

Teacher professional development for a future with generative artificial intelligence – an integrative literature review

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ABSTRACT

Artificial Intelligence (AI) has been part of every citizen's life for several years. Still, the emergence of generative AI (GenAI), accessible to all, has raised discussions about the ethical issues they raise, particularly in education. GenAI tools generate content according to user requests, but are students using these tools ethically and safely? Can teachers guide students in this use and use these tools in their teaching activities? This paper argues that teacher professional development (TPD) is an essential key trigger in adopting these emerging technologies. The paper will present an integrative literature review that discusses the components of TPD that may empower teachers to guide their students towards the ethical and safe use of GenAI. According to the literature review, one key component of TPD should be AI literacy, which involves understanding AI, its capabilities and limitations, and its potential benefits and drawbacks in education. Another essential component is hands-on activities that engage teachers, their peers, and students in actively using these tools during the training process. The paper will discuss the advantages of working with GenAI tools and designing lesson plans to implement them critically in the classroom.

KEYWORDS: Generative Artificial Intelligence, Ethics, Teacher, Professional development, Integrative literature review

1 INTRODUCTION

The term AI was coined in 1956, and since then, there has been an attempt to understand how a machine can simulate human behaviour, namely its intelligence (Oliveira, 2017). Recently, a field of AI has emerged, generative AI (GenAI), which, unlike intelligent systems that are programmed to receive data and return decisions or descriptions, produces new content in the form of image, text, sound or other formats (Muller et al., 2022). In the specific case of Generative Pre-trained Transformers (GPT), these are large language models (LLM) that are based on multi-layered artificial neural networks and are trained (using machine learning algorithms) through large amounts of data to generate text similar to that of any human being (Alberts et al., 2023). Models like the one used by ChatGPT are tools with GenAI that compose poems, write papers, solve code problems, and generate algorithms, interacting with human beings through written conversation. While AI-powered tools are not new, the quality of the results produced by ChatGPT surprised the average user, which led to it reaching around 1 million subscribers within a week (Baidoo-Anu & Ansah, 2023). It would not be unreasonable to claim that students and teachers will be among the millions of current subscribers to tools such as ChatGPT. However, how are students using these tools? Do they use them to develop and deepen their learning? Or do they uncritically use the results and claim to be the authors of the content produced?

About a year before the public launch of ChatGPT, the United Nations Educational, Scientific and Cultural Organization (UNESCO) had already adopted a set of recommendations covering its areas of intervention – education, science, culture, communication and information (UNESCO, 2021). However, the impact of ChatGPT on society was so significant that UNESCO

reinforced, on March 30, 2023, an appeal for all countries to implement these recommendations (UNESCO, 2023). Concerning education systems, and in line with global concerns, UNESCO (2021) suggests the need to implement innovative pedagogical practices, which include ethical reflections on the use of AI tools, the stimulation of critical thinking, the implementation of design practices, thus developing new digital skills that allow their safe use. The following recommendations stand out:

- The development of AI literacy;
- The promotion of critical and creative thinking skills, teamwork, communication and the development of socio-emotional and ethical skills within the scope of AI;
- Training for students and teachers on AI, both in the technical aspect and in the humanistic, ethical, and social aspects, paying attention to the relational, social, and traditional forms of education that underpin the teacher-student relationship.

At a time when AI advancements are taking a turn that is predicted to be unstoppable and disruptive (Kasneci et al., 2023; Tlili et al., 2023), it is important to reflect on the future of education and how to guide students to make ethical and safe use of tools with GenAI. Thus, teachers are encouraged to make the best use of their potential for the sake of not only their students' learning but also their personal and professional development.

In this context, teacher professional development (TPD) emerges as a path that can give teachers the confidence to integrate tools with GenAI into their teaching practices. This leads us to formulate the following research question for the literature review presented in this article: What components should be incorporated into the design of a TPD continuous training action

regarding the ethical integration of GenAI in their teaching practices?

2 METHODOLOGY

An integrative literature review was carried out to identify a TPD's components aimed at incorporating tools with GenAI ethically and safely in teaching practices. This method is considered appropriate since it will allow critical analysis and synthesis of empirical and theoretical studies on a subject that has only recently reached the sphere of research (Torraco, 2005; Whittemore & Knafl, 2005).

Following the method suggested by Whittemore & Knafl (2005), we started the study by identifying the problem. Tools with GenAI are accessible to any user. However, they raise ethical issues teachers must handle in the classroom. To guide their students towards an ethical and safe use of these tools, in-service teachers need to know them and, if they wish, incorporate them into their teaching practices.

