Lecture Notes in Networks and Systems 859

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Perspectives and Trends in Education and Technology

Selected Papers from ICITED24, Volume 2

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ISSN 2367-3370 ISSN 2367-3389 (electronic)
Lecture Notes in Networks and Systems
ISBN 978-3-031-78154-4 ISBN 978-3-031-78155-1 (eBook)
https://doi.org/10.1007/978-3-031-78155-1

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

This book—Perspectives and Trends in Education and Technology Volume 2: Selected Papers from ICITED24—from the LNNS Series is composed of the best selected papers accepted for presentation and discussion at the 2024 International Conference in Information Technology & Education (ICITED'24). The ICITED is a multidisciplinary conference with a special focus on new Technologies and Systems in the Education sector and was held between July 11 and 13, 2024. The ICITED'24 was supported by the Pernambuco University, Recife, Brazil, and by IADITI—International Association for Digital Transformation and Technological Innovation.

The International Conference in Information Technology & Education is an international forum for researchers and professionals in the education sector, which enables the discussion of the latest innovations, trends and concerns in several areas, in the education sector, associated with information technologies and systems. It is an event for professionals in the sector, in search of technology solutions, where academics, IT experts and business managers meet to discuss new ideas that help them maximize the potential of learning processes through technology.

The ICITED'24 Scientific Committee is composed of a multidisciplinary group of 143 experts who assessed some 262 papers from 26 countries, received for each of the main topics proposed for the conference: (a) ICT and Virtual learning; (b) Pedagogical & Didactical Innovations; (c) Technologies issues in Education in the different scientific areas; (d) Quality in Education; (e) Technological Issues in Education and Research; (f) Educational Software and Serious Games; (g) Curriculum Design and Innovation and (h) University-Industry Collaboration; ICITED SUMMIT'24—Accelerator Program for EdTech Startups; SPECIAL SESSIONS: DTLP'24—Digital Transformation in the Teaching and Learning Process; EU-AIEdu'24—EXPERIENCES IN THE USE OF ARTIFICIAL INTELLIGENCE IN EDUCATION; E4TLI—EDUCATION FOR TECHNOLOGICAL LITERACY AND INCLUSION; EUROPROJECTS'24—European projects; FoE'24—Future of Education. Difree—Digital Freelancing European Erasmus Plus KA project. SPECIAL TRACKS: Digital Literacy x Media Literacy—New Literacies and Education in Brazil; Cultural Tourism, Education and Marketing—CulTurEM'24; New Technologies in Accounting Education; Internationalization in Higher Education as a challenge; Education and the problems of the contemporary world.

The papers accepted for presentation and discussion at the conference are published by Springer and will be submitted for indexing by ISI, SCOPUS, EI-Compendex, Google Scholar and SpringerLink. We thank all those who contributed to the ICITED'24 conference (authors, committees, workshop organizers and sponsors).

We deeply appreciate your involvement and support, which were crucial to the success of the conference.

July 2024

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Teachers' Perceptions of Knowledge Production in the Age of Artificial Intelligence: A Systematic Literature Review

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Abstract. This article aims to carry out a systematic review of the literature on Artificial Intelligence and knowledge production in educational contexts. Using parameters and guidelines based on the PRISMA Group, a collection of papers was selected from the Web of Science, Scopus and Scielo bibliographic databases with the aim of verifying perceptions of the use of AI solutions in the student learning process, as well as challenges and possibilities. To this end, a bibliographic review and corresponding analysis and reflection on the research results found between 2019 and 2024 were carried out. The results allow us to see that this is an area in rapid development, although there are challenges and considerations linked to ethical commitment, authorship, and originality, including the most comprehensive proposals, even within the scope of this research.

Keywords: Artificial Intelligence · Knowledge production · Ethical commitment · Teacher perception

1 Introduction

Generally speaking, Artificial Intelligence (AI) consists of using computers to perform tasks that generally require human intelligence, such as thinking, learning, planning and reasoning. According to Lee [1], in the mid-1950s this mission was set by the pioneers of AI: to recreate human intelligence in a machine. Initially thought to be a very ambitious but well-defined goal, it has now spawned a series of developments. AI can be used to develop computer systems that mimic the human brain's ability to process information, make decisions and solve problems. Artificial Intelligence algorithms are programmed to work with large amounts of data and recognise complex patterns, thus enabling computers to make intelligent decisions and carry out precise actions.

