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Ethical approach to the use of immersive technologies. Advance about digitalisation of multilingual programs in the EHEA

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This study explores the ethical implications of integrating advanced immersive technologies into education using a snowball documentary methodology, considering multidisciplinary perspectives. Advocating for a holistic approach, it suggests combining legal frameworks, ethical codes, and educational programs centered on core values. The evolving ethical landscape of immersive technologies reveals varied viewpoints among researchers, with some emphasizing concerns and others highlighting advantages. Additionally, some leverage immersive technologies for ethical education in response to emerging challenges. Post-implementation, ethical challenges and norms contribute to the ongoing expansion of the topic. A closer examination identifies nuanced differences and commonalities between immersive technologies and the Metaverse, emphasizing multifaceted considerations. Legal aspects are thoroughly covered in AR, VR, and MxR technologies, while the Metaverse focuses on identity protection. In education, immersive technologies exhibit more developed ethical concerns, underscoring the richness compared to the Metaverse.

KEYWORDS

advanced technology, Humanism, human rights, ethics of technology, Responsibility

1 Introduction

In the context of the digital revolution, the literature found indicates a growing prevalence of immersive technologies in the educational settings (Bernate and Vargas, 2020; Martín-Ramallal, 2020; Mendoza, et al., 2023). However, the integration of these technologies has not unfolded as expected by many, as it is not presented as the definitive solution (Bernate and Vargas, 2020; Bruno, et al., 2020). This phenomenon is attributed to various factors, as identify by researchers, including limited funding, educators' reluctance, and, in some cases, a lack of familiarity or technological knowledge necessary for the effective development and application of these tools (Jamaludin et al., 2020; Costan, et al., 2021; González and Valencia, 2022).

This phenomenon reveals the intricacies associated to the integration of immersive technologies in education, emphasizing a challenge that extend beyond the mere availability of tools. One key aspect that has garnered significant attention in recent years relates to the ethical dilemmas that may arise during the utilization of immersive technologies (Costan et al., 2021) -whether augmented, virtual, mixed reality, or within the emerging paradigm of the Metaverse-, in educational contexts.

Therefore, it is necessary to examine the existing academic literature to understand how researchers are approaching this scenario and whether substantial data has been provided to address these issues. This will ensure that the incorporation of immersive technologies into education is done in an ethical and responsible manner. The incorporation of immersive technologies in educational environments poses ethical challenges, such as ensuring equal access and promoting responsible use of these technologies for instructional purposes. Partarakis and Zabulis (2024) argue that improving technological literacy through education demands concerted efforts to equip individuals of all demographics to navigate new technologies. This entails creating robust educational programs and fostering a culture of lifelong learning.

In the context of accelerated technological development, the integration of different technologies in today's society poses ethical challenges of considerable magnitude, especially when it comes to the inclusion of technology in education, which is why it is essential to establish the ethical principles mentioned. Gómez-Trigueros and Ortega-Sánchez (2022), citing Arroyo (2016), explain that ethical knowledge is a foundation that provides moral guidelines to promote appropriate and respectful interpersonal relationships. It promotes behaviours guided by shared values that contribute to building healthy and ethical relationships in society. Ethics in the use of technology thus refers to the principles and norms that guide behaviour and decisions related to technology, encompassing an assessment of what is deemed considered morally right or wrong in the development, use and consequences of digital technologies (Hagendorff, 2020; Mohammed, et al., 2020).

While many authors cited in the literature review this understanding of ethics in the use of technology is not unanimous, Bietti (2020) argues that the use of the term ethics in relation to technology poses challenges, as the term has been used by some technology companies to disguise dubious practices. Bietti (ibid.) counters these perceptions by arguing that both the overuse of the term ethics by some companies and the exaggerated criticism by others is a misunderstanding, as he believes ethics should not simply be a cover for dubious behavior or something that can be easily dismissed. On the contrary, he argues that ethics can be a valuable tool for evaluating technology policy strategies. It should not be seen as an obstacle, but as a compass that guides ethical decisions in an increasingly technological world.

In this inquiry, the second section introduces the intersection of advanced technologies (AR, VR and MxR mainly) and education, while the third section addresses ethical themes related to the Metaverse, a fully immersive advanced technology.