The SCOPUS and Web Of Science (WoS) databases were chosen to identify the relevant literature in this area, as they cover many academic journals and journals in fields encompassing technology and social sciences. In the selection phase of the articles, the following keywords were used, connected with the boolean operator AND, teach*, tool*, educat*, (train* OR development OR literacy), ("artificial intelligence" OR ai OR generative OR "generative pre trained transformer" OR "generative pre-trained transformer" e ethic*), limited by the time frame from 2017 to 2024. In the SCOPUS database, we searched for Article title, Abstract, Keyword and in WoS, in All Fields. Article collection took place from 1 September 2023 to 31 December 2023 and returned 128 articles, 26 of which were deleted for being duplicates.

In the next phase, 102 articles were analysed, of which 62 were excluded because they were written in languages other than Spanish, English or Portuguese or involved payment to be accessed. After reading the abstract, articles addressing GenAI from the perspective of teaching content from computer science disciplines or exploring software with GenAI were also excluded.

After reading and analysing the texts of the remaining 40 articles, 33 were selected for analysis. Of these studies, 19 were carried out in the context of higher education, 11 in non-higher education, and three did not specify the level of education. From this reading, the information was organised to identify what is referred about TPD and the components that this development may include. A mapping of the ethical problems identified in the literature was made, which justified the need for TPD.

3 RESULTS

The controversy surrounding GenAI models in education is primarily related to the authorship of the content generated and its possible uncritical use by students. Several studies point, for example, to the attention that should be given to plagiarism situations (Al-Zahrani, 2023; Chen & Lin, 2023; Cotton et al., 2023; Dakakni & Safa, 2023; Farrelly & Baker, 2023; Gutiérrez-Cirlos et al., 2023; Hasanein & Sobaih, 2023; Ka Yuk Chan & Hu, 2023; Mohammadkarimi, 2023; Muñoz-Basols, Craig, et al., 2023; Oddone et al., 2023; Shimizu et al., 2023; Spivakovsky et al., 2023; Zou & Huang, 2023). However, at the time this text is being written, there are no known tools that allow distinguishing, with a high degree of certainty, AI-generated texts from those written by humans, which leads to questions about the authenticity of the work

carried out and the scientific integrity of its authors (Alarcon-Llontop et al., 2023; Al-Zahrani, 2023; Cotton et al., 2023; Farrelly & Baker, 2023; Gutiérrez-Cirlos et al., 2023; Hasanein & Sobaih, 2023; Hassabis et al., 2017; Ka Yuk Chan & Hu, 2023; Shimizu et al., 2023; Spivakovsky et al., 2023).

The study of Dakakni & Safa (2023) concludes that 85% of the students surveyed (in higher education) use tools with GenAI in an unethical way to carry out their work. They also conclude that teachers need to know how to integrate tools with AI and thus guide their students. In the same educational context, Cotton et al. (2023) reflect on the ethical problems of these tools and conclude on the need for training to deal with these problems, and Mohammadkarimi (2023) states that the data collected from higher education teachers points to the need to have skills to discourage failures of ethical conduct in students. In the same vein, the study of Alarcon-Llontop et al. (2023) concludes that teachers refer to ethical problems as an aspect of which they should be more aware and, therefore, point to the need for developing competencies not only in the technological component but also in the ethical component. These concerns, however, are not exclusive to higher education, as in the context of non-higher education, Bendeche et al. (2021) consider that training in this field should be mandatory for all in-service teachers. Ali et al. (2023) are more specific and believe that teachers should teach their students how computers collect information, how they make representations of reality and train this data, how they interact naturally with human beings, and the ethical implications that this interaction raises. However, their teachers must also have this knowledge for students to learn.

Both Celik (2022), in the context of non-higher education, and Russell et al. (2023), in higher education, state in their studies that teachers should be able to understand, justify and evaluate the results returned by AI tools. Farrelly & Baker (2023) point to the need for TPD because teachers need to know about AI and how it works. Teachers should know how to guide students in the responsible and ethical use of AI and to understand its positive and negative aspects (Hasanein & Sobaih, 2023). TPD is seen as a way to empower teachers to guide students in the ethical and safe use of AI tools, including GenAI, thus ensuring an environment conducive to the development of student learning.

However, knowledge about GenAI tools and awareness of the ethical challenges that arise when using them are not pointed out as the only aspects to consider in TPD actions. The usefulness and pedagogical intent, as well as the knowledge about the possible strategies or methodologies for their integration, are also aspects to be considered since the emergence of innovative technologies may imply a change of pedagogical practices in the classroom (Jeon & Lee, 2023). The same is referred by Spivakovsky et al. (2023), who, in their study, mention that the academic community referred to the need for TPD in AI, encompassing literacy and ethics, as well as the need to understand the pedagogical advantages that these tools can bring to the educational context.

