

TECHNOLOGY AND TEACHING: CHALLENGES AND OPPORTUNITIES IN THE AGE OF TECHNOLOGICAL INNOVATION. AN EXPLORATORY SURVEY OF TFA SUPPORT TEACHERS¹

TECNOLOGIA E DIDATTICA: SFIDE E OPPORTUNITÀ NELL'ERA DELL'INNOVAZIONE TECNOLOGICA. UN'INDAGINE ESPLORATIVA TRA I DOCENTI DI SOSTEGNO TFA



Antonio Balestra
Link Campus University
a.balestra@unilink.it



Riccardo Mancini
Link Campus University
r.mancini@unilink.it



Riccardo Sebastiani
Link Campus University
r.sebastiani@unilink.it



Maria Grazia Simone
e-Campus University
mariagraziasimone@unicampus.it



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ABSTRACT

Technological innovation continually shapes "new educational worlds," requiring teachers to develop a dynamic relationship with technologies. Based on data from a questionnaire distributed to more than 1,000 students in a TFA course, the study analyses teachers' interaction with technology, frequency of use, and challenges related to students with disabilities, integrating a future perspective on the importance of AI in teacher education.

L'innovazione tecnologica plasma continuamente "nuovi mondi educativi", richiedendo agli insegnanti di sviluppare un rapporto dinamico con le tecnologie. Basato su dati di un questionario distribuito a oltre 1.000 studenti di un corso TFA, lo studio analizza l'interazione degli insegnanti con la tecnologia, la frequenza d'uso e le sfide legate agli studenti con disabilità, integrando una prospettiva futura sull'importanza dell'IA nella formazione degli insegnanti.

KEYWORDS

Inglese: educational technologies, inclusion, didactics

Italiano: tecnologie educative, inclusione, didattica

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1. Introduction

The pace of technological innovation continues to reshape the landscape of teaching and learning, with a growing emphasis on personalised education and inclusivity. Adapting to this new reality requires teachers to possess a diverse set of digital and technological skills. It is crucial to reaffirm a principle already established: that the mere introduction of technology does not inherently equate to innovation. Technology should serve as a tool to facilitate complex educational processes, requiring an integrated and targeted application of digital knowledge, skills, and attitudes, guided by educational wisdom that enables the teacher to assess the suitability of their choices, verify the completeness of the analysis, the order of their work, the relevance of the means, the appropriateness of certain stimuli, and above all the meaning and significance of the entire process (Paparella, 2009). In this perspective, the digital literacy of teachers would be insufficient if not supported by a technological culture that allows for a rethinking of methods for constructing, representing, and sharing knowledge. Teacher training programmes should therefore significantly incorporate technology to adequately prepare them for the evolving educational contexts. In this direction, the ICT Competency Standards for Teachers published by UNESCO represent one of the most influential reference models for defining teachers' digital competencies. This plan aims to promote teachers' professional development by combining skills in the use of information and communication technologies (ICT) with educational innovation, school organization, and curricula. UNESCO's 2011 standards outline distinct competencies based on different approaches and educational domains (UNESCO, 2011). These approaches include models that focus on the development of technological knowledge and skills, as well as those centred on deep knowledge and knowledge creation. Educational domains encompass curriculum and assessment, pedagogy, ICT, organization and administration, as well as teacher professional development. Recently, TPACK (Technological Pedagogical Content Knowledge) has emerged as an interesting model for describing the set of teachers' knowledge required to effectively interact, from a pedagogical point of view, with technology. This model recognizes that teaching is a complex process that requires a flexible and integrated combination of knowledge. Teachers must operate in a dynamic and complex environment, integrating knowledge of student thinking, subject matter, and technology. At the core of TPACK (Fig. 1) are three types of knowledge: Content Knowledge (CK) concerning the subject matter taught, Pedagogical Knowledge (PK) referring to teaching processes, and Technological Knowledge (TK) concerning the technologies used. This model underscores the

importance of understanding the interaction between technology, pedagogy, and content to provide quality teaching (Mishra, Koehler, Henriksen, 2011).