AI is considered a branch of Computer Science. However, it is a branch that crosses several areas of knowledge due to its breadth. Therefore, as you can see in the Fig. 1, AI can be related to various other areas such as philosophy, psychology, maths, linguistics and many others.

A. Abreu et al. (Eds.): ICITED 2024, LNNS 859, pp. 196–205, 2025.
https://doi.org/10.1007/978-3-031-78155-1_18

According to Russell and Norvig [2], AI can be categorised in four ways: (i) systems that act like human beings, (ii) systems that think like human beings, (iii) systems that think rationally and (iv) systems that act rationally. Systems that act like humans are those that exhibit human-like behaviour in such a way that they have the capacity for natural language processing, knowledge representation, automated argumentation, and machine learning, so as to enable the system to adapt to new circumstances and be able to exceed current knowledge.

According to the same authors, solutions that think like human beings are those that have been developed as systems that try to simulate the way human beings think. Systems that think rationally are those based on indisputable argumentation procedures. Systems that act rationally make use of agents, i.e. programmes with independent control that can understand the environment and adapting to changes [2].

According to Haenlein and Kaplan [3], for a system to be considered intelligent, it must be able to interpret a large amount of external data independently, as well as adapt flexibly to achieve specific results. From this point of view and reflecting on their applicability in the field of education and knowledge production, intelligent systems need to go through a few discovery paths to be fully utilised and re-signified, as we propose in this article.

AI has gone through several stages during its evolution. Researchers date the start of the discussion back to the 1940s, to a fictional story called Runaround written by Isaac Asimov. In this work, the author mentions the three laws of robotics for the first time [3]. The first states that a robot cannot harm a human being or allow a human being to suffer any harm. The second law states that robots must obey orders from human beings if they do not violate the first law. Finally, the third law is that the robot must protect its own existence as long as it doesn't conflict with the other two laws.

However, other authors such as Couceiro et al. [3] present another point of view which assumes that the beginning of studies was in 1943, when Warren McCulloch and Walter Pitts developed the first neural network model and the first idea of an artificial neurone in the article "A logical calculus of the ideas immanent in nervous activity". In any case, what is most widely recognised among researchers in the field is the publication "Computing Machinery and Intelligence" (1950) by Alan Turing. Called "The Turing Test" or "The Imitation Game", it was formulated as an experiment to assess whether a human could identify, after questioning, whether the answers were coming from a human or a computer. If it couldn't recognise, the computer would pass the test and could be considered "intelligent" [2].

After this period, there were no major advances in the area, but in 1956, researchers John McCarthy, Hyman Minsky, Claude Shannon and Nathaniel Roches-ter organised a two-month seminar in Darmouth, which was attended by Trenchard More (Princeton), Arthur Samuel (IBM), Allen Newell and Herbet Simon (CMU), Ray Solomonoff and Oliver Selfridge (MIT). The Logic Theorist (LT) reasoning programme was an outstanding publication at the time. The seminar also introduced important figures in history who, according to Russell and Norvig [2], "over the next 20 years, the field would be dominated by these people and their students and colleagues at MIT, CMU, Stanford and IBM".

In 1969, the DENDRAL programme was developed at Stanford University. This solution was able to find organic molecular structures based on the mass spectrometry of the chemical bonds present in an unknown molecule. The system worked automatically to make decisions. AI became an industry in the 1980s. One of the milestones was the creation of R1, the first successful commercial expert system at the Digital Equipament Corporation (DE). Other highlights were the Fifth-Generation project and the Microelectronics and Computer Technology Corporation (MCT), both of which included chip design and human interface research, i.e. AI was part of a broad endeavour [4].

Nowadays, AI has entered a stage where its applications are becoming increasingly noticeable and impactful for society. It is driven by visible advances in hardware, such as graphics processing units (GPU) that speed up the training of neural networks as well as high volumes of data for training. A renowned IT research and consulting company called Gartner presented the "Hype Cycle for Artificial Intelligence, 2023" to show the progress and expectations of emerging AI technologies. The company created a graph broken down into five phases, as can be seen in the image below.