Starting from the framework of technological, pedagogical, and content knowledge (TPACK) of Mishra & Koehler (2006), Celik (2022) looks at the knowledge that teachers should have to integrate AI tools in an ethical way and with pedagogical value in their teaching practices. To the TPACK framework, Celik (2022) adds the ethical component underlying the use of these tools and concludes that teachers should understand what AI is, how it works, what pedagogical advantages they can derive from these tools and what ethical implications arise from integrating AI tools into their teaching practices. They conclude that teachers' knowledge of AI

ethics is essential for adopting these tools. Nazaretsky, Cukurova, et al. (2022) report that for teachers to trust AI tools and integrate them into their teaching practice, they need to understand how AI works and be aware of the ethical issues that these tools raise, which is aligned with the conclusions of Lucas, et al. (2023, p. 65), that states that the digital competence level, indicated by the DigCompEdu framework affects the level of knowledge about AI, and this level plays an important role in the confidence that teachers have to use these tools. However, a good starting point for planning educational interventions is understanding how students use the tools. Ka Yuk Chan & Hu (2023) highlight the importance of more research to integrate GenAI into teaching. Understanding how students use it and their concerns can help teachers identify student flaws, intervene to improve their AI literacy, and integrate these tools into their teaching and learning processes.

4 DISCUSSION

In the specific case of Portugal, the regulation on inclusive education advocates in its preamble that "it is up to each school to define the process in which it identifies the barriers to learning that the student faces, focusing on the diversity of strategies to overcome them, to ensure that each student has access to the curriculum and learning, pushing each and everyone to the limit of their potential" (DR, 2018). In this sense, it will be up to the school, through its teachers, to guide its students towards an ethical and safe use of tools with GenAI, but teachers must improve their competencies to do so. In Portugal, teachers self-assessed their digital competence using the DigCompEdu framework, leading to the conclusion that the level of digital skills of teachers in non-tertiary education is low, which directly affects the level of AI literacy and leads to a lack of confidence among teachers to adopt these tools (Lucas, 2023, p. 65).

TPD is understood in Portugal as "a structural element in improving the quality, effectiveness and efficiency of the education system" (DGE, n.d.) to improve the education system and students' educational results, with a view to the continuous improvement of teachers throughout their lives. In the view of Guskey (2002), TPD is decisive in changing teaching practices, attitudes and beliefs, and students' learning outcomes. The same author mentions that changes in teaching practices, which improve students' learning, are a gradual and challenging process for teachers. The risks of failure are high, so regular feedback on student learning is vital, but it should be monitored and supported during TPD. This follow-up should be carried out over time since, according to Garet et al. (2001), long-term TPD has more impact on teachers than short-term actions, as it allows teachers to develop deeper discussions on the topics to be addressed and on the pedagogical strategies that can be adopted. On the other hand, the same author mentions that it allows teachers to carry out different pedagogical practices in the classroom and obtain feedback from their peers through the interactions and reflections that should occur during the TPD sessions.

The need to implement TPD on AI is a constant in all the studies analysed. Still, although no study directly informs about the components of it, we can conclude that more than simply addressing technology is needed. It is necessary to understand what teachers need to know to integrate technology into teaching processes (Mishra & Koehler, 2006). For teachers to work with emerging digital technologies, they have to acquire new knowledge and skills and be willing to adopt these technologies (Trust et al.,

2016). Trust et al. (2016) conclude in their study, which involved 1417 teachers, that personal learning networks not only helped them to respond to specific pedagogical needs but also to their emotional needs, leading them to adopt new pedagogical strategies.

We have to be aware that it is highly likely that a high number of students use tools with GenAI, as they are accessible and free for conversational use. Even if they do not use them, it will be good to prepare them for a future in which these tools will be part of our daily lives. Thus, it will be essential to increase teachers' confidence in adopting these tools in their teaching practices and, through this use, guide students. In the Nazaretsky, Ariely, et al. (2022) study, teacher trust is a determining factor for adopting these tools. The authors conclude that the fact that teachers acquired more knowledge about AI, knew how AI makes decisions, applied this knowledge and used the tools in the classroom, becoming aware of their limitations and capabilities, increased the confidence and willingness of teachers to use these tools. In the study of Nazaretsky, Cukurova, et al. (2022), it is mentioned that the factors that influence the adoption of AI tools by teachers are not only related to the possession of knowledge about how they work but also to knowing how they can use them in an educational context, what are the benefits they bring to their teaching practices and what educational strategies can be adopted with these tools.