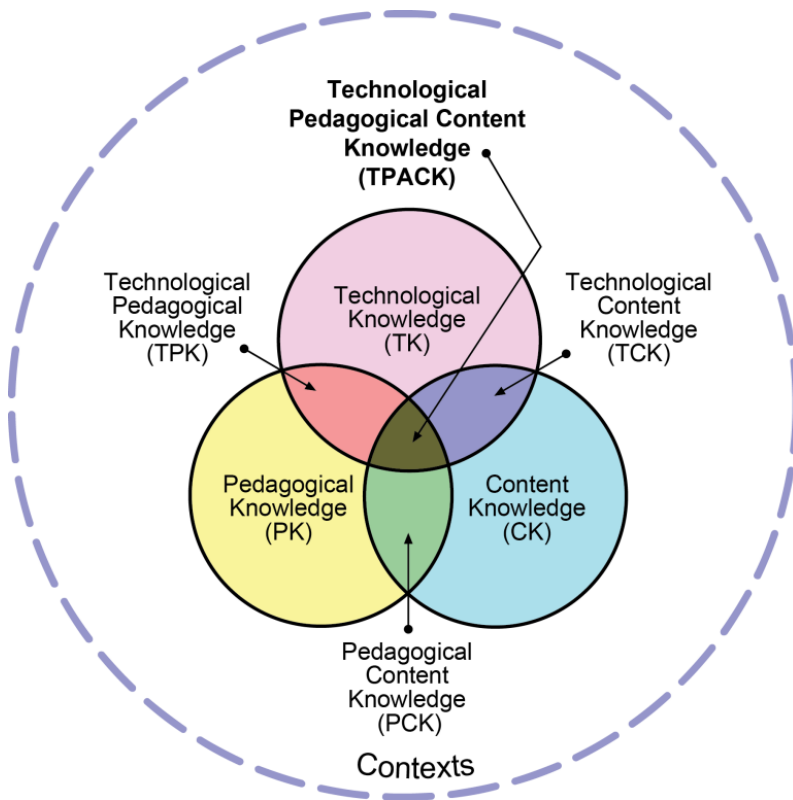


Figure 1. The TPACK model. Reproduced with permission of the editor, © 2012 by tpack.org

To date, the Italian education system has not officially adopted the TPACK model as part of teacher training pathways, but existing regulations align with the principles of the model itself. Recent ministerial guidelines recognize the importance of new technologies in the educational environment. To consciously integrate the TPACK model into school programs, three possibilities appear feasible: enhancing technology knowledge, exploring intersections between technology, pedagogy, and content, and directly studying the TPACK model. This multidisciplinary approach could be crucial for addressing the challenge of technological education (Di Blas, Fabbri, Ferrari, 2008).

In this direction, we cannot overlook DigCompEdu, an acronym for "Digital Competence Framework for Educators," a reference framework developed by the European Union in 2017 to define and promote teachers' digital competencies, with operational indications for integrating technology into educational practice (Punie,

2017). Divided into six competency areas and 22 total competencies, this framework has been adopted in the Guidelines for Integrated Digital Teaching (DDI) and the Train for the Future Programme. Competencies range from professional use of digital technologies to the creation and sharing of educational resources, from classroom technology management to learning assessment, to supporting the development of students' digital skills. The goal is to promote effective, responsible, and inclusive use of technology in education.

Despite the various frameworks developed as guidance for teacher training and for integrating technology into educational practice, the lack of digital preparation in the Italian teaching staff remains evident, as highlighted during the pandemic emergency of 2020-21 (Ceccacci, 2021), (Lucisano et al., 2021). Students, teachers, and families have shown a widespread lack of digital skills.