2 Ethical issues related to immersive technologies (AR, VR, and MxR) and education

Partarakis and Zabulis (2024) in a systematic review on topics related to immersive technologies, they emphasize that key factors encompass the seamless integration of technologies, ethical considerations, accessibility, promotion of technological literacy through education, interoperability, user trust, environmental sustainability, and adherence to regulatory frameworks. Hence, society is tasked with addressing ethical challenges to ensure that immersive technologies are used responsibly and beneficially for the entire population. We provide an identification of ethical issues related to education in the field of immersive technologies.

In the context of responsible use of immersive technology, Christopoulos et al. (2021) have identified several new ethical issues in an intervention. These encompass various personal factors (e.g., potential threats) and classification issues (e.g., physical, psychological, moral). Chow et al. (2015) conducted a study on mobile and augmented reality usage aimed at helping students integrate these technologies and use them ethically. Tan et al. (2022) explored immersive technology's role in social and emotional learning. Findings suggest that virtual environments enhance perspective-taking and empath in addressing ethical dilemmas compared to traditional methods. Bakhmat et al. (2022) argue that moral and moral standards play a crucial role in shaping the digital competencies of teachers. These ethical constants help maintain a balance between technological advancements and the human dimension.

Exploring access and inequality of use, this ethical analysis is not limited to the aforementioned consideration, but also extends to the related social and economic dimensions. Equality, social justice and economic sustainability are inextricably linked to ethical technological development. Partarakis and Zabulis (2024) point out that it is important to enable these technologies towards inclusion in educational environment.

Excessive use of immersive technologies can contribute to addiction and impact mental health. Society must address how to balance the benefits of these technologies with the health and well-being of individuals. In this line, ethical dilemma arises from psychological effects associated with immersion in virtual environments (Caballero Trenado, 2023; Lorente, 2023).

In this situation, the protection of privacy and data protection are key concerns that must be given great attention when designing and implementing technologies. This ensures the protection of individual rights and guarantees transparent and secure practices in the management of personal data (Jamaludin et al., 2020; Mohammed, et al., 2020; López Escarcena, 2021; Cruz Ángeles, 2023). This focus on the protection of privacy is linked to the critical examination of artificial intelligence and automated decision-making. It is argued that addressing algorithmic bias and promoting accountability are essential to ensure fairness and transparency (Nevanpera et al., 2021).

In line with these principles, ethics in the use of technology emphasizes the importance of empowering users and respecting their autonomy. To this end, it is essential to build user-machine interfaces at the design stage that not only enable informed decisions but also give people substantial control over their interaction with the technology. In addition, the integrity of technological systems and the safety of users require ethical practices, including the responsible disclosure of vulnerabilities and the proactive adoption of measures to ensure the security of systems. Southgate et al. (2019) emphasize that in the virtual reality intervention teachers-researchers where committed to students' safety. Kremer et al. (2023) advocate for the use of virtual reality in educational training to ensure the safety of the patients preventing contagion.

Although safety and security are not usually perceived directly as ethical issues, an ethical consideration arises from the perspective of Nevanpera et al. (2021) when examined in the context of human rights. In this scenario, it is argued that an ethical discussion must take place, especially when the purpose of these measures is to protect people from social, emotional and physical challenges. In other words, when security becomes a means to protect people's fundamental rights, ethical reflection is warranted to ensure that these protective measures are in line with broader ethical principles.

In this sense, Rosetti and Angeluci, 2021 emphasise the importance of incorporating ethical principles from the earliest stages of design. They argue that minimal governance with normative ethical regulations is essential to ensure that fundamental principles such as safety, transparency, human dignity, non-discrimination, freedom of choice, privacy protection and accountability are included in the design itself. This approach suggests that ethics should not be an afterthought, but an integral part of the design of immersive technology. Suh and Prophet (2018) propose to improve user experiences with immersive technology, systems designers should prioritize minimizing the negative effects such as motion sickness, cognitive overload, physical discomfort, and distraction.

Furthermore, it is assumed that ethics in technology also encompasses corporate responsibility. Technology companies, it is argued, should act with integrity and transparency and make a positive contribution to society, which includes ethical practises in advertising, labour relations and corporate decisions (Orozco Martinez, 2021).