Thus, the literature suggests that at the beginning of the TPD sessions, teachers should understand the stage at which their students are using tools with GenAI, it will be necessary to ask students, openly, sincerely and free from prejudice and limitations, whether or not they are using them, and if so, how they are using them, as suggested by Ka Yuk Chan & Hu (2023). However, to do so, teachers must have some AI literacy.

Long & Magerko (2020) define AI literacy as "a set of competencies that enables individuals to critically evaluate AI technologies; communicate and collaborate effectively with AI; and use AI as a tool online, at home, and in the workplace". Farrelly & Baker (2023) and Shimizu et al. (2023) believe that AI literacy should be incorporated into subject curricula, which meets the results of Al-Zahrani (2023), whereas, in the study carried out with higher education students, they considered essential to have training development and guidance on how to use these tools from their teachers. However, suppose there is no prospect of this incorporation. In that case, the teachers themselves should seek this knowledge and transmit it to the students since students must know not only how to use tools with AI but also know the concepts underlying these tools and develop skills to use them ethically and responsibly (Ng et al., 2021). The latest research recognises the need for learners, as well as their teachers, to know AI literacy (Jeon & Lee, 2023; Mouta et al., 2023; Russell et al., 2023; Shimizu et al., 2023), even if it is not deep knowledge (Spivakovsky et al., 2023), so that everyone has informed access to the tools (Farrelly & Baker, 2023).

A TPD training initiative is proposed, deeply rooted in the literature review findings, highlighting its significance and relevance to the field of education. According to the main aspects that resulted from the competencies listed in the Long & Magerko (2020) framework, teachers must acquire the necessary knowledge to answer questions such as, "What is AI?" and "What can AI do?", "How does AI work?" and "How should it be used?". The proposal gives particular emphasis to the discussion of the ethical issues that the AI tools raise in order to enable teachers to use them ethically and, thus, guide their students. Also, a list of strategies that emerge from

the literature is suggested so that teachers can choose those that can bring pedagogical value to their teaching practices.

4.1 AI basic knowledge

AI literacy will initially involve awareness of what AI is (Alarcon-Llontop et al., 2023; Celik, 2022; Farrelly & Baker, 2023; Russell et al., 2023) and what it can do, acquiring generic AI-related knowledge, such as machine learning or deep learning, among others (Celik, 2022; Farrelly & Baker, 2023; Mouta et al., 2023; Muñoz-Basols, Craig, et al., 2023; Nazaretsky, Ariely, et al., 2022; Oddone et al., 2023; Spivakovsky et al., 2023; Taibi et al., 2023). But, once they have the basic knowledge accessible to any citizen (Spivakovsky et al., 2023), they need to acquire the necessary skills to use AI tools in the educational context, including GenAI (Jeon & Lee, 2023; Oddone et al., 2023; Russell et al., 2023; Spivakovsky et al., 2023).

4.2 AI tools

Knowing and trying AI tools, teachers gain confidence to work with them, so they should try a wide range of tools to know them and feel safer using them in an educational context (Lazarus et al., 2022). This task requires time and the ability to search for the tools that best suit the pedagogical intentionality of each teacher (Nazaretsky, Ariely et al., 2022). At this stage, sharing in the TPD sessions context is essential, as Garet et al. (2001) suggested.

By knowing, reflecting and selecting tools that best suit their pedagogical goals, teachers also need to know the positive and negative aspects that the tools bring to the educational context (Muñoz-Basols, Craig, et al., 2023) and what ethical challenges these tools raise (Alarcon-Llontop et al., 2023; Farrelly & Baker, 2023; Jeon & Lee, 2023; Muñoz-Basols, Craig, et al., 2023; Russell et al., 2023; Spivakovsky et al., 2023).

4.3 Ethical considerations

The ethical challenges that involve these tools have served as a motto for global discussions, which is why we started with UNESCO's recommendations on the Ethics of Artificial Intelligence (UNESCO, 2021) and the guide published by UNESCO that aims to guide education towards an ethical but effective use of tools with GenAI (Miao et al., 2023), to identify the ethical principles that emerge most frequently from the literature when reflecting on teacher education in AI.