The training of digital skills for both in-service teachers and the new generations of teachers in university programs has been neglected. This lack of attention could affect the ability of new teachers to adequately develop the digital skills of their students. Tailored training programs need to be developed to bridge this gap and train teachers capable of critically integrating technology into teaching. Furthermore, it is important to open a public debate on political, cultural, and economic issues concerning the adoption of digital technologies, emphasizing the need for a broader and shared vision of the digital within the educational context (Ranieri, 2022).

The evolution of student profiles, characterized by a preference for interactive, multisensory, and personalized learning experiences, along with increased digital literacy, underscores the urgent need for this. Nonetheless, educator training in technology remains a necessary challenge. Overcoming resistance to change, addressing barriers to training access, and tackling disparities in technology availability are among the critical obstacles educators may face in their digital skills development journey (Fernández-Batanero, 2022). The rapidity of technological transformations can be a major challenge for educators, as technologies become obsolete quickly, despite technology integration still finding disappointing levels of penetration and success. Research on technology integration identifies teachers' technological skills as one of the main barriers to effective technology integration (Bećirović, 2023), (Runge et al., 2023). Teachers must possess knowledge that goes beyond technological aspects and must understand that technology has both advantages and limitations for content representation and the identification of relevant teaching approaches (Mishra, Koehler, Henriksen, 2011).

In this scenario, the relevance of artificial intelligence cannot be overlooked, as its use has exponentially increased in various sectors, including education. Consequently, educators will increasingly need to enhance their competence in using technologies related to artificial intelligence, without neglecting the possibility of using it for the training of today's and tomorrow's teachers.

The most urgent task is to develop tailored training programs and conduct research to assess the impact and effectiveness of AI-focused training initiatives, both during pre-service training and throughout educators' careers (al-Zyoud, 2020).

2. Methods and materials

The COVID-19 pandemic has brought about substantial changes (Simone, 2022) even in global education systems, affecting approximately 1.6 billion students and influencing as much as 94% of the world's student population (Brief, 2020). In response to this unprecedented educational emergency, there has been a significant shift towards online or hybrid forms of teaching and learning, with teachers taking the lead in integrating new technologies into their teaching approach (Whalley et al., 2021).

Based on the premises developed so far, to investigate the relationship between teachers in the initial training phase and technology, an exploratory survey was conducted using a survey instrument (Limone, Simone, 2022), which aimed to investigate primarily four dimensions:

1. Motivation for teaching and professional skills
2. Relationship with disability and the concept of inclusion
3. Relationship with technologies
4. Covid and distance learning

The instrument used was developed during the pandemic period to understand the experiences, challenges, and perceptions of participants in initial training courses for educational support (Simone, 2021), and in the academic year 2023/2024, it was administered to students of the TFA support course at Link Campus University. The aim was also to collect data on the motivations driving participants to become support teachers, the skills they believe they need to develop, and their relationship with technology.

Focusing particularly on this last aspect, this study explored various aspects related to the use of technology in teaching, with particular attention to technologies used with students with disabilities (Table 1).

EXPLORED VARIABLES	DESCRIPTION
Personal relationship with technology	Evaluation of participants' personal relationship with technology and computer tools
Impact of educational technology on students with disabilities	Examination of the impact of educational technology on teaching outcomes for students with disabilities
Frequency of technology use in teaching activities	Analysis of the frequency of technology use in teaching activities and contextualization in different settings
Types of technology used to support student learning	Identification of the most common types of technology used to support student learning among students with disabilities
Perceptions of the usefulness of computer technology in special education	Assessment of teachers' perceptions of the usefulness of computer technology in special education
Major difficulties in using technology for students with disabilities	Analysis of the main difficulties in using technology for students with disabilities
Technological accessibility for students with disabilities	Examination of the technological accessibility provided by the school to students with disabilities
Openness to experimenting with new technologies to improve teaching	Exploration of teachers' willingness to test new digital tools and approaches
Technical support for integrating technologies into teaching practice	Evaluation of available resources and training to help teachers effectively use digital tools