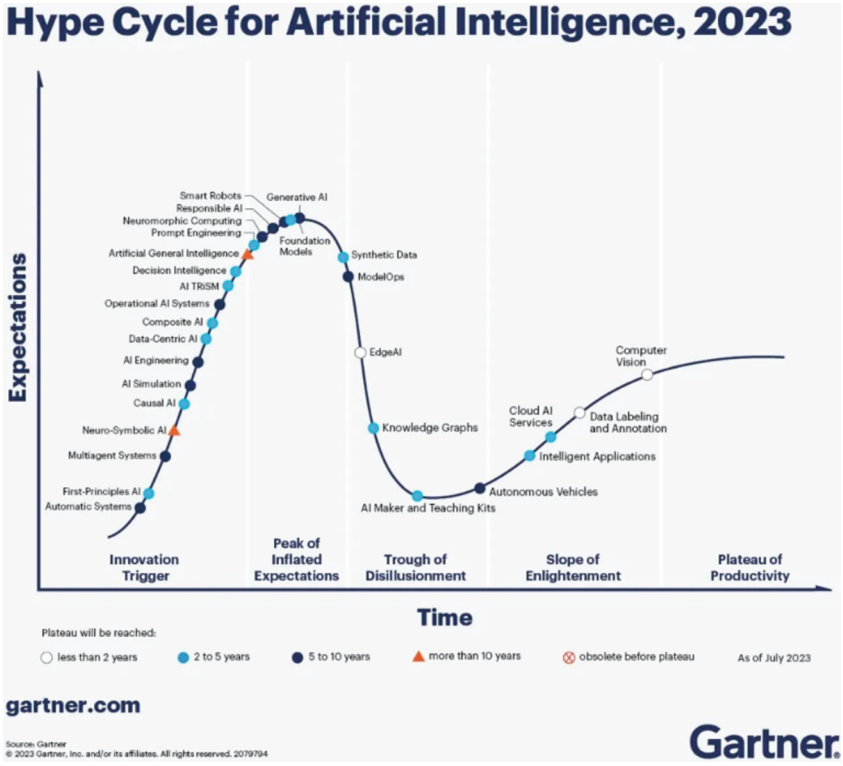

Fig. 1. Ciclo da IA, 2023. Fonte: https://www.gartner.com/en/articles/what-s-new-in-artificial-intelligence-from-the-2023-gartner-hype-cycle. Acesso em 07 Mar 2024.

In this analysis, it is possible to see five phases of evolution. In the first, called the "Innovation Trigger", the first steps to be inspired by the structure of the human brain

appear, although they are still in the early stages of development. The second stage, the "Peak of Inflated Expectations", is where some successful experiences have taken place, which may or may not have spurred companies to continue working in the area. The third stage, known as the "Valley of Disillusionment", also acts as a watershed, because many of the experiments and implementations did not offer the desired results. The fourth phase, the "Information Slope", saw more examples of how AI can benefit countless areas with practical applications. Decision Intelligence, which brings together AI and decision-making, and Operational AI Systems, which integrates AI into daily operations, have gained more momentum and demonstrated their true usefulness. For the time being, we are on the "Plateau of Productivity", where AI is widely adopted, and its value is becoming increasingly praised. It is in this last stage that this research is focussed and aims to understand how, in education, this evolution has been perceived and manifested in various contexts. For this study, the teacher's perspective will serve as a scope and will be further developed in subsequent research.

2 Artificial Intelligence and Education: Paths of Discovery

Current and future technological scenarios are instigating fundamental discussions about our symbiotic revolution in emerging technologies, and AI is not absent from this context. According to Gabriel [5], in addition to the need to understand the current transformations, their impacts and the paths that humanity is following, there is an urgent need to be prepared to adapt skills more quickly in this process of experimenting with the various technological disruptions that we are experiencing.

AI is thus present in everyday life and impacts various areas of life, such as health, security, communication, marketing, education, agriculture, among others. Among the many areas in which AI is involved, the field of education is not far behind. According to UNESCO [6], innovations in AI methods have expanded the potential of technological educational solution tools, even leading to speculation that technology could supplant human interaction in education.

Authors such as Boulay [1] and Veiga and Andrade [7] divide the area of AI and education into three fronts: students, teachers, and schools. Regarding the student, adaptive platforms, detection of gaps and weaknesses, content curation, design of activities for recovery and pedagogical activities with chatbots have gained prominence. Therefore, when thinking about student autonomy, AI has the potential to transform self-directed and personalised learning to provide students with resources that can be adapted to their individual learning needs.