Of the articles selected in this literature review, the principle of responsibility and accountability is the most mentioned by the authors. Teachers should understand that GenAI calls into question the authenticity of the texts and the work carried out, as it enhances plagiarism situations (Al-Zahrani, 2023; Chen & Lin, 2023; Cotton et al., 2023; Dakakni & Safa, 2023; Farrelly & Baker, 2023; Gutiérrez-Cirlos et al., 2023; Hasanein & Sobaih, 2023; Ka Yuk Chan & Hu, 2023; Mohammadkarimi, 2023; Muñoz-Basols, Neville, et al., 2023; Oddone et al., 2023; Shimizu et al., 2023; Spivakovsky et al., 2023; Zou & Huang, 2023). On the one hand, they can be a full copy of the generated content. On the other hand, since the results of these models are the result of data with which they have been trained, there may not be the consent of the original data authors for them to be used. Teachers should be aware that if the origin of the information cannot be verified, the use of this content may violate the rights of the authors (Alarcon-Llontop et al., 2023; Durán, 2023; Oddone et al., 2023; Pack & Maloney, 2023). In higher education, some authors suggest that plagiarism should be reviewed and rules defined for using these tools in academic writing (Spivakovsky et al., 2023; Zou & Huang, 2023). These rules may

include the declaration of use, or not, of tools with GenAI as Cotton et al. (2023) suggested. This situation could be a good topic for reflection and discussion among teachers in TPD sessions.

Equity and non-discrimination are the second most cited ethical principles. Given that GenAI-powered models are trained on a massive amount of data collected mainly from the internet, the results they return to users have the potential to perpetuate biases and discriminatory content embedded in that data (Ali et al., 2023; Celik, 2022; Hasanein & Sobaih, 2023; Ka Yuk Chan & Hu, 2023; Pack & Maloney, 2023; Rahimzadeh et al., 2023; Taibi et al., 2023) or in the algorithms of the models (Akgun & Greenhow, 2022; Ali et al., 2023; Chounta et al., 2022; du Boulay, 2023; Lazarus et al., 2022; Oddone et al., 2023; Russell et al., 2023). On the other hand, if the data is not large enough or diverse, the possibility of obtaining discriminatory and biased data increases (Spivakovsky et al., 2023). Thus, if GenAI models are trained on biased data, they can return content that, while appearing to be convincing, may be biased (Al-Zahrani, 2023; Farrelly & Baker, 2023) or incorrect (Oddone et al., 2023; Pack & Maloney, 2023; Shimizu et al., 2023). Thus, the critical look and confirmation of information through reading other sources of information proves to be essential (Oddone et al., 2023). In this context, the principle of do no harm is pointed out in the articles consulted since the content generated can harm or cause damage, even if there is no intention on the part of the companies or users (Ka Yuk Chan & Hu, 2023; Murillo-Ligorred et al., 2023). Equal access to technology is another aspect that must be considered in the educational context, not favouring or disadvantaging any student (Cotton et al., 2023; Mouta et al., 2023).

The right to privacy and data protection is a principle that is discussed in many of the revised articles. AI-powered systems that use deep learning in artificial neural networks are understood as black boxes, as it is challenging to know how these systems handle and use data (Yang et al., 2022). Teachers should be aware that data provided by users voluntarily (through the iterations they make with the systems) or involuntarily (through the data that is collected over the Internet) exposes the user to vulnerabilities that may jeopardise their privacy (Ali et al., 2023; Bendeche et al., 2021; Chounta et al., 2022; Dakakni & Safa, 2023; du Boulay, 2023; Durán, 2023; Ka Yuk Chan & Hu, 2023; Lazarus et al., 2022; Mouta et al., 2023; Nazaretsky, Cukurova, et al., 2022; Oddone et al., 2023; Spivakovsky et al., 2023; Zou & Huang, 2023). This topic is even more worrying when considering the educational context, especially in non-higher education, so teachers and students must be aware of this and develop skills to deal with this issue (Ali et al., 2023; Bendeche et al., 2021; du Boulay, 2023; Mouta et al., 2023; Muñoz-Basols, Neville, et al., 2023). One way they do this is to obtain information about the terms of use and data protection policies of each system before accepting their terms of use (Akgun & Greenhow, 2022; Oddone et al., 2023; Pack & Maloney, 2023).

Bearing in mind that TPD ultimately aims to improve student's learning processes, UNESCO (Miao et al., 2023) believes that the use of tools with GenAI in education can limit students' autonomy and initiative, offering predetermined solutions and restricting learning experiences and, consequently, students' intellectual development. Some of the studies reviewed address this issue (Chen & Lin, 2023; Dakakni & Safa, 2023; Hasanein & Sobaih, 2023; Lazarus et al., 2022; Mouta et al., 2023; Shimizu et al., 2023; Zou & Huang, 2023). Teachers should be aware that tools with GenAI can limit the diversity of ideas and critical thinking, so reinforcing dominant views gleaned from the data on which the

systems have been trained can limit creativity and imagination and create standardised responses, this being a problem that UNESCO (Miao et al., 2023) refers to homogeneous responses vs creativity and diverse results.