Table 1. Relationship between teachers in training and technology in inclusive teaching

The research group was particularly interested in participants' relationship with technology and computer tools, examining how this could influence teaching

practices and support for students with disabilities. The impact of educational technology on teaching outcomes for students with disabilities was analyzed, seeking to understand how the integration of digital tools could enhance their learning, engagement, and inclusion. Additionally, the frequency of technology use in teaching activities and its implications for inclusive teaching were examined. Among the aspects considered, we investigated the types of technology most commonly used to support student learning and the challenges related to accessibility and personalized learning. Finally, we evaluated the technological accessibility provided by the school to students with disabilities, examining the policies and practices implemented to ensure equitable participation.

To operationally conduct the study, the survey tool was administered to 1078 students enrolled in a TFA support course at Link Campus University in October 2023. The Google Forms web application was used, which allowed for efficient and centralized data collection from participants, facilitating systematic and organized information gathering.

3. Results

The analysis of the main findings from the survey reveals that the majority of respondents (76.1%) are female teachers. This data reflects the gender distribution in the Italian school landscape, confirming a traditionally higher female attraction to education professions. According to data released by the Ministry of Education and Merit on September 1, 2023, 81.5% of teachers in Italian state schools are female. The gender imbalance in the teaching profession can be attributed to long-standing stereotypes associating teaching with women (Guerrini, 2015).

Regarding the age of the interviewed teachers, 36.1% are aged between 30 and 40 years, followed by 35.5% between 40 and 50 years, a demographic distribution indicating a fair representation of teachers across different age groups.

It is interesting to note that the correlation between age and attitude towards technology is weak (0.0394), suggesting that there is no significant relationship between teachers' age and their propensity to adopt technology in teaching practice.

The majority of teachers (35.6%) have a positive view of technology, while only a small percentage (7.7%) hold a negative opinion. This suggests broad consensus

on the relevance and importance of educational technologies in teaching students with disabilities (Chart 1).

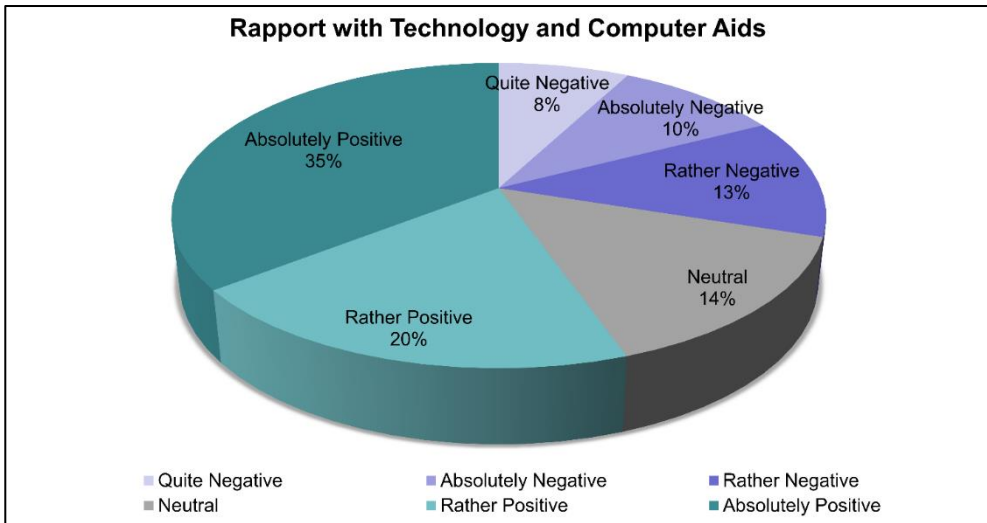


Chart 1. Pie chart: Rapport with technologies and computer aids

A significant datum is that half of the teachers (49.3%) use technology daily, demonstrating an integration of technology into their professional routine (Chart 2). This indicates a high level of familiarity and comfort in using digital tools among the interviewed teachers.