Regarding misinformation, Cho et al. (2023) utilize immersive technologies escape rooms to train and equip individuals with critical resources against misinformation. During the VR intervention, Brown et al. (2023) maintained apolitical and generalized narrative examples while preserving cultural relevance as a mitigation measure. However, they caution that, firstly, the unique threat of spreading misinformation in virtual reality is real and relevant. Secondly, they recommend that the decision to test the effectiveness of misinformation in VR could easily cross the boundaries of established ethical practices. Regarding manipulation, Hein et al. (2021) propose that the portrayal of other individuals and self-presentation can be manipulated in immersive technologies. Research in behavioral psychology presents promising results in this context, particularly applicable in the field of intercultural competence.

Concerning cultural integration, Bekele and Champion (2019) express a positive perception of an intervention involving AR, VR and MxR for dissemination of cultural knowledge in Virtual Heritage. From the interaction standpoint, viable approaches were identified in collaborative and multimodal interaction methods. Hein et al. (2021) found that a substantial number of studies were noted for comparing traditional teaching methods with immersive technologies' interventions labelled for foreign language learning. The criteria predominantly examined were cognitive learning achievements, such as vocabulary or speaking, affective variables, including motivation, satisfaction, or speaking anxiety and discomfort. Several advantages of immersive technology in foreign language teaching were employed and demonstrated in the studies identified, including heightened attention, motivation, and enjoyment. These authors have identified significant potential and a current research gap in the field of intercultural and transcultural language learning.

Below is a summary Table 1 with all the seven topics, researchers and approaches expressed in this section with a direct or indirect relationship to the educational context where it converges along with other disciplines.

3 Ethical issues related to metaverse and education

In the context of digital transformation, the introduction of immersive technologies, especially with the advent of the metaverse, represents both a critical challenge and an opportunity to shape a technological environment that reflects ethical values and ensures fairness.

Based on the definitions of Cruz Ángeles, 2023, there are differences between Metaverse and metaverse (upper and lower case). This distinction is given for analysis in academic and legal fields, thus the author defines Metaverse (with the first capital letter), as the global conception of a three-dimensional and collective online digital space, that combines aspects of the physical and virtual worlds, while metaverse (with lower case) is used to describe individual digital worlds or platforms that exist within the broader framework of the Metaverse and which, although interconnected, retain their own specificities and distinguishing features, from virtual reality games to specific social networks. In this dissertation, to align the discourse coherently with the addressed theme, we will broadly focus on immersive Metaverse technology in general.

Metaverse's role in education includes creating immersive learning environments, allowing language learning (Hwang, 2021), fostering real-time collaboration, providing interactive educational experiences, enabling remote and global training (AlSaleem, 2023), and developing advanced digital skills. This technology enhances understanding, motivation and enjoyment (Talan and Kalinkara, 2022), encourages global access, and prepares students for navigating virtual environments in the digital age. Li and Yu (2023) have discovered that blended language learning in the Metaverse entails key factors such as learner engagement, learning outcomes, and digital literacy.

Al-Adwan and Al-Debei (2023) concluded that, among higher education students (Generation Z), the following variables: performance expectation, effort, favorable conditions, hedonic motivation, value for money, personal innovation in the field of technologies were significant in predisposing to adopt Metaverse technology, except for the factor of social influence.

However, Onu et al. (2023) maintain that some learners may be hesitant to adopt Metaverse technology and may not be ready for engage at the beginning of the learning process. Talan and Kalınkara, 2022 gathered the students' perception that Metaverse complicates learning, causes distraction, disconnects students from real-life experiences, and disrupts classroom discipline.

From an expert perspective, various authors explore several fundamental elements that are considered essential for creating an ethical and enriching Metaverse for human existence: ethical design, protections of identities, access and equity and regulation.

TABLE 1 Ethical issues related to immersive technologies (AR, VR, MR) in educational context.

