

AI-based Practical Approach to the Development of the Digital Competencies of Educators

D. Galante-Sempere^{*a}, J. B. ^b, Alonso-Hernández^a

^aDepartamento de Ingeniería Electrónica y Automática, Institute for Applied Microelectronics (IUMA); ^bDepartamento de Señales y Comunicaciones, Institute for Technological Development and Communications Innovation (IDeTIC)

Universidad de Las Palmas de Gran Canaria, E-35017 Las Palmas de Gran Canaria, Spain

ABSTRACT

This paper presents a methodology for the application of Artificial Intelligence (AI) in higher education as a virtual assistant to contribute to the development of the Digital Competencies of Educators (DigCompEdu). To achieve this, the contribution's context is provided, including a general description of the various Competencies involved, a review of the most relevant state of the art proposals, and the identification of the Competencies in which the use of AI can contribute. Additionally, a series of practical examples are contextualized to demonstrate the usefulness and potential of AI and modern AI-based tools as virtual assistants for the development and improvement of the Digital Competencies of Educators.

Keywords: Digital Competencies of Educators, Education, Educational Innovation, Artificial Intelligence, ChatGPT-4, Information and Communication Technologies.

1. INTRODUCTION

The Digital Competencies of Educators (DigCompEdu) are outlined in the European Framework as a set of skills and abilities that are essential for educators [1], [2]. It should not be confused with the use of Information and Communication Technologies (ICT), although it builds upon them. Furthermore, it is emphasized that DigCompEdu are not simply digital management skills, but a combination of these skills with education training and pedagogical abilities. It is expected that by the end of 2024, around 80% of educators will have certified digital teaching competencies. Specialized courses that endorse each level and specific certification tests that determine the extent to which each competency is developed are available for this purpose [3], [4]. The aim of this work is to make a contribution to the development of digital teaching competencies in education by providing a practical approach to move from a theoretical background to the classrooms. To achieve this, the use of AI-based tools available to all users for free at the time of this writing is proposed. The adopted approach primarily focuses on the development of specific competencies that can benefit through the use of available AI-based tools, thereby alleviating the workload of educators. It's important to note that, due to their nature, not all competencies can benefit from the use of AI.

The aim is for educators to be able to redistribute the time allocated to many of their daily tasks in order to spend more time interacting with students. In summary, educators can save time on tasks such as content preparation, administration, task assessment, reviewing and correction, or professional development. The rest of the document is organized as follows, a review of the state of the art and an overview of key theoretical concepts for this work are presented in Section 2. In Section 3, the problem to be addressed is contextualized, and a comprehensive discussion of the methodology to apply AI to teaching in order to promote and enhance digital teaching competencies is provided. Finally, the conclusions of the work are presented in Section 4.

2. STATE-OF-THE-ART REVIEW AND BACKGROUND

A pilot study conducted among European teachers indicates a positive attitude towards AI in education and a high motivation to include related content in schools [5]. Furthermore, among the total number of teachers involved, it appears that the level of skills related to digital content and tools is very basic, and when it comes to AI-based content and tools, there are clearly several deficiencies. Therefore, in order to include and integrate AI in education, it is necessary to consider some options. On one hand, establish a network of experts in AI in education, or at least