Along with intellectual development, some authors identify human interaction as something that GenAI should not reduce, as well as the socio-emotional aspects of teaching and learning processes (Chen & Lin, 2023; Chounta et al., 2022; Dakakni & Safa, 2023; Hasanein & Sobaih, 2023; Ka Yuk Chan & Hu, 2023; Mouta et al., 2023; Shimizu et al., 2023), which is in line with UNESCO guidelines (Miao et al., 2023). Social relationships between students and their teachers are considered essential for their development (Jeon & Lee, 2023; Shchavinsky et al., 2023), and its lack impacts their psychological well-being. On the other hand, interactions with tools or applications with machine learning algorithms can lead to the manipulation of students if they are not alert to the need to maintain a critical spirit when using them (Ali et al., 2023; Taibi et al., 2023).

Pedagogical adequacy is another ethical principle that must be taken into account when we talk about education. As suggested by Adams et al. (2023), as an ethical value, pedagogical adequacy involves teachers' reflection on their responsibility to bring didactic value to their approaches and ensure their well-being and that of their students. The same authors emphasise the need for teachers to select and use AI tools in a way that is useful for improve students' learning, is fair and supports them in their learning processes, reflecting on the necessary balance not to violate the principles previously enunciated. UNESCO also states that the relevance of the use of these tools should come from the motivation of each one to use them, as they should contribute to facilitating the teaching and learning processes, be appropriate to the age group of the students, and the content generated should respond to the pedagogical intentionality defined by the teachers. To do this, developing and applying critical thinking skills is necessary when using these tools (Miao et al., 2023). Some of these aspects are referred to in the literature review by Nazaretsky, Ariely, et al. (2022), Hasanein & Sobaih (2023) and Celik (2022).

4.4 Hands on activities in the classroom

Aware of the ethical problems that GenAI tools raise, when adopted in an educational context, an important part of TPD will be defining strategies for using the tools in the classroom. Table 1 shows a wide range of strategies that are reported in the studies in this literature review. Again, the joint reflections that can be developed during the TPD sessions are vital for teachers to find the most appropriate methodologies or strategies for their context and not violate ethical principles that may diminish students' learning. To do this, they need time not only to interact but also to experiment strategies in the classroom, to reflect and discuss with their peers what went well and not so well so that they can reformulate them and adapt them to their teaching and learning context.

AI tools, can...	References
Work as a personal assistant	Spivakovsky et al. (2023); Shimizu et al. (2023); Shchavinsky et al. (2023); Hasanein & Sobaih (2023); Zou & Huang (2023); Farrelly & Baker (2023); Alarcon-Llontop et al. (2023); Durán (2023); Pack & Maloney (2023); Pack & Maloney (2023); Taibi et al. (2023); Rahimzadeh et al. (2023); Chen & Lin (2023); Akgun & Greenhow (2022); Celik (2022); Ka Yuk Chan & Hu (2023);