Issues	Researchers	Approach
Responsible use of immersive technologies in educational settings entails collaboration among teachers, parents, and students to ensure ethical and equitable utilization of these tools	Chow et al. (2015), Mohammed, et al. (2020), Hagendorff (2020), Tan et al. (2022)	Ethical-Moral Theoretical-Practical Perspective; Educational approach
Addressing access and inequalities in immersive technology highlights the imperative to bridge socio-economic gaps, ensuring inclusive integration into educational environments for all	Partarakis and Zabulis (2024)	Socio-Economic perspective; Educational approach
The topic of addiction and mental health highlights the importance of balancing the benefits of immersive technologies with individuals' psychological wellbeing, emphasizing the need for a cautious approach	Caballero Trenado (2023), Lorente (2023)	Psychological approach; Educational approach
Addressing protection, privacy, and data security in immersive technology emphasizes safeguarding individual rights and ensuring transparent practices, crucial for ethical technology integration and user trust	Jamaludin et al. (2020), Mohammed et al. (2020), López Escarcena (2021), Nevanpera (2021), Cruz Ángeles (2023)	Legal perspective; Educational approach
Focusing on development and design, it's vital to prioritize user experience, safety, and ethical considerations, ensuring immersive technology aligns with fundamental principles and societal wellbeing	Suh and Prophet (2018), Southgate et al. (2019), Rosetti and Angeluci (2021), Orozco Martinez (2021), Kremer et al. (2023)	Engineering perspective; Educational approach
Addressing misinformation and manipulation in immersive technology necessitates strategies to mitigate their effects, safeguarding against potential harm to users and maintaining ethical integrity in virtual environments	Cho et al. (2023), Brown et al. (2023)	Business Production perspective; Educational approach
Cultural integration in immersive technology underscores its potential for fostering cross-cultural understanding and engagement, urging designers to embrace diverse perspectives for enriching user experiences and educational outcomes	Bekele and Champion (2019), Hein et al. (2021)	Socio-political-legal approach; Educational approach

Source: own elaboration.

The concept of ethical design proves to be a fundamental principle in the construction of the Metaverse. The integration of ethical considerations in the early stages of technology development is becoming the order of the day. This means that the architecture and functions of the Metaverse are guided by sound ethical principles, mitigating risks such as algorithmic bias and promoting privacy and inclusion (Nevanpera et al., 2021; Rosetti and Angeluci, 2021; Cruz Ángeles, 2023).

The protection of personal data and the integrity of individuals in the Metaverse is becoming a priority. The protection of identities includes not only measures to prevent the theft of virtual identities, but also ensuring confidentiality in the handling of sensitive data and thus establishing ethical protocols for the management of digital identities (Jamaludin et al., 2020; Cruz Ángeles, 2023).

The principle of equity emerges as an essential component to ensure that the Metaverse is accessible and beneficial in an equitable manner. This includes removing barriers that may exclude certain groups, such as economic inequalities or limited technological access, expensiveness, time-consuming (AlSaleem, 2023), as well as race and psychomotor and cognitive deficits. Therefore, this becomes a central task. An equitable approach strives for inclusion and diversity in participation in the Metaverse, (Zallio and Clarkson, 2022; Meenaakshisundaram, 2023).

Ethical regulation is an essential element in establishing a legal framework to oversee and govern the development and operation of the Metaverse. This regulatory framework focuses on preventing abuse, protecting the rights of individuals and ensuring that practices in the Metaverse comply with previously established ethical standards (Rosetti and Angeluci, 2021; UNESCO, 2021).

To compile the information, all these aspects exposed are presented in this summary Table 2.

4 Research methodology

The research method was a mini literature review, also known as a brief literature review or narrative review, which is a type of academic literature analysis that focuses on a concise and selective review of existing studies and publications on a particular topic. It differs from a more comprehensive systematic review in that it is more concise and focuses on specific aspects of the topic.

Within this method, the snowball documentary approach was used. This iterative approach enables the discovery of new relevant sources and ensures a more complete coverage of the topic, thus contributing to the robustness and completeness of the review. The key to the snowball technique (Hepplestone et al., 2011) is not limiting oneself to the initial sources; rather, actively seeking to build a network of references that lead to new relevant research. This approach allows for a deeper and more comprehensive exploration of the topic, combining analysis and synthesis (Sánchez-Gordón and Luján-Mora, 2018), as each newly identified source may provide additional perspective or approaches that might have been overlooked initially.

We started by searching for keywords in WOS related to the topic: ethics, educational context, and immersive technologies or synonyms. Once finding the most relevant sources identifying impactful articles peer review from the last 5 years on each immersive technology, we applied the snowball technique. We

TABLE 2 Ethical issues related to Metaverse and education.