consolidate a common foundational knowledge for teachers that enables them to have sufficient criteria to use AI appropriately [6]. The most recent work on AI in education (sometimes called AIEd) primarily focuses on proposing methodologies centered on automated adaptive assessments, generating teaching content, reviewing student responses, and personalization and addressing diversity through content adaptation [7]–[12]. It is highlighted that [7] demonstrated that up to 85% of the effort in correcting activities can be reduced using the OpenAI model, resulting in a series of high-quality and precise corrections, and students perceived a high quality of feedback received. On the other hand, AI is also very useful for generating question-answer pairs or obtaining distractor answers, used for tasks such as multiple-choice quizzes or generating teaching content and tasks related to reading comprehension [13]. Similarly, it has also been shown that AI tools can be focused on specific fields and used to develop various activities to improve teaching or create challenges and encourage critical thinking in students. Studies in various fields, such as basic sciences, mathematics, Spanish language and literature, biology, physics, medicine, law, and economics, have addressed this matter. In particular, in the field of mathematics, AI can be used to generate problems with written statements that combine language interpretation with equation identification and problem contextualization [14]–[16]. Likewise, the possibility of directing conversations between students and AI to prompt the generation of educational content dialogues has been studied. The idea is based on following a set of guidelines and sequencing specific questions and answers for the student to develop their own educational process [17]. Of course, one of the conclusions reached is that, while useful, these generated responses are far below the quality that can be obtained from a real dialogue with a teacher. In this regard, numerous studies seek to determine the level of accuracy and errors of a specific tool, such as ChatGPT, in specific domains, such as software validation and testing [18], are subject to evaluation. Naturally, many of these studies are based on complex fields and advanced problems, often beyond the high school level. The conclusions from such studies consistently emphasize the need to thoroughly explore responses and verify results before concluding whether the response is correct or incorrect. It is important to be careful in establishing the context of questions and problems and provide as much additional information as possible to generate the most accurate responses.

3. ROADMAP TO THE DEVELOPMENT OF THE DIGCOMPEDU

Many works delve into the study of AI possibilities, impact, use and applications in education. However, few authors propose practical methodologies to bring this new knowledge to the real environment where the education process happens. Therefore, we propose a practical approach to move from the fact that AI can be included in higher education to the classroom by giving specific outlines and templates to help the teachers assess their DigCompEdu. To introduce this roadmap, we highlight that AI's potential lies in the highly adaptable context it provides. AI can be treated as a scientific calculator, as a simple tool in the teacher's hand, or as an efficient virtual assistant, consultant and virtual trainer to improve the development of the DigCompEdu. To sum up, AI provides a new, efficient way of performing as a teacher to save time while enhancing the quality of aspects such as: inclusive education, communication, task assessment, content adaptation, professional development, content update, learning disabilities assessment and many more. Following the previous discussion, it can be identified that, although there are multiple studies on the use of AI for specific tasks, it is possible to extend the functionality in the following fields:

- **Support for Inclusive Education:** Inclusive education is closely tied to diversity. However, inclusive education is about fostering respect and acceptance of individuals of all kinds, without making distinctions based on ethnicity, gender, sexual orientation, faith, or disabilities, among other factors. It aims to provide a safe school environment where all students can thrive. This means creating a diverse environment with a wide range of students. In other words, educators will encounter individuals from different ethnicities, genders, sexual orientations, religions, or disabilities, among other aspects. As part of their role, educators need to adapt content to this reality, and they can use AI to ease the effort involved. An AI tool can modify or adapt the planning of various content to include all necessary measures for ensuring inclusive education. It can also be used to review content and provide corrections that promote inclusive education. In this line, the interaction demonstrated in Figure 2 is highlighted, showing an example of how ChatGPT-4 can generate a content adaptation instantly to ensure inclusive education in the context of higher education.
- **Adaptation of Content for Diverse Learners:** In close connection to the previous idea, this refers to using AI to modify content and make it accessible to students of all kinds of profiles. This field includes, for example, students with high abilities. AI tools can provide extension exercises and problems, as well as support for self-learning or guided learning, thus lightening the teaching load. Likewise, students with disabilities can benefit from the use of AI tools that can adapt regular content to their specific needs to ensure they can access the same

content as their peers. An example of how AI-based tools can be used to generate a content adaptation for diversity in higher education is presented in Figure 3.

