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Ethical Considerations for Equitable Outcome-Based Education in the Metaverse: A Qualitative Study

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ABSTRACT

The integration of Outcome-based education (OBE) into Metaverse environments promises new opportunities for immersive, authentic, and competency-driven learning experiences. However, it also presents profound ethical challenges, particularly concerning equity, accessibility, privacy, and fairness. This qualitative study investigates two research questions: (1) What ethical concerns do learners and educators identify about implementing OBE in Metaverse environments? (2) What design, policy, and pedagogical practices are recommended to mitigate inequities and value learners' rights and dignity? Semi-structured interviews were conducted with 11 XR experts across education, design, and policy domains. Thematic analysis revealed three primary ethical concerns: digital access inequities, bias in assessment algorithms, and privacy and data governance risk. Recommendations emerging from the study include equity-first design principles, theoretical assessment frameworks, robust data governance policies, and culturally responsive pedagogical approaches. The findings provide an evidence-based framework to guide ethical deployment of OBE in Metaverse learning environments.

1. INTRODUCTION

Outcome-Based Education (OBE) emphasises the achievement of predefined learning outcomes, with curriculum design and assessment processes aligned to ensure mastery for all learners (Spady, 1994). The metaverse—a persistent, interactive, and networked 3D environment experienced through extended reality (XR) technologies—offers unique possibilities for OBE. It enables immersive, authentic learning scenarios in which learners can demonstrate competencies in realistic, context-rich environments (Mystakidis, 2022). The integration of Outcome-Based Education (OBE) within metaverse environments presents a paradigm shift in pedagogical approaches. Yet, it simultaneously introduces complex ethical considerations regarding equity and access (Zallio & Clarkson, 2022). This research examines the perspectives of various stakeholders, including learners and educators, to identify key ethical concerns arising from implementing OBE in these immersive digital spaces. Furthermore, it will propose actionable design, policy, and pedagogical practices intended to mitigate inequities and uphold the fundamental rights and dignity of learners within these rapidly evolving educational ecosystems (Gómez-Zará et al., 2023). The Metaverse,

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characterised by its persistent, interactive, and embodied nature, offers new avenues for educational delivery, allowing learners to engage in personalised and safe virtual realities (López-Belmonte et al., 2023). However, the rapid adoption of metaverse technologies in education, while promising enhanced engagement and novel learning experiences, necessitates a thorough examination of potential challenges, including those related to critical thinking and equitable access (Kaddoura & Husseiny, 2023). Addressing these challenges is paramount to ensure that the benefits of metaverse-enhanced OBE are universally accessible and do not compromise the quality of learning for any demographic (Maghaydah et al., 2024). This paper contributes to the growing discourse on ethical AI in education by specifically focusing on the unique ethical dilemmas arising from the convergence of OBE principles and metaverse technologies (Girvan & Savage, 2012). This includes investigating issues such as data privacy, algorithmic bias, content moderation, and the potential for surveillance capitalism within these virtual learning environments, which are crucial for developing ethical design principles. The immersive and interactive nature of the Metaverse, while offering significant educational advantages, also brings forth concerns related to the psychological and societal impacts on users, necessitating a comprehensive understanding of its implications beyond the technical aspects (Kabilan, 2023). For instance, the ability to break spatial limitations in the Metaverse unlocks unprecedented learning activities, enabling learners to perceive, explore, and create in novel ways (Zhang et al., 2022). This immersive potential, however, must be carefully managed to ensure that these virtual educational environments foster genuine learning and personal growth without introducing new forms of ethical compromise or digital exclusion (Barráez-Herrera, 2022). Moreover, the customisable curricula and gamified learning experiences within the Metaverse, while offering significant pedagogical advantages, also raise questions about the potential for reliance on technology and the limitation of traditional human-centric instructional methods (Kaddoura & Husseiny, 2023). The strategic integration of artificial intelligence within these metaverse platforms can further personalise learning by analysing student data to identify strengths and weaknesses, thus recommending tailored educational pathways and experiences (George & Wooden, 2023). However, this data-driven personalisation also introduces ethical considerations surrounding data privacy, algorithmic transparency, and the potential for biased recommendations that could limit a learner's educational path or reinforce existing societal biases (Marabelli & Lirio, 2024). Existing studies focus on technological design, but few address equity and ethical frameworks. Therefore, a robust ethical framework is essential to navigate these complexities, ensuring that technological advancements in education serve to democratise access and enhance learning outcomes for all, rather than perpetuate or exacerbate existing inequalities.