Issues	Researchers	Approach
Exploring ethical design principles in Metaverse development, emphasis lies on integrity and inclusivity, ensuring privacy and equitable practices in technological design	Nevanpera et al. (2021), Rosetti and Angeluci (2021), Cruz Ángeles (2023)	Engineering perspective Educational Approach
Investigating protection of identities in Metaverse, authors prioritize safeguarding privacy and confidentiality, ensuring ethical management of digital identities for user integrity and security	Jamaludin et al. (2020), Cruz Ángeles (2023)	Engineering perspective; Educational Approach
In Metaverse discussions, scholars stress access and equity, striving to remove barriers like economic disparities and limited technological access, ensuring inclusive participation for all users	Zallio and Clarkson (2022), AlSaleem (2023), Meenaakshisundaram (2023)	Socio-Economic perspective; Educational approach
In Metaverse discourse, scholars underscore regulation, advocating for a legal framework to ensure ethical practices, prevent abuse, and protect individuals' rights in digital environments	Rosetti and Angeluci (2021), UNESCO (2021)	Legal perspective; Educational approach

Source: own elaboration.

expand the search of the topic through the bibliographic references of the selected studies. We expanded the final documentary corpus using Google Scholar to find studies citing the identified peer review articles and review their references.

Thus, in line with Pellas et al. (2021) the inclusive criteria comprised peer review articles, preferably in English, published between 2018 and 2023, addressing ethical concerns related immersive technologies, and considering both abstract and full-texts. The specific criteria encompassed peer review articles providing recommendations or discussion on ethical issues regarding immersive technologies in an educational context, focusing on full-text content. Exclusion criteria involving books, book chapters, conference materials, reports, *etc.*,; articles lacking recommendations or discussion on the topic; and research or systematic articles with small sample size or inadequately structured research method.

Subsequently, through the critical reading of the references found, the ethical aspects of the use of immersive technologies in education expressed by the different authors in their articles, as well as the possible solutions they propose for it, are presented in a table.

5 Results

The following results have been obtained regarding ethical aspects. The results will be divided into two parts, focusing on general findings and potential ethical solutions.

5.1 Results regarding immersive technology (AR, VR and MxR) and the metaverse

If we compare the results of the dimensions uncovered through the review in both immersive technologies and the Metaverse, some are common, while others are diverse. The three common dimensions include access and inequalities, protection, privacy and data protection, and development and design. Protection, privacy, and data protection are more developed in all three technologies (AR, VR, and MxR) within the regulatory legal sphere, whereas in the Metaverse, it only addresses the *protection of identities* due to the use of Avatars and legally discusses *regulation*. In contrast, in all three immersive technologies (AR, VR, and MxR) in education, it seems that ethical issues are more developed than in the Metaverse, as responsible use of educational agents, addiction and mental health, misinformation and manipulation, and cultural integration emerge.

Among these dimensions, the aspects that have been most repetitive and that emerge as being greatest ethical challenges in Education are the following. From a socioeconomic and educational perspective, the challenge of *economic inequality* and technological sterns from the issue of *accessibility* due to the high cost of devices of all immersive technologies. This situation poses a risk that education may become exclusive, catering primarily individuals with economic resources. In this line, the concept of Digital and Social Divide underscores the potential for an *increasing gap* in both digital and economic aspects among different population groups, resulting in the creation of social inequalities due to the lack of universal access.

From a psychological and educational standpoint, concerns about *addiction* and mental health arise in immersive technologies (AR, VR, and MxR). The potential promotion of isolation through a preference for virtual environments may pose risks, leading individuals who identify more with virtual environments to experience difficulties in real-life social relationships.

Regarding the responsibility of use in educational agents, we came across a related theme: impact on human relations and pedagogical training. Concerns are raised about the quality of *human relations* and connections in virtual learning environments (VR), along with challenges in training and mentoring teachers to avoid bias and *discrimination* in the design of virtual environments.

From an educational and communicative perspective, limitations of the Metaverse as a substitute for face-to-face education have been identified. It is acknowledged that the Metaverse can be a valuable tool but cannot fully replace *face-to-face education*. There is a focus on the significance of personal relationships and human connection in traditional education, advocating for the human social learning aspect that requires contact, interaction, and proximity.

From a legal-regulatory and educational standpoint, the *breach of ethical norms* in the Metaverse poses an ethical challenge in addressing and preventing such incidents. We face another related

challenge involving the lack of ethical norms in the Metaverse. The allure of the absence of norms is present, but it has an impact on *empathy education*. There is also concern due to the distortion of ethical awareness resulting from actions in the Metaverse that might be considered crimes in the real world.