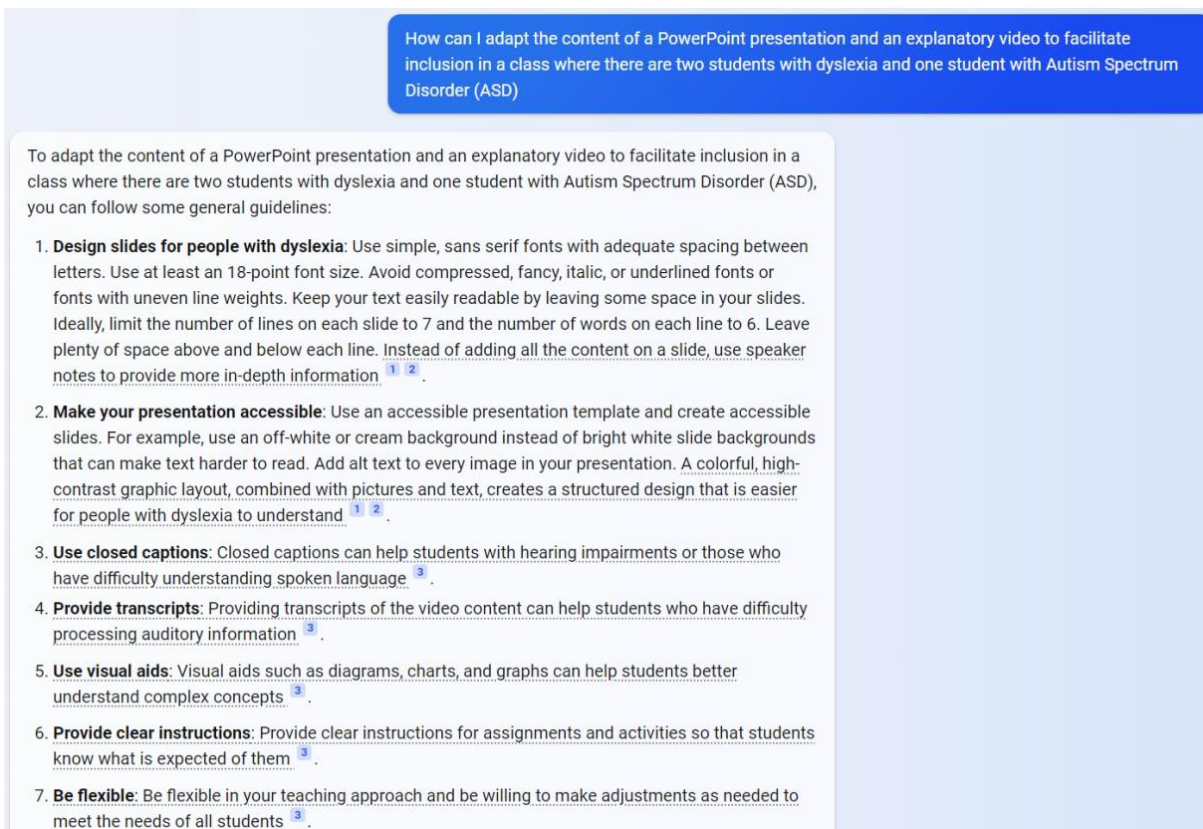


Figure 1. Interaction with ChatGPT-4 to obtain material adaptations catering to inclusive education in higher education.

Template: How can I adapt the content of a PowerPoint presentation and an explanatory video to facilitate inclusion in a class where there are two students with dyslexia and one student with Autism Spectrum Disorder (ASD)?

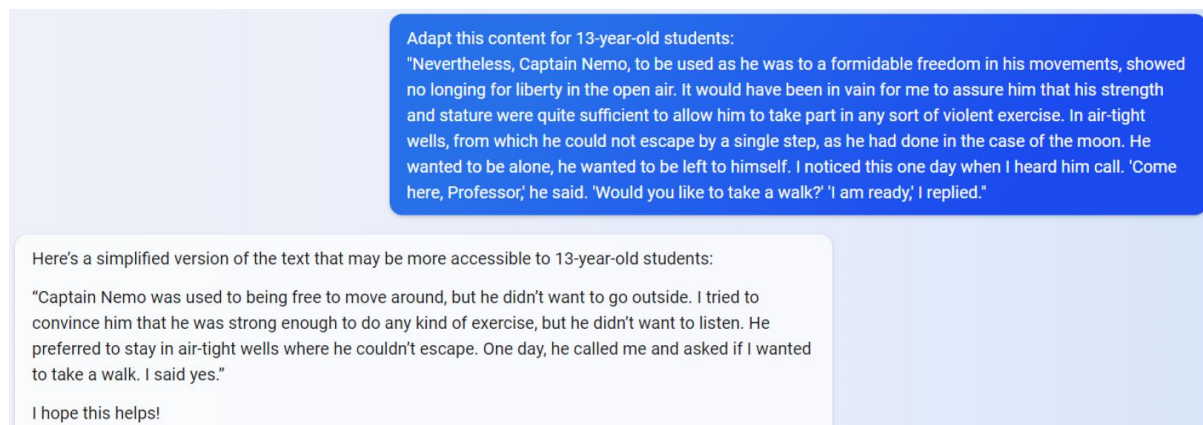


Figure 2. Example with ChatGPT-4 to adapt the contents for diversity in higher education.