With a view to assisting teaching activities, there has been talk of using it in contexts such as correcting work, assessing oral expression and reading, Virtual Reality, Augmented Reality, Intelligent Tutoring Systems and Deep Learning Systems. In this way, positive results can be achieved as teachers take ownership and see the possibilities of using AI solutions through didactic transposition - including those not necessarily developed for educational purposes. With AI, teachers can develop a more interactive, dynamic and creative teaching and learning environment, including stimulating critical thinking and problem-solving skills.

In order to achieve the necessary goal, the use of technology cannot be seen in an ufanistic way. After all, it must be borne in mind that AI does not replace teacher

mediation in the classroom, regardless of the modality. As already mentioned, solutions that work with personalised adaptive software can help teachers to monitor student progress, identify patterns of errors, give differentiated feedback and automate some activities that are carried out routinely, reducing teaching effort in some tasks. However, despite favourable research results, as in Lemos [8], not all widely used interventions show consistent evidence of positive effects. For example, UNESCO [6] pointed to a meta-analysis of studies on an AI learning and assessment system that was used with more than 25 million students in the United States and found that its performance in improving learning outcomes was no better than traditional classroom teaching. AI therefore has the potential to become an ally for education professionals.

In addition to the advantages for students and teachers, educational institutions can use AI to improve the educational experience and even optimise processes such as data analysis. With the advance of technology and the increased availability of learning management systems and virtual platforms, institutions have a significant amount of educational data at their disposal. Analysing this data - while respecting the necessary ethical and privacy issues - makes it possible to identify patterns, trends, and correlations in order to provide useful information for improving the quality of education. According to Guimarães Junior, Nascimento, Polak, Chagas, Silva, de Paula, Souza and Santana [9], by analysing educational data, it is possible to gain insights into students' academic progress, as well as identify areas for improvement and personalise teaching according to the individual needs of each student.

Therefore, through predictive analysis, the institution can, for example, identify which students are at risk of poor performance and intervene early, offering additional support and resources that are needed to improve their results. In addition, data analysis can help recognise which methodologies applied in a given educational context have proved to be most effective and which strategies can be implemented to promote student retention and engagement, and even help prevent drop-out.

It is clear that there are challenges when adopting AI resources in educational contexts. With these dilemmas in mind, when implementing AI-based educational technologies, schools need to adopt and implement agreed standards and good practices to protect the rights, well-being and online safety of students and teachers, taking into account, for example, screen time and connection time, privacy and the protection of individuals' data to ensure that the data generated in the teaching and learning process is analysed solely from this perspective. Not thinking about the course of digital learning and beyond, but analysing it only as a public good; avoiding surveillance of students and teachers; protecting against commercial advertising in educational environments; and regulating the ethical use of artificial intelligence in education. With all this in mind, a current systematic review has been developed and will be explained below.

3 Methodology

In order to retrieve and understand the scale of the studies carried out in the area in question, the SRL (Systematic Literature Review) methodology was used. According to Maria Galvão and Ivan Ricarte [10], the SLR is a type of research that follows specific protocols and seeks to understand and give a rationale to a consistent corpus of scientific

research in a given context. To this end, the review follows inclusion and exclusion protocols, as well as careful analysis. In addition, tools have been developed to help verify the minimum quality criteria of literature reviews, before, during and after publication. For this research we selected the Preferred Reporting Items for Systematic Reviews and Meta-Analyses, also known as PRISMA [11], which presents a list of items that should be present in a systematic review (PRISMA checklist), as well as explaining the flow of inclusion and exclusion criteria for articles in a systematic review (PRISMA flow diagram).

The systematic review was carried out by consulting the Scopus, Web of Science (WoS) and Scientific Electronic Library Online (SciELO) databases. The databases were selected using the following criteria: they represented Portuguese and Brazilian scientific production and covered research in the field of education and educational technologies. They were also indexed in journals with good impact factors. The searches were based on the results of empirical research, carried out in educational contexts, which described teachers' perceptions of the use of AI for knowledge production, considering aspects related to personal understanding of the advantages, challenges and risks involved in this subject in the aforementioned labour context.