5.2 Possible solution for ethics in immersive technologies in education

Each author offers different approaches to address ethics in the use of advanced immersive technologies and emphasises the importance of strengthening regulatory aspects such as transparency, inclusion, individual autonomy and privacy. Sanroman (2023), Caballero Trenado, 2023, Pase (2012) propose the establishment of specific laws to regulate the ethical use of immersive technologies in education.

The legal-regulatory solution should come from consolidating European digital law through the European Declaration on Digital Rights and Principles by the Comisión, 2022, UNESCO (2021), and the Parlamento, 2020. Codina (2023) advocates for fostering solidarity, promoting inclusion, and safeguarding freedom of choice in the realm of digital transformation.

Regarding the Metaverse, authors such as Ortega-Rodriguez, 2022, Adams et al. (2018) suggest the development of a code of ethics for the Metaverse, addressing transparency, coexistence, inclusion, and ethics as a cornerstone, starting from the design. These authors, Kim and Park, 2022, Steele et al. (2020), advocate for re-establishing ethics as technology advances, with a focus on ethical education in the Metaverse. These scholars, Li et al. (2022), emphasize considering individual autonomy and privacy in the educational Metaverse, addressing central ethical issues. Munn and Weijers (2023), Slater et al. (2020), Rueda and Lara (2020), Carter and Egliston (2020) acknowledge that Metaverses bear moral similarities to the physical world but highlight the risks involved in developing them as commercial enterprises.

6 Discussion

6.1 Exploring ethics in immersive technology integration

A through and thoughtful exploration of critical issue of ethics in the integration of immersive technologies into education necessitates the examination of various academic, legal, socioeconomic, psychological, engineering, political and philosophical, and other perspectives that converge on the phenomenon and contribute to the understanding of this complex landscape, and the advocacy of a holistic approach that combines legal frameworks, ethical codes and educational programmes focused on core values.

We have observed that immersive technologies' ethical approach is an expanding field in education where there is still much to be researched and standardised. We found researchers, who, as a result of investigating the intervention, raise concerns about negative ethical aspects (Suh and Prophet, 2018; Hein et al., 2021; Christopoulos et al., 2021) that should be regulated or, on the contrary, others academics emphasize only the advantages of using these technologies (Bekele and Champion, 2019; Kremer et al., 2023). Additionally, there are others researchers (Chow et al., 2015; Cho et al., 2023) leveraging immersive technologies for ethical education in response to these ethical challenges.

We have noticed that ethical challenges and ethical norms arise subsequent to the implementation of these technologies. This circumstance contributes to the ongoing expansion of this topic as educational interventions are implemented and a better understanding is gained of the benefits, drawbacks, and negative factors that need to be regulated.

A closer look at the results reveals nuanced differences and commonalities in dimensions between immersive technologies and the Metaverse. Shared dimensions, including access, inequalities, protection, privacy, data protection, and development/design, highlight multifaceted considerations. Legal aspects are thoroughly covered in AR, VR, and MxR technologies, while the Metaverse primarily focuses on identity protection through Avatars and regulatory discussions.

In education, a detailed analysis shows more developed ethical concerns in immersive technologies (AR, VR, and MxR). This is seen in the emphasis on responsible use of the educational agents, addressing addiction, mental health, misinformation, manipulation, and promoting cultural integration. This succinct exploration underscores the richness of ethical considerations within immersive technologies, particularly compared to the Metaverse.

6.2 Regulating advanced technologies

The European Declaration on Digital Rights and Principles, in which the European Union took an important step towards consolidating European digital law with the adoption of this declaration on 15 December 2022 (Comisión, 2022), becomes a fundamental pillar that, while not a legal norm, reflects the EU's commitment to a safe and human-centred digital transformation and supports fundamental values and rights. It emphasises solidarity, inclusion and freedom of choice, seeks to address ethical and societal challenges arising from digitalization and can, even if it is seen by some opponents as a political expression. Digitalization is part of digital constitutionalism and underpins the strategic agenda of the Digital Decade 2030, serving as a guide for policymakers and strengthening the European Charter of Fundamental Rights, but can also influence judicial interpretations.