Template: Adapt the following content for <student profile> students.

- **Reducing the Digital Divide Among Educators:** Since each educator has different skill levels and varying degrees of knowledge of ICT and digital competencies, AI can be used to support teachers in managing digital tools and all types of computer or electronic tasks. An example is presented in Figure 4, demonstrating how AI-

based tools can be used as virtual assistants to provide the educator with specific steps to perform a certain task involving ICT resources in a user-friendly way.

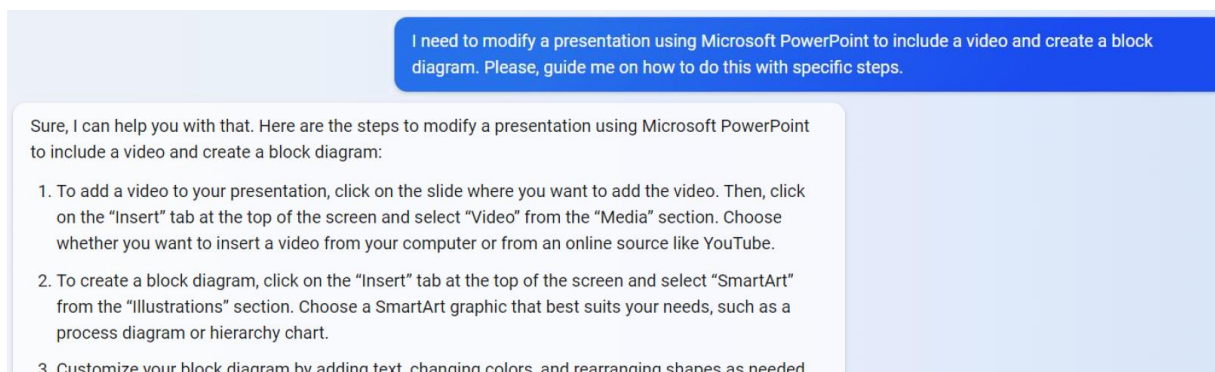


Figure 3. Example of use of ChatGPT-4 to help reduce the digital divide among higher education teachers.

- **Adaptation of Content and Activities for Learning Difficulties:** One of the fundamental utilities of AI-based tools is their ability to identify flaws or difficulties in learning. For example, if ChatGPT is given an essay or a text comment, the same tool can be used to detect weaknesses in the text's structure, argument development, or even issues in the student's writing process. In this way, AI can be employed to identify and address these learning difficulties, both by providing task analysis to the teacher and by offering suggestions and adaptations that will benefit the students in adapting to their needs. In Figure 5, we show how ChatGPT can be used to adapt the contents of a task to attend to learning disabilities in a higher education environment.
- **Improving the Quality of Communication with Families, Students, and Other Educators:** For those facing difficulties in communicating effectively, AI is a powerful tool. It offers the ability to review entire texts, adapt message content to a specific communication style, or reorganize the structure of a message based on particular guidelines. In fact, this aspect of AI has been extensively explored in fields such as legal document drafting (Choi et al., 2023). In Figure 6, the generation of a communication with a family given a specific context and guidelines is demonstrated, proving the usefulness of AI-based communication in enhancing the educator's communicative skills.
- **Facilitating Personalized Attention:** One of the most powerful advantages of AI is its ability to personalize almost anything. For example, you can request ChatGPT to generate a series of first-degree math problems based on the Harry Potter book series, Star Wars, or The Lord of the Rings, and so on. The same can be done with any other field, not just mathematics, and with any other topic (anime series, video games, music, dance styles, fashion, sports, etc.). Likewise, AI enables exercises in a subject to be presented in the form of role-playing games or project-based learning, aligning perfectly with current pedagogical principles. We present how ChatGPT-4 can be used to generate personalized feedback from the result of a specific task in the context of higher education, as shown in Figure 7.
- **Information Retrieval and Content Update:** AI-based tools can act as advanced content search engines. They can be used to obtain very specific information about a particular field or context, or to efficiently refresh content. In fact, it has been demonstrated that AI even offers the possibility of conducting searches or comparisons of the state of the art. This advantage, which is already being utilized by researchers writing scientific articles, can benefit educators in their efforts to verify new information or stay updated on a particular topic. An example is provided in Figure 8 to demonstrate how AI tools can generate highly valuable information regarding information retrieval and content updates in the field of Fluid Mechanics.