2. LITERATURE REVIEW

2.1 Outcome-Based Education

Outcome-Based Education is a pedagogical framework that clearly defines the learning outcomes students are expected to achieve by the end of a course or program, shifting the focus from instructional inputs to measurable results. This approach emphasises the demonstration of competency and the application of knowledge rather than mere content recall. The core principle of OBE is that all curriculum, instruction, and assessment should be aligned to these predetermined outcomes, ensuring a coherent and purposeful educational experience. This student-centric model demands that educators design learning activities and assessments directly linked to the desired outcomes, fostering a more targeted and effective learning process (Maghsudi et al., 2021). This educational philosophy defines the precise knowledge and skills students must acquire, thereby establishing clear objectives that enhance the educational process by increasing its concentration and goal-directedness (Bohra et al., 2024). Conversely, the successful implementation of OBE critically depends on the clear and measurable definition of learning outcomes, which can be challenging to articulate effectively, particularly for complex or interdisciplinary subjects (Yu et al., 2017). Despite these challenges, OBE has been widely adopted across various educational levels and disciplines due to its potential to enhance accountability and promote a deeper understanding of subject matter (Srinivasa & Upadhyaya, 2021). Moreover, OBE emphasises the product of what kind of graduate will be produced rather than solely focusing on the educational process, thereby providing a robust framework for

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curriculum evaluation and continuous improvement (Harden, 1999). This approach ensures that learners acquire practical skills, attitudes, knowledge, and values applicable in various real-world situations, moving beyond theoretical knowledge acquisition. It has been noted that OBE interventions positively impact nursing students' competencies, leading to improvements in knowledge acquisition, practical skills, and professional attitudes (Tan et al., 2018). The systematic and valid assessment of transferable skills like communication and teamwork, crucial for an outcome-based approach, remains a complex task, even as OBE has gained widespread acceptance and expanded beyond engineering into fields such as entrepreneurship and accounting (El-Hassan et al., 2024; Othman et al., 2022; Gunarathne et al., 2019). The implementation of OBE in educational institutions necessitates a comprehensive understanding and readiness from educators to adapt their teaching methodologies and assessment practices to align with the outcome-focused paradigm (Raof et al., 2022). This framework has gained prominence as an effective strategy for developing talent and improving the quality of education in various disciplines, including vocational training and business English programs (Qi-shen & Zha, 2021).

2.2 Ethical consideration in education

The integration of advanced technologies, particularly within immersive environments like the Metaverse, introduces novel ethical dilemmas that extend beyond traditional pedagogical concerns, encompassing issues such as digital equity, data governance, and algorithmic fairness. These emerging concerns necessitate a thorough examination of how educational technologies uphold or challenge principles of learner autonomy, privacy, and the equitable distribution of educational resources. For instance, the pervasive collection of biometric and behavioral data in metaverse learning environments raises significant privacy concerns, requiring strict ethical guidelines to protect sensitive learner information from misuse or unauthorised access. Furthermore, the potential for personalised education, while offering substantial benefits in tailoring learning experiences, also introduces challenges related to digital discrimination, which could limit exposure to diverse perspectives and sustain educational diversities (Qushem et al., 2021). Moreover, the increasing commercialisation of educational technology, particularly by entities engaging in surveillance capitalism, introduces a distinct set of ethical challenges related to data monetisation and the potential for exploiting learner data for non-educational purposes (Zeide & Nissenbaum, 2018). These concerns are amplified in the context of Massive Open Online Courses and virtual education providers, which, by operating outside traditional regulatory frameworks, may undermine core educational values such as equal access and self-actualisation (Zeide & Nissenbaum, 2018). The transformative potential of the Metaverse in education, offering immersive and interactive learning experiences, must therefore be carefully balanced against these ethical considerations to ensure that technological advancements genuinely serve to democratise and enhance, rather than compromise, educational equity and integrity.

2.3 The Metaverse in Education

The Metaverse, often described as a persistent, interconnected set of virtual spaces, promises to transform educational delivery by providing immersive and interactive learning experiences that transcend the limitations of traditional 2D online platforms (Zhang et al., 2022). This environment enables dynamic interaction with educational content, allowing learners to engage with abstract concepts through 3D models and augmented realities, thereby deepening their comprehension and fostering participatory learning (Zhang et al., 2022). Leveraging advanced virtual reality and augmented reality devices, the Metaverse merges fantasy and reality into a unified virtual environment, offering a paradigm shift from conventional educational tools (Aloqaily et al., 2022). This transformative potential includes the creation of innovative learning environments that facilitate collaborative and experiential education, potentially addressing the shortcomings of traditional pedagogical approaches (As et al., 2022). Such platforms enable a seamless blend of the physical and virtual, fostering a richer, more engaging learning ecosystem that can adapt to diverse learning styles and needs (Guan et al., 2023). This digital evolution extends the traditional classroom into expansive virtual realms, allowing for global collaboration and access to specialised learning resources previously unavailable (Barráez-Herrera, 2022; Zallio et al., 2023). The integration of virtual

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technologies, such as virtual reality (VR) and augmented reality (AR), into educational settings has been facilitated by the widespread adoption of smartphones and increased investment from major technology companies, making immersive learning experiences more accessible to a broader audience (Luis et al., 2016). The enhanced accessibility of these immersive technologies supports the implementation of outcome-based education principles within metaverse environments by providing diverse pathways for learners to demonstrate mastery of skills and competencies. However, the widespread adoption of AR and VR technologies in education still faces significant hurdles, including high costs, technical constraints, and ethical concerns that necessitate careful consideration and collaborative efforts among stakeholders to ensure equitable access and effective pedagogical integration (Thangavel, 2025). This transformation necessitates a thorough examination of the ethical implications of outcome-based education in metaverse environments, particularly concerning issues of fairness, transparency, and accountability in skill assessment and credentialing (Chalkiadakis et al