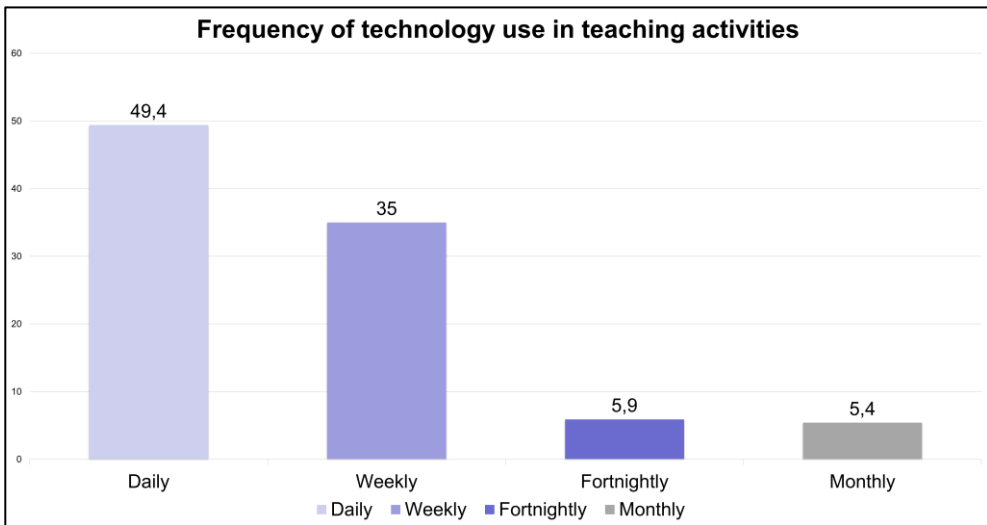


Chart 2. Bar graph: Frequency of technology use in teaching activities

Teachers use a variety of digital tools to support the learning of students with disabilities, including the Internet for research (69.5%) and discipline-specific learning apps (29.9%). This highlights the importance of technology as a teaching resource to personalize instruction and support students with special needs. Despite the recognized benefits of technology, such as producing customized materials (63.8%) and enhancing learning motivation (63.5%), teachers still face some challenges in adopting and using technology. These challenges include a shortage of equipment (40.3%) and a lack of computer skills (37.8%). Nevertheless, the majority of teachers (65.3%) view technological accessibility for students with disabilities positively (Chart 3). This suggests recognition of the importance of ensuring equal opportunities for access to educational technology for all students.