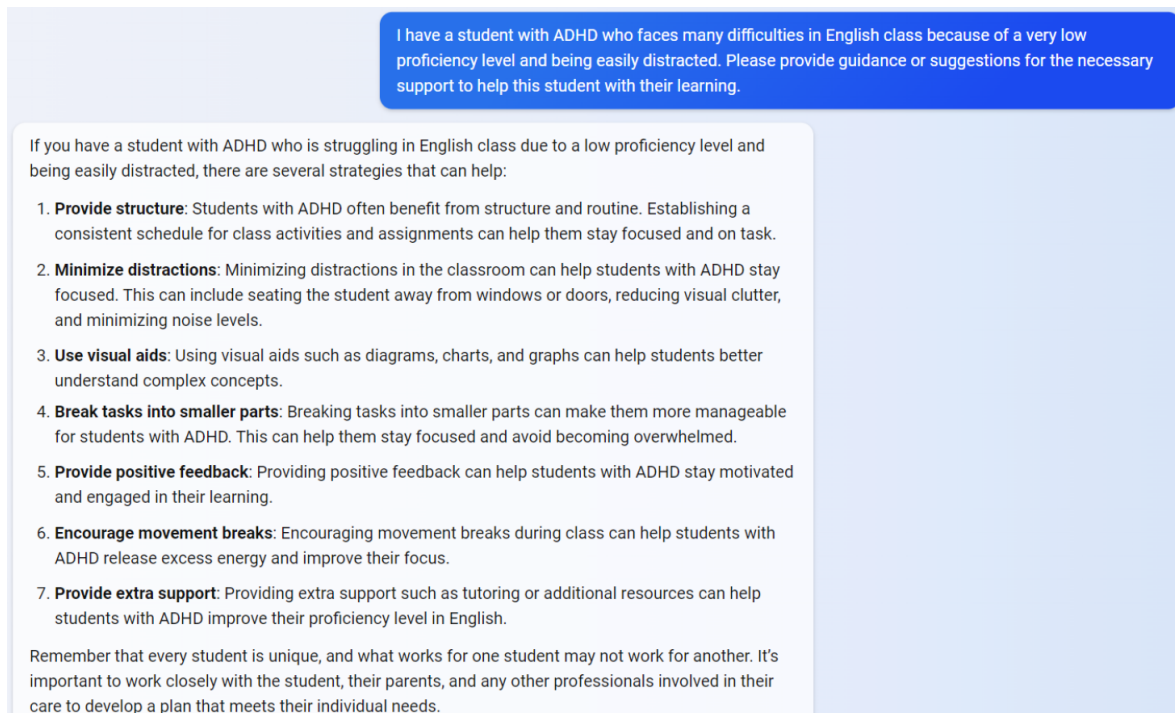


Figure 4. Interaction with ChatGPT-4 focused on the development of materials catering to learning disabilities in higher education.

Template: I have a student with <learning difficulty type> who faces many difficulties in <subject name> class because of <provide context>. Please provide guidance or suggestions for the necessary support to help this student with their learning.

