the clinical management of shock in emergencies. The results of both studies showed that their students were motivated to finish the task at hand, and that they also used other educational resource, including games, to reinforce self-learning(Park et al., 2020; Riaño et al., 2018). Using interactive resources, another study showed that integrating a module to complement traditional training methods, such as interactive multi-media e-books, is a promising approach to improve learning and student ability in the improvement of clinical competences, to promote safety and reliability in health care(Hsiao et al., 2020).

5. Final Considerations

Distance education is constantly growing since its emergence in teaching around the world, both in mixed courses and in those that are entirely carried out at a distance. Considering the acceptance of the population, there have been many discussions regarding the need for learning tools, here called learning objects, to be used as facilitators of learning and motivators of the teaching learning process.

These objects include video classes, podcasts, e-books, and interactive games. They were found to be more interesting and attractive for this process and were broadly described in the articles found. As a result, digital technologies planted their roots on the educational field and on the daily life of people, in their professional formation. This formation is positive for health professionals, especially in the fields of medicine, nursing, and dentistry, so they can be trained and formed as professionals.

The different learning objects were identified in this study in an interactive and positive way, in the process of teaching-learning. They tend to evolve faster thanks to the intense massification of Internet

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that resulted from the COVID-19 pandemic. Therefore, we expect this virtual educational benefit to become consolidated, so new strategies and tools become available in teaching strategies.

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