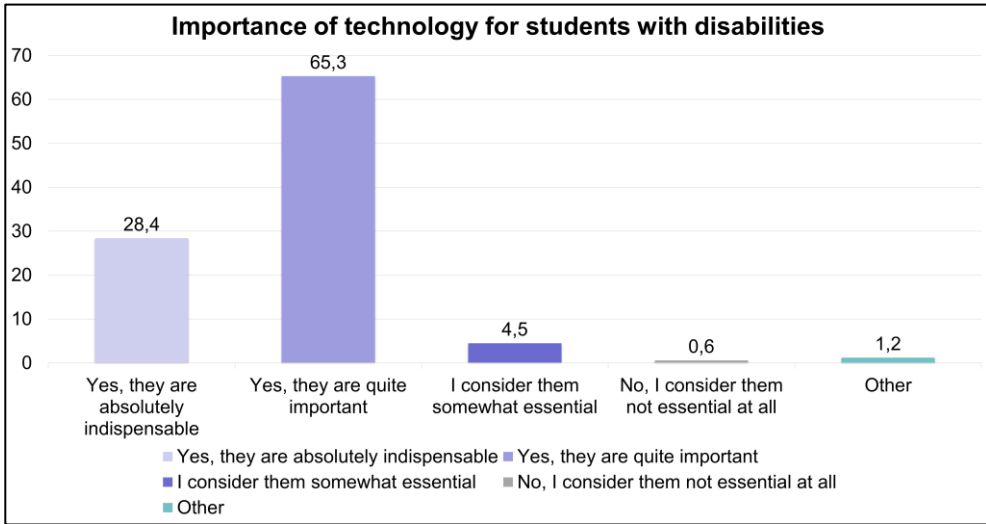


Chart 3. Bar graph: Importance of technologies for students with disabilities

Furthermore, a significant percentage of teachers (60.4%) feel adequately supported technically, indicating a level of satisfaction with the technical support received to integrate technologies into teaching practice. This technical support can play a crucial role in facilitating the adoption and effective use of technology by teachers. Finally, the fact that 67.6% of teachers expressed openness to experimenting with innovative technologies for teaching students with disabilities indicates a mindset of openness and willingness to adapt to new teaching methods supported by technology. This predisposition to innovation could foster further developments in the integration of technology in inclusive education.

4. Discussion

In the current educational landscape and the general reconfiguration of teaching-learning processes following technological innovation, it is evident that teachers face various challenges. This study has highlighted that the majority of teachers have a positive view of technology and recognize its crucial role in improving student learning, especially for those with disabilities. However, some data must necessarily give cause for reflection. 37.8% of respondents reported having poor computer skills, and 40.3% emphasized the shortage of technological equipment in school contexts, highlighting how much progress still needs to be made to meet the needs of a school and society increasingly demanding digital inclusivity.

Although the COVID-19 pandemic has led to a significant increase in the use of online and blended technologies in educational and teaching-learning contexts, many teachers, even within the scope of this survey, have acknowledged not being adequately prepared to address the emergency through the use of technology-supported teaching. The deficiencies were not only related to the technologies themselves but also to the ability to redesign teaching to adapt to the new educational context (Ranieri, 2020). The data confirm what emerged in the OECD-Talis 2018 report (OECD, 2019), where only 36% of teachers feel prepared in ICT, compared to the OECD average of 43%.

The study highlights how the most widely used technology in classroom contexts is mainly interactive multimedia whiteboards (IMWBs), primarily used in a transmissive logic for content representation, image visualization, and internet research.

Given the credit to the data from the survey, it is straightforward to hypothesize that teachers may not be fully ready to use AI-based tools due to a lack of technological skills, not to mention the ethical challenges and full understanding of the psychological, social, behavioral dynamics, etc., associated with AI itself (Zawacki-Richter, 2019).

Yet, for almost a quarter of a century, there have been studies and research on the use of artificial intelligence in education (in July of this year, the twenty-fifth international conference on artificial intelligence in education will be held in Brazil). Artificial Intelligence in Education (AIEd) is a rapidly growing field that involves various disciplines, including psychology, neuroscience, linguistics, sociology, anthropology, and education. The main objective of AIEd is to promote the development of adaptive learning environments and personalized, inclusive, engaging, and effective tools. This field explores the potential opportunities for

pedagogical reflection and educational intervention offered by the use of AI in teaching-learning processes (Chaudhry, Kazim, 2022).

AI could be used to automate tasks not strictly related to teaching, improve data analysis, and optimize online teaching. AIED automates activities such as task generation, student assessment, and feedback, allowing teachers to save time and focus on more meaningful tasks. AI-based tools adapt to students' individual needs, enhancing knowledge acquisition and motivating students through interaction with intelligent agents (Garg, Sharma, 2020), (Bah, Artaria, 2020), (Lampou, 2023).

To fully exploit the potential of AI in teaching-learning processes, teachers need to acquire the necessary skills to effectively use AI-based tools and address the challenges associated with adopting this technology (Bittencourt et al, 2023), (Tapalova, Zhiyenbayeva, 2022).