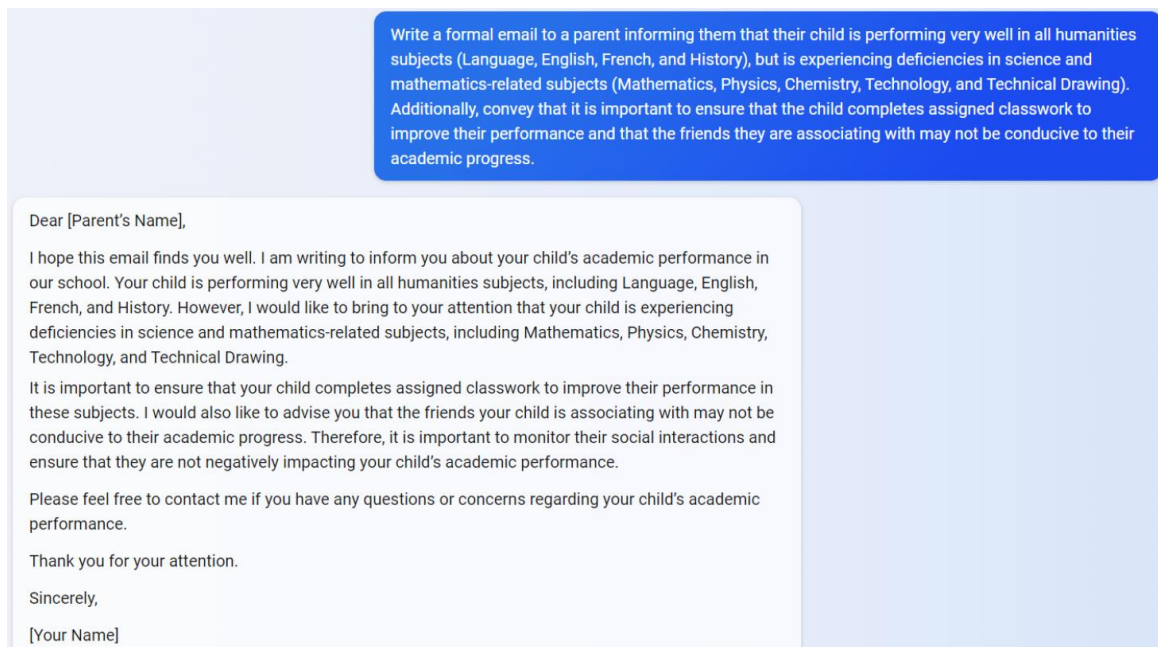


Figure 5. Using ChatGPT-4 to improve communication quality in higher education between the teacher and the families.

Template: Write a <formal/informal/professional/casual/persuasive/technical/academic...> email to a <parent/student/teacher/ association/entity...> informing them that <positive/negative aspects> but is experiencing deficiencies in <negative/positive aspects>. Additionally, convey that <additional details>.

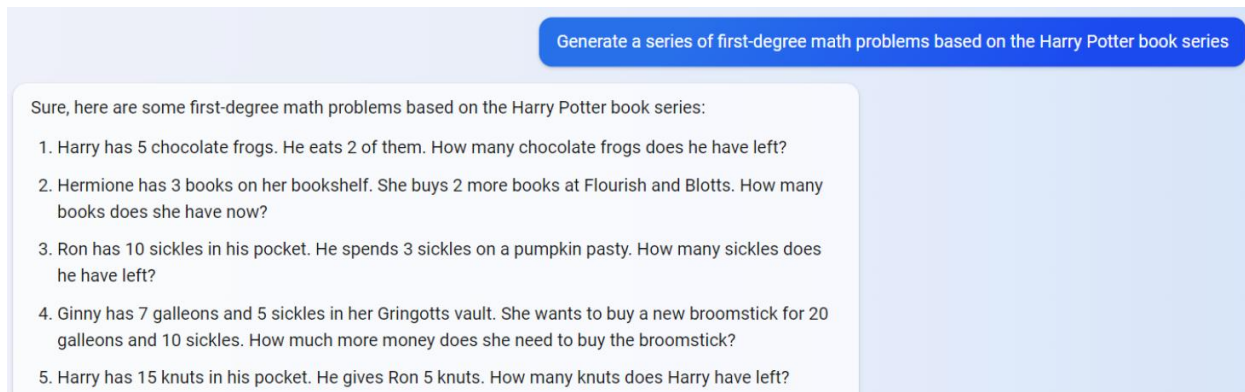


Figure 6. Interaction with ChatGPT-4 to generate personalized feedback in a higher education scenario.