By emphasising the need for connectivity, education, training and digital skills, as well as fair and equal working conditions, the Declaration positions itself as a guide for policymakers and reinforces the European Charter of Fundamental Rights, making this policy framework an important support for building an ethical and sustainable digital environment in education.

Sanroman (2023) contributes to the discussion by proposing the implementation of specific laws to ethically regulate the use of immersive technologies in education. The central idea is the need to create clear legal frameworks to guide the development and use of these technologies. Such an approach is supported in the Declaration by addressing ethical and social challenges arising from digitalization. The importance of this proposal lies in providing

clear guidelines to ensure fairness, privacy and protection of rights in the use of immersive technologies in education.

In contrast, Ortega-Rodriguez, 2022 presents a practical perspective of responsible interaction, but not before pointing out the educational possibilities in the Metaverse. He focuses on the acquisition of cultural knowledge. Citing (Castells, 2005), this author explains that culture in this horizon is defined as the background and experiences of the participants, which are essential for setting norms in the knowledge society.

Both (Ortega-Rodriguez, 2022) and Martins and Wolfe (2022) argue for a Metaverse code of ethics that addresses transparency in communication, values for coexistence, inclusion, the recognition of avatars as real persons and ethics as cornerstones for the design of educational programmes and experiences, promoting a virtual environment in which the identity of users is protected and in which positive interactions and consumer confidentiality are favoured. This paper makes an important contribution to the development of crucial ethical guidelines for design and interaction in the Metaverse and provides a solid framework for future research and educational applications.

Kim and Park, 2022 research introduces a ground-breaking approach to ethics education in the Metaverse, specifically for adolescent. It specifically targets younger users with the aim of forming a solid ethical foundation from the early stages of interaction with immersive technologies. The premise of ethical restoration is taken for this approach. Their focus is on tailored education within this digital realm, emphasizing core values like metacognition, judgment, sensitivity, and moral responsibility. This innovative ethics education transcends traditional paradigms, addressing unique challenges and opportunities in the virtual environment. It prioritizes cultivating metacognitive skills, enabling critical evaluation of actions within the virtual realm. Emphasis on sound judgment is crucial for responsible participation in the Metaverse, while cultivating sensitivity enhances empathy for diverse virtual experiences. Moral responsibility, a focal point, urges adolescents to recognize the impact of their actions in the virtual community, extending the ethos beyond the digital realm to real-world consequences. Kim and Park´s work significantly contributes to a nuanced ethics education framework for adolescents in the ever-evolving Metaverse.

6.3 Philosophical perspectives

Although the dissertation by Zhang et al. (2022) did not include surveys or in-depth interviews with real users, it highlights the relevance of recognising ethics in the Metaverse through case studies, while proposing an ethical educational model for the Metaverse that encompasses competencies, objectives, content and teaching/learning methods, thus contributing to the ethical formation of users in this emerging environment.

Philosophical considerations of ethics in the Metaverse are reflected by Munn and Weijers (2023), as their philosophical perspective addresses the concerns expressed by many philosophers about the human risks associated with the development and use of metaverses. Their analysis focuses on the widely held view that metaverses, as virtual environments, have no meaning or value from a prudential perspective, as the experiences within them are seen as inherently unreal.

The central critique they advance is that the supposed unreality of metaverses is not simply limited to their virtual or intangible nature. Rather, it stems from the notion that what happens in these spaces, regardless of the experiences and opportunities they offer, is somehow diminished in value and different from actions in the physical world. From this perspective, interactions and behaviours in metaverses are perceived as inferior, placing a lower value on the lives of those who actively participate in these platforms.

The central concern of some researchers, discussed by Munn and Weijers, is the possibility that repeated exposure to these diminished virtual experiences could dehumanise users or even worsen their offline interactions. Munn and Weijers, however, disagree with this view, arguing that metaverses are actually morally similar to the physical world and that these virtual environments are capable of providing most of the experiences and interactions we have in the physical world, whether positive or negative. However, they concede that metaverses are not without risk and point out that the real ethical problem in their current incarnation lies in the risks associated with their development as commercial enterprises.

The fundamental criticism focuses on the danger that companies that control the development and maintenance of metaverses tie users to specific infrastructures. The approach they offer to user development would exert influence over users. This in itself poses a real and significant ethical risk, as these companies may have objectives and motivations that differ from the interests of metaverse users (Morandin-Ahuerma, 2023).