The following terms were used to select and filter the articles: "Artificial Intelligence" and "Knowledge production". The Portuguese terms "Inteligência Artificial" and "Produção do conhecimento" were also used. The search results were limited to articles published in scientific journals between 2019 and 2024, in English and Portuguese. In addition, inclusion and exclusion factors were used as shown in Table 1.

Table 1. Inclusion and exclusion criteria.

Inclusion factors	Exclusion factors
– Articles and full papers published in peer-reviewed scientific journals; – Documents dated between 2019 and 2024; – Documents in Portuguese and English; – Research in the areas of Social Sciences, Information Systems, Social Communication and Education	– Documents containing less than 4 pages

Source Prepared by the authors (2024)

The search was carried out between 21 March and 11 April 2024. Based on the established criteria, the search resulted in 77 results and the following diagram represents the selection of articles according to the selected methodology.

Following the steps listed in Fig. 2, 3 documents were selected according to the respective inclusion and exclusion criteria (Table 2).

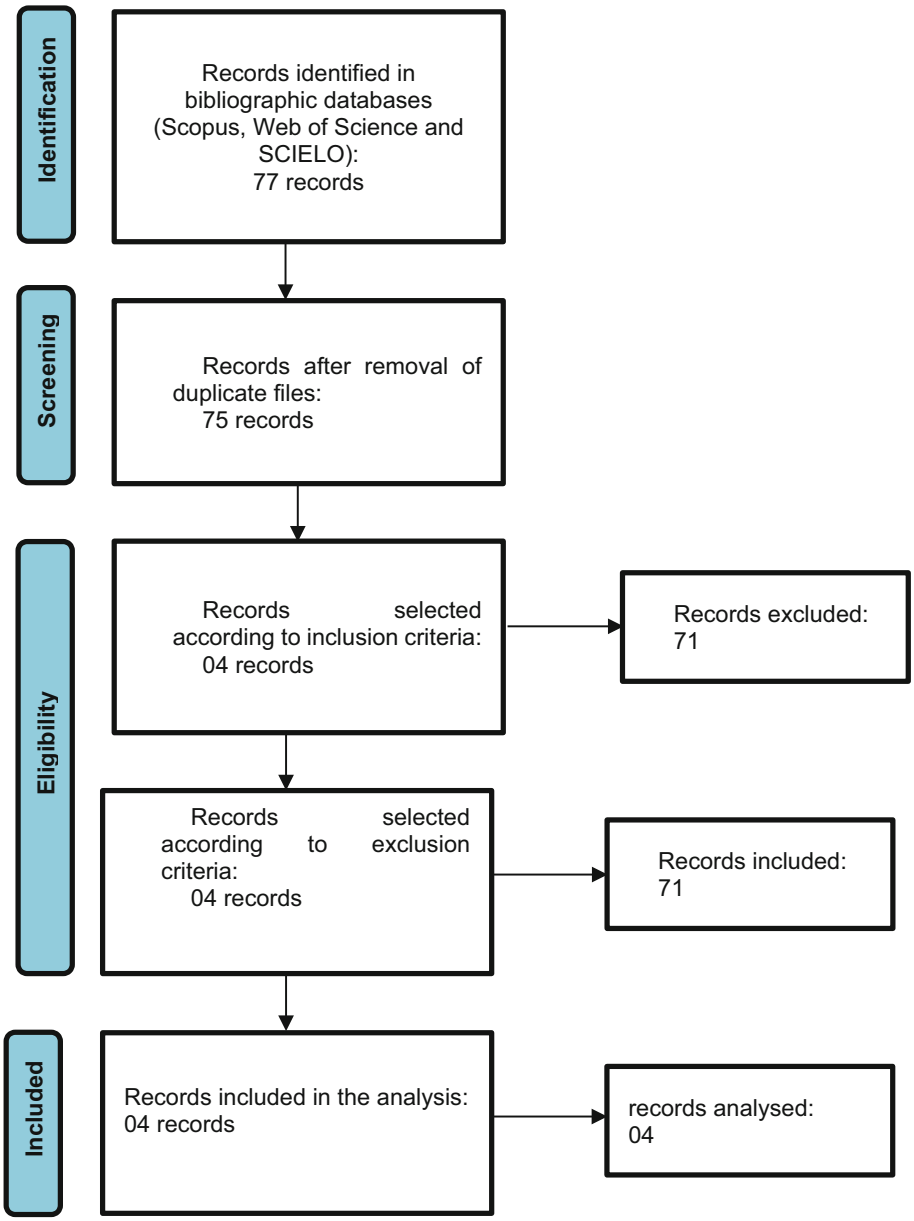

Fig. 2. Systematic Literature Review Process. Source: Adapted from The PRISMA Group [12].