5. Conclusions

This study aimed to highlight the importance of technology in education, emphasizing the need to enhance teacher training to effectively address the challenges of the digital era. Technological innovation continually generates "new educational worlds." These include online and blended learning, and the use of emerging technologies such as artificial intelligence, virtual reality, augmented reality, blockchain, and the Internet of Things to enhance the learning experience. Such technologies can be useful in promoting greater and more effective personalized learning, considering the individual needs of students, and preparing them for an ever-evolving world.

While teachers recognize the value of technology, it is crucial to overcome barriers hindering the full integration of technology into daily teaching practices. Investing in teacher training and access to technological resources is essential to ensure equitable and high-quality learning for all students, including those with disabilities. Only through joint commitment from educational institutions, policymakers, and the educational community can an inclusive and technologically advanced school environment be created to meet the needs of all students.

Given the current context and emerging challenges in the education sector, there is a clear opportunity for the use of artificial intelligence (AI) as a tool to support teacher training. However, it is essential to recognize that this approach still requires further research and reflection.

Investments in teacher training are significant but often insufficient to ensure adequate preparation for educators. The introduction of AI could represent a response to these challenges, but it requires thorough evaluation and contextual adaptation.

In the context of current technological evolution, policymakers must consider the need to review traditional models of teacher training. AI, along with other emerging technologies, raises fundamental questions about the nature of the teaching profession itself and the skills required of educators in the future. While AI can offer significant benefits, it is essential to ensure that teachers are adequately trained to use this technology effectively and ethically.

The discussion on the use of AI in teacher training must be informed by a solid evidence base and careful assessment of ethical, social, and cultural implications. AI-based tools, such as ChatGPT, emphasize the importance of teachers' digital skills and underscore the need for a holistic approach to teacher training. As we explore the potential of AI in teacher training, it is essential to consider the complex dynamics characterizing the interaction between humans and intelligent machines. Teachers must be prepared to address emerging challenges and capitalize on the opportunities offered by AI to improve the quality of education.

References

Al-Zyoud, H. M. M. (2020). The role of artificial intelligence in teacher professional development. *Universal Journal of Educational Research*, 8(11B), 6263-6272.

Bah, Y. M., & Artaria, M. D. (2020). Corona virus (COVID-19) and education for all achievement: artificial intelligence and special education needs-achievements and challenges. *COUNS-EDU: The International Journal of Counseling and Education*, 5(2), 64-70.

Bećirović, S. (2023). Challenges and Barriers for Effective Integration of Technologies into Teaching and Learning. In *Digital Pedagogy: The Use of Digital Technologies in Contemporary Education* (pp. 123-133). Singapore: Springer Nature Singapore.

Bittencourt, I. I., Chalco, G., Santos, J., Fernandes, S., Silva, J., Batista, N., ... & Isotani, S. (2023). Positive artificial intelligence in education (P-AIED): A roadmap. *International Journal of Artificial Intelligence in Education*, 1-61.

Brief, P. (2020). Education during COVID-19 and beyond. *United Nations*, 1--26.

Ceccacci, L. (2021). La sfida della valutazione in DAD: note a margine di un percorso di formazione per docenti della secondaria di area umanistica. *Formazione & insegnamento*, 19(2), 218-227.

Chaudhry, M. A., & Kazim, E. (2022). Artificial Intelligence in Education (AIEd): A high-level academic and industry note 2021. *AI and Ethics*, 2(1), 157-165.

Di Blas, N., Fabbri, M., & Ferrari, L. (2018). Il modello TPACK nella formazione delle competenze digitali dei docenti. Normative ministeriali e implicazioni pedagogiche. *Italian Journal of Educational Technology*, 1, 24-38.

Fernández-Batanero, J. M., Montenegro-Rueda, M., Fernández-Cerero, J., & García-Martínez, I. (2022). Digital competences for teacher professional development. Systematic review. *European Journal of Teacher Education*, 45(4), 513-531.