AI tools, can...	References
	Chounta et al. (2022); Lazarus et al. (2022); Jeon & Lee (2023).
Enhance the development of critical thinking, since all information must be analyzed and compared with other sources.	Spivakovsky et al. (2023); Shimizu et al. (2023); Shchavinsky et al. (2023); Hasanein & Sobaih (2023); Zou & Huang (2023); Mohammadkarimi (2023); Sharples (2023); Murillo-Ligorred et al. (2023); Oddone et al. (2023); Rahimzadeh et al. (2023); Muñoz-Basols, Craig, et al. (2023); Lazarus et al. (2022); Jeon & Lee (2023); Cotton et al. (2023).
Enhance the development of creativity, as it can give ideas and perspectives different from those of the user.	Murillo-Ligorred et al. (2023).
Increase knowledge	Spivakovsky et al. (2023); Shimizu et al. (2023); Shchavinsky et al. (2023); Dakakni & Safa (2023); Hasanein & Sobaih (2023); Farrelly & Baker (2023); Sharples (2023); Mouta et al. (2023); Alarcon-Llontop et al. (2023); Oddone et al. (2023); (Durán, 2023); (Muñoz-Basols, Craig, et al., 2023); Ka Yuk Chan & Hu (2023); Lazarus et al. (2022); Russell et al. (2023); Jeon & Lee (2023)
Analyze student work and give them feedback	Spivakovsky et al. (2023); Hasanein & Sobaih (2023); Zou & Huang (2023); Farrelly & Baker (2023); Sharples (2023); Durán (2023); Rahimzadeh et al. (2023); Akgun & Greenhow (2022); Celik (2022); Ka Yuk Chan & Hu (2023); Lazarus et al. (2022); Jeon & Lee (2023); Cotton et al. (2023)
Help to get information	Spivakovsky et al. (2023); Shimizu et al. (2023); Shchavinsky et al. (2023); Dakakni & Safa (2023); Hasanein & Sobaih (2023); Zou & Huang (2023); Sharples (2023); (Alarcon-Llontop et al., 2023); (Rahimzadeh et al., 2023); Ka Yuk Chan & Hu (2023); Chounta et al. (2022); Lazarus et al. (2022); Jeon & Lee (2023)
Help organize information	Shchavinsky et al. (2023); Hasanein & Sobaih (2023); Zou & Huang (2023); Sharples (2023); Oddone et al. (2023); Pack & Maloney (2023); Rahimzadeh et al. (2023); Ka Yuk Chan & Hu (2023); Russell et al. (2023); Jeon & Lee (2023)
Analyze and interpret data	Spivakovsky et al. (2023); Shchavinsky et al. (2023); Hasanein & Sobaih (2023); Gutiérrez-Cirlos et al. (2023); Durán (2023); Pack & Maloney (2023); Ka Yuk Chan & Hu (2023); Chounta et al. (2022); Russell et al. (2023);
Help write	Spivakovsky et al. (2023); Shchavinsky et al. (2023); Dakakni & Safa (2023);

AI tools, can...	References
	Hasanein & Sobaih (2023); Gutiérrez-Cirlos et al. (2023); Oddone et al. (2023); Rahimzadeh et al. (2023).
Help learn without pressure as they are available 24/7	Spivakovsky et al. (2023); Hasanein & Sobaih (2023); Zou & Huang (2023); Rahimzadeh et al. (2023); Lazarus et al. (2022); Cotton et al. (2023)
Help summarize	Dakakni & Safa (2023); Zou & Huang (2023); Pack & Maloney (2023); Rahimzadeh et al. (2023); Ka Yuk Chan & Hu (2023); Russell et al. (2023);
Serve as an aid for brainstorming ideas	Shchavinsky et al. (2023); Dakakni & Safa (2023); Zou & Huang (2023); Sharples (2023); Ka Yuk Chan & Hu (2023);
Assist with language teaching or learning, as well as translations	Spivakovsky et al. (2023); Shimizu et al. (2023); Dakakni & Safa (2023); Hasanein & Sobaih (2023); Zou & Huang (2023); Farrelly & Baker (2023);
Help generate code	Spivakovsky et al. (2023); Dakakni & Safa (2023); Hasanein & Sobaih (2023); Pack & Maloney (2023);
Provide personalized teaching through interactions that adapt to the content and characteristics of the students	(Spivakovsky et al., 2023); (Hasanein & Sobaih, 2023); (Chounta et al., 2022); (Cotton et al., 2023)
Serve as an aid in collaborative work among students	Sharples (2023).
Increase student motivation	Spivakovsky et al. (2023); Hasanein & Sobaih (2023); Farrelly & Baker (2023); Muñoz-Basols, Craig, et al. (2023); Ka Yuk Chan & Hu (2023); Jeon & Lee (2023); (Cotton et al., 2023)
Reduce students anxiety	Hasanein & Sobaih (2023); Zou & Huang (2023); Mouta et al. (2023).
Reduce repetitive administrative tasks	(Spivakovsky et al., 2023); (Shchavinsky et al., 2023); Hasanein & Sobaih (2023); (Aларcon-Llontop et al., 2023); (Durán, 2023); (Akgun & Greenhow, 2022); (Chounta et al., 2022); (Lazarus et al., 2022); (Jeon & Lee, 2023)
Assist in the preparation of classes, recommending content, methodologies, strategies, ...	Spivakovsky et al. (2023); Shimizu et al. (2023); Hasanein & Sobaih (2023); Rahimzadeh et al. (2023); Celik (2022); (Ka Yuk Chan & Hu, 2023) Chounta et al. (2022); Jeon & Lee (2023)