4 Discussion of Results

The systematic literature review allowed us to gather and organise various academic productions on the subject, which leads us to infer that the area of AI has received a great deal of attention from researchers, the media and the public.

Table 2. Articles included in the RSL.

Nº	Authors	Ano	Título do documento
1	Cress, Ulrike; Kimmerle, Joachim [13]	2023	Co-constructing knowledge with generative AI tools: Reflections from a CSCL perspective
2	Candido, J. G.; Loguercio, R. Q. [14]	2023	Educação 4.0: a estética pós-humana na educação em ciências
3	Nemorin, S.; Vlachidis, A.; Ayerakwa, H. M.; Panagiotis, A. [15]	2023	AI hyped? A horizon scan of discourse on artificial intelligence in education (AIED) and development
4	Mejía, M. [16]	2023	Cambio de época y su impacto en la educación

Source: Prepared by the authors (2024)

In an article, Cress and Kimmerle [13] reflected on the extent to which these tools can be used by users for individual learning, as well as for knowledge building, in order to trigger a collective effort to develop new insights. They reinforce that, for future research paths in the area of computer-supported collaborative learning, the co-construction of human-AI knowledge in terms of terminology, theory and methodology can be taken into account.

Candido and Loguercio [14] reflect on the strangeness and effects of Artificial Intelligence on science and, consequently, on education. For them, what is emerging is a biopolitical strategy in which the confluence of sustainability and intelligent technologies produces a post-human aesthetic. As science educators, they explain the urgent responsibility of discerning and participating in the construction of this emerging society, promoting critical analysis in all spaces, beyond technophobia or technolatry, but capable of understanding the effects of this new industrial revolution and acting to produce policies that avoid the marginalisation and even exclusion/elimination of subjects.

Still from this perspective, the studies by Nemorim, Vlachidis, Ayeraka and Andriotis [15] seek to understand how AI, as a socio-technical system, can be implicated in a form of knowledge production that legitimises certain types of epistemologies to the detriment of others. In their analysis, the authors recognise the relationship between power and knowledge in an overview of themes that have emerged in recent years and assess emerging issues in science and technology. Mejía [16] emphasises that it is crucial to start thinking of education as a channel for innovation and transformation, strengthening the link between practice, thought and resistance.

Based on the results, it can be seen that AI solutions associated with teaching and learning processes bring up reflections that cut across the humanities and the exact sciences and, in this context, the teacher's perception of their use from the perspective of building knowledge can become crucial.

5 Conclusions

In view of the discussions based on the research results presented, it can be concluded that Artificial Intelligence and the production of knowledge in educational contexts is an area that can be further studied. There are challenges and considerations linked to ethical commitment, authorship and originality that deserve further investigation and which are being proposed in further research.

It is safe to assume that, with the technological advances that are present in human society on a daily basis, AI solutions are increasingly present in the educational environment; however, in order for them to be used effectively, they need to be critically and attentively re-signified. Effective didactic transposition is needed.

This transposition must consider affective, educational and ethical bases that enable the participants involved to understand their development possibilities without forgetting their responsibilities in relation to themselves, others and society in general in the process of building knowledge. Thus, once used in a fullest way, can be properly explored and implemented in teaching and learning processes.

Finally, we reiterate that we do not gain from the perspective of being negatively concerned about AI solutions in themselves. On the contrary, we must not lose the perception of the use of technology as a social product, and not as something autonomous just about itself or as an ideology. In this way, we can also allow us to think of it as an instrument that can enable the training of people in the most diverse areas. It is, therefore, about placing Digital Information and Communication Technologies (DIT) at the service of the subject's integral formation.

Acknowledgement. This work has been supported by FCT – Fundação para a Ciência e Tecnologia within the Research Center in Basic Education with reference UIDB/05777/2020 (https://doi.org/https://doi.org/10.54499/UIDB/05777/2020).

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