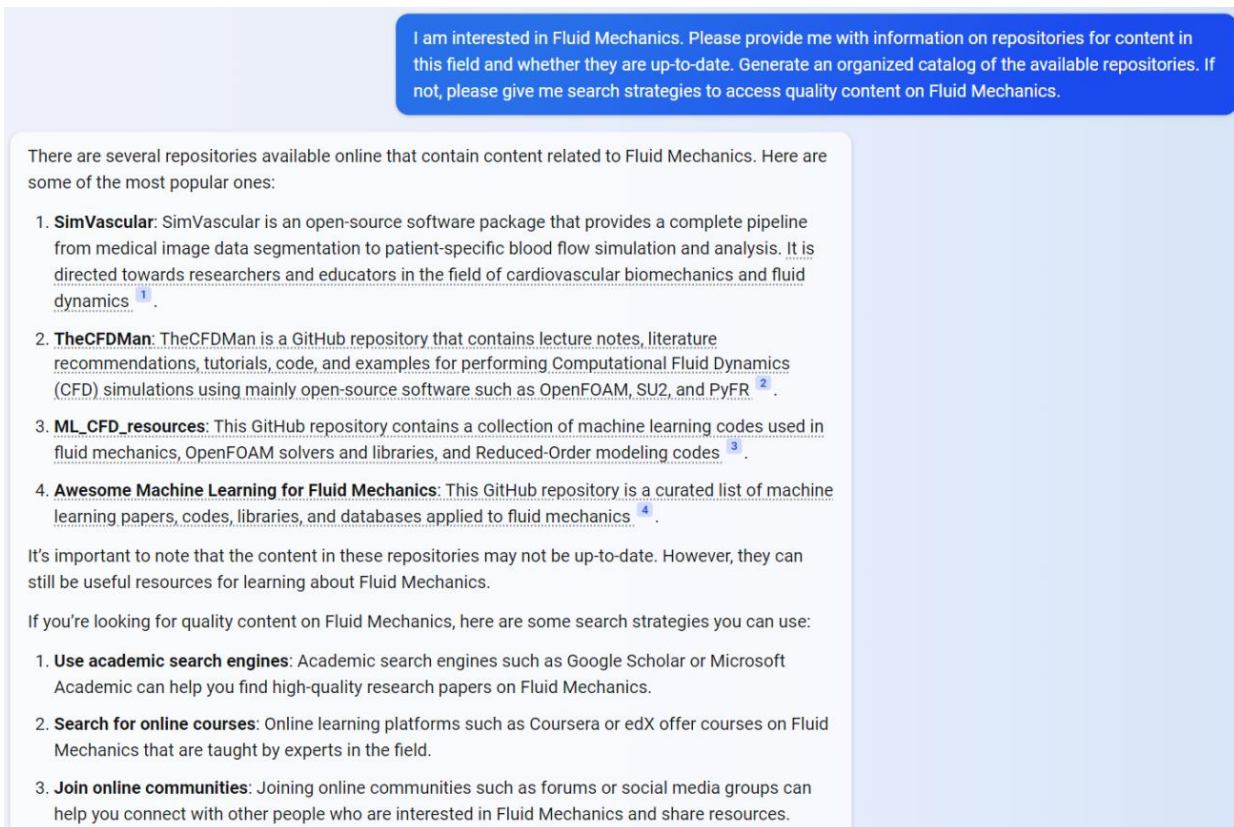


Figure 7. Using ChatGPT-4 as a virtual assistant and virtual trainer to retrieve high-quality information and update contents in higher education.

Template: I am interested in <field or subject>. Please provide me with information on repositories for content in this field and whether they are up to date. Generate an organized catalog of the available repositories. If not, please give me search strategies to access quality content on <field or subject>.

- **Professional Development for Educators:** Tools like ChatGPT can provide educators with personalized guidance to develop their knowledge, stay up-to-date, or enhance their self-learning. There are numerous (informal) proposals that demonstrate how AI can be used to learn tasks that may initially appear complex, such as learning programming languages, video editing and production, or entering the world of computer animation. Educators can benefit from these tools as they offer a powerful way to expand their knowledge, skills, and digital capabilities. In Figure 9, an example of how to use AI to enhance educators' professional development is shown.