Consequently, Munn and Weijers propose the need to carefully consider the governance and development of metaverses, advocating for regulation that avoids the consolidation of power in the hands of corporate entities and ensures the equal participation of users in decision-making about the future of these virtual environments. Other questions remain to be investigated from a cultural and global approach: how different cultures and regions of the world approach ethics in the use of immersive technologies in education; how immersive technologies impact on learning; and how the agents involved in the learning process (teachers, students and parents) participate in the ethical framework.

7 Conclusion and recommendations for future research

This comprehensive review of ethics in the use of immersive technologies in education has highlighted the complexity and multidimensionality of this emerging topic by looking at different perspectives, from policy frameworks to specific proposals for ethical codes and the integration of values in educational programmes.

This study thoroughly examines the ethical implications of integrating immersive technologies into education, demanding a comprehensive perspective that spans academic multidisciplinary viewpoints. The recommended holistic approach, combining legal frameworks, ethical codes, and education programs centered on core values, is highlighted as essential for navigating the complex ethical landscape. As immersive technologies become integral to education,

ongoing research and standardization efforts underscore the dynamic nature of the ethical dimension. Researchers' perspectives vary, with some emphasizing concerns about negative ethical education in response to emerging challenges. Post-implementation, ethical challenges and norms arise, contributing to the continuous expansion of the topic. An in-depth analysis reveals nuanced differences and commonalities between immersive technologies and the Metaverse, emphasizing multifaceted considerations. Legal aspects receive comprehensive coverage in AR, VR, and MxR technologies, while the Metaverse focuses primarily on identity protection and regulatory discussions. Notably, in education, immersive technologies exhibit more advanced ethical concerns, particularly in the responsible use of educational agents, addressing addiction, mental health, misinformation, manipulation, and promoting cultural integration. This succinct exploration underscores the richness and depth of ethical considerations within immersive technologies, setting them apart from the Metaverse.

Therefore, a broad horizon is outlined that aims to set out the ethical challenges associated with digital immersion in education and the approach proposed by several researchers. In this line, Partarakis and Zabulis (2024) recommend that addressing these challenges requires a collaborative and forward-looking approach, along a dedication to ethical practices, inclusive design, promoting technological literacy through education, and establishing frameworks that balance innovation with responsibility.

It is imperative that legal frameworks are effectively implemented to ensure the protection of rights and equity in the use of these technologies. Furthermore, specific ethical codes need to be created for the Metaverse, adding a crucial layer of detail and guidance to ensure ethical practises in virtual interaction and providing clear guidelines for users and developers in this emerging environment.

The philosophical perspective presented by Munn and Weijers (2023) adds an additional layer to the discussion and shifts the focus to governance and power in the development of virtual platforms. This broader approach encourages reflection on how development decisions affect the user experience and emphasizes the importance of avoiding the consolidation of power in the hands of corporations.

Future research is suggested to address the limitations identified, such as the lack of detailed surveys with real users. A better understanding of user experiences and ethical concerns will provide a more solid foundation for the development of effective ethical practices and policies in the field of immersive technologies.

It also emphasizes the importance of continuing to monitor the implementation of the European Declaration on Digital Rights and Principles and to assess its impact on shaping an ethical digital environment. This ongoing evaluation process will allow ethical policies and practices to be adapted and improved as the technological landscape evolves. Similarly, it would be interesting to know the impact of the implementation of the ethical framework and regulations and what the long-term implications are in terms of changes in educational dynamics.

Ultimately, ethics in the use of immersive technologies in education is a dynamic area that requires adaptability and constant reflection. Close collaboration between researchers, policymakers and education professionals will be key to ensuring an ethical and equitable virtual environment for future generations. Promoting ethics in digital immersion is not only a shared responsibility, but also a necessity to ensure a sustainable and ethical educational future.

Data availability statement

The original contributions presented in the study are included in the article, further inquiries can be directed to the corresponding author.

Author contributions

BP-A: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Resources, Visualisation, Supervision, Writing–original draft, Writing–review and editing. FA-R: Conceptualization, Project Administration, Formal Analysis, Funding acquisition, Resources, Validation, Visualisation, Supervision, Writing–original draft, Writing–review and editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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