Table 1 - Strategies reported in the studies selected for the literature review

5 CONCLUSIONS

We can assume that tools with GenAI are part of our daily lives and are not expected to disappear. Thus, teachers should seek professional development to guide their students and confidently

integrate these tools into their teaching practices. To this end, TPD could include AI literacy, as suggested by Long & Magerko (2020). A component of the TPD will be knowing what AI is and how it works, but another no less important component will be knowing tools with GenAI and understanding what you can and cannot do. In addition to this component, teachers should understand the ethical problems that arise when these tools are used and, through joint reflections with their peers, develop competencies for an ethical and safe use, know the benefits and limitations of the systems and, thus, feel able to guide their students. Another critical component of the TPD will be the development of lesson plans, which integrate tools with GenAI to be implemented in the classroom with students. The TPD sessions will be privileged spaces for reflections and joint discussions between peers so that each one can find the most appropriate strategies and methodologies for each teacher's teaching context. It won't do to ignore that students possibly already use these tools, even if their teachers don't master them, so the best way is to open up with them and bring these tools into the classroom. However, to do so, teachers need to get their hands on work and acquire the knowledge and skills required to guide their students.

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DESENVOLUPAMENT PROFESSIONAL DOCENT PER A UN FUTUR AMB INTEL·LIGÈNCIA ARTIFICIAL GENERATIVA: UNA REVISIÓ BIBLIOGRÀFICA INTEGRADORA

La Intel·ligència Artificial (IA) forma part de la vida de tots els ciutadans des de fa diversos anys. Tot i així, l'aparició de la IA generativa (GenAI), accessible per a tothom, ha suscitat debats sobre les qüestions ètiques que plantegen, especialment en l'educació. Les eines de GenAI generen contingut d'acord amb les sol·licituds dels usuaris, però els estudiants fan servir aquestes eines de manera ètica i segura? Poden els professors orientar els alumnes en aquest ús i utilitzar aquestes eines en les seves activitats docents? En aquest article s'argumenta que el desenvolupament professional docent (DPT) és un desencadenant clau essencial en l'adopció d'aquestes tecnologies emergents. L'article presentarà una revisió integradora de la literatura que analitza els components de la TPD que poden empoderar els docents per guiar els seus estudiants cap a l'ús ètic i segur de la GenAI. D'acord amb la revisió de la literatura, un component clau de la TPD hauria de ser l'alfabetització en IA, que implica comprendre la IA, les seves capacitats, les seves limitacions i els seus possibles beneficis i inconvenients en l'educació. Realitzar activitats pràctiques que involucrin els mestres i els estudiants, també és un component essencial en l'ús actiu d'aquestes eines durant el procés de capacització. El document determinarà els avantatges de treballar amb eines de GenAI i dissenyarà plans/projectes/esquemes de lliçons per implementar-los críticament a l'aula.

PARAULES CLAU: Intel·ligència Artificial Generativa; Ètica; Professorat; Desenvolupament professional; Revisió integradora de la literatura

DESARROLLO PROFESIONAL DOCENTE PARA UN FUTURO CON INTELIGENCIA ARTIFICIAL GENERATIVA: UNA REVISIÓN INTEGRADORA DE LA LITERATURA

La Inteligencia Artificial (IA) forma parte de la vida de todos los ciudadanos desde hace varios años. Aun así, la aparición de la IA generativa (GenAI), accesible para todos, ha suscitado debates sobre las cuestiones éticas que plantean, especialmente en la educación. Las herramientas de GenAI generan contenido de acuerdo con las solicitudes de los usuarios, pero ¿los estudiantes usan estas herramientas de manera ética y segura? ¿Pueden los profesores orientar a los alumnos en este uso y utilizar estas herramientas en sus actividades docentes? En este artículo se argumenta que el desarrollo profesional docente (DPT) es un desencadenante clave esencial en la adopción de estas tecnologías emergentes. El artículo presentará una revisión integradora de la literatura que analiza los componentes de la TPD que pueden empoderar a los docentes para guiar a sus estudiantes hacia el uso ético y seguro de la GenAI. De acuerdo con la revisión de la literatura, un componente clave de la TPD debería ser la alfabetización en IA, que implica comprender la IA, sus capacidades, sus limitaciones y sus posibles beneficios e inconvenientes en la educación. Realizar actividades prácticas que involucren a los maestros y a los estudiantes, también es un componente esencial en el uso activo de estas herramientas durante el proceso de capacitación. El documento determinará las ventajas de trabajar con herramientas de GenAI y diseñará planes/proyectos/esquemas de lecciones para implementarlos críticamente en el aula.

PALABRAS CLAVE: Inteligencia Artificial Generativa; Ètica; Profesorado; Desarrollo profesional; Revisión integradora de la literatura

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