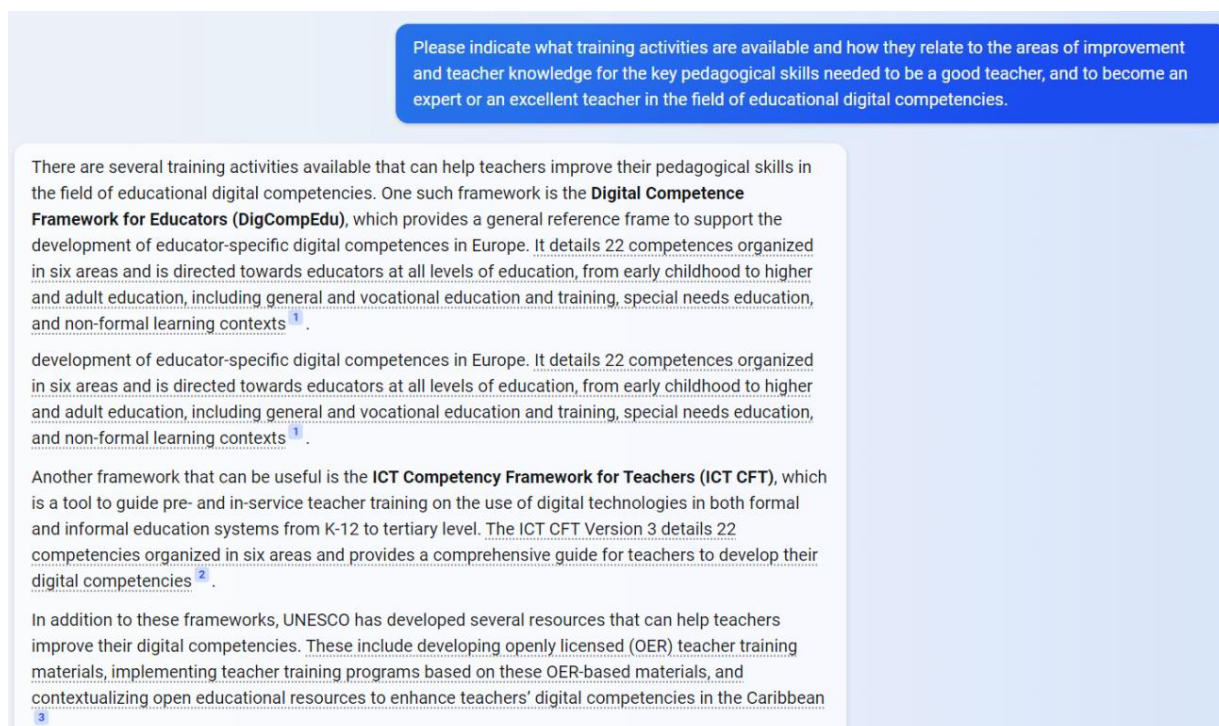


Figure 8. Case of use of ChatGPT-4 as a virtual trainer to enhance professional development in higher education teachers.

Template: Please indicate what training activities are available and how they relate to the areas of improvement and teacher knowledge for the key pedagogical skills needed to be a good teacher, and to become an expert or an excellent teacher in the field of educational digital competencies.

4. CONCLUSIONS

AI, and particularly ChatGPT, is a powerful tool in the work of educators. As seen on multiple occasions, AI provides highly detailed responses in just a few seconds, significantly relieving the workload of educators. It is worth noting that AI is particularly useful in crafting messages and communications with a specific style and in providing suggestions regarding sources of information or educational materials in a particular context. Another especially relevant feature is its ability to offer analysis or ideas about a student's performance or for specific cases of learning difficulties. Several examples of use and templates to be used practically in a higher education context as part of the development of educators' digital competencies have been presented. This work has presented a series of use cases demonstrating the utility of AI-based tools in contributing to the support and improvement of digital education competencies. It has broken down the main competencies that benefit from the use of AI. Similarly, each of them has been examined to address how the use of AI specifically contributes to each level proposed by the European regulatory framework, concluding AI tools can efficiently be used as virtual assistants and trainers to save time and leave educators with more time to spend with their students instead of performing administrative tasks or content preparation.

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