Garg, S., & Sharma, S. (2020). Impact of artificial intelligence in special need education to promote inclusive pedagogy. *International Journal of Information and Education Technology*, 10(7), 523-527.

Guerrini, V. (2015). La dimensione di genere nella professionalità docente. Prospettive per un rinnovamento delle competenze degli/Ile insegnanti dai risultati di una ricerca in Toscana. *Formazione & insegnamento*, 13(2), 209-218.

Lampou, R. (2023). The integration of artificial intelligence in education: opportunities and challenges. *Review of Artificial Intelligence in Education*, 4(00), e015-e015.

Limone, P., & Simone, M. G. (2022). Specializzarsi online durante la pandemia: un'indagine esplorativa sui docenti di sostegno in fase di formazione iniziale. *RIVISTA ITALIANA DI RICERCA EDUCATIVA*, (28), 076-084

Lucisano, P., de Luca, A. M., & Zanazzi, S. (2021). Le risposte degli insegnanti all'emergenza COVID-19. In *La DaD in emergenza: vissuti e valutazioni degli insegnanti italiani. Scelte metodologiche e primi risultati nazionali*. (pp. 13-51). Pensa MultiMedia.

Mishra, P., Koehler, M. J., & Henriksen, D. (2011). The seven trans-disciplinary habits of mind: Extending the TPACK framework towards 21st century learning. *Educational Technology*, 22-28.

OECD (2019), *TALIS 2018 Results (Volume I): Teachers and School Leaders as Lifelong Learners*, TALIS, OECD Publishing, Paris, <https://doi.org/10.1787/1d0bc92a-en>.

Paparella, N. (Ed.). (2009). *Il Progetto educativo* (Vol. 1). Armando Editore.

Punie, Y., editor(s), Redecker, C., European Framework for the Digital Competence of Educators: DigCompEdu , EUR 28775 EN, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-73718-3 (print),978-92-79-73494-6 (pdf), doi:10.2760/178382 (print),10.2760/159770 (online), JRC107466.

Ranieri, M. (2020). La Scuola dopo la DaD. Riflessioni intorno alle sfide del digitale in educazione. *Studi sulla Formazione/Open Journal of Education*, 23(2), 69-76.

Ranieri, M. (2022). Le competenze digitali degli insegnanti. In *Il Tirocinio Diretto Digitale Integrato (TDDI). Il progetto sperimentale per lo sviluppo delle competenze delle maestre e dei maestri* (pp. 49-60). Florence University Press.

Runge, I., Lazarides, R., Rubach, C., Richter, D., & Scheiter, K. (2023). Teacher-reported instructional quality in the context of technology-enhanced teaching: The role of teachers' digital competence-related beliefs in empowering learners. *Computers & Education*, 198, 104761.

Simone M.G. (2022). Cambiamenti. Sfide e compiti educativi. Milano: FrancoAngeli

Simone, M. G. (2021). After the Covid-19 Pandemic: Rethinking the Relationship between Technology and Teacher Training. *INTERNATIONAL JOURNAL OF EDUCATION*, 2, 62-74.

Tapalova, O., & Zhiyenbayeva, N. (2022). Artificial intelligence in education: AIEd for personalised learning pathways. *Electronic Journal of e-Learning*, 20(5), 639-653.

United Nations Educational, Scientific and Cultural Organization. (2011). UNESCO ICT competency framework for teachers.

Whalley, B., France, D., Park, J., Mauchline, A., & Welsh, K. (2021). Towards flexible personalized learning and the future educational system in the fourth industrial revolution in the wake of Covid-19. *Higher Education Pedagogies*, 6(1), 79-99.

Zawacki-Richter, O., Marín, V.I., Bond, M., Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education – where are

the educators? *International Journal of Educational Technology in Higher Education*
16(39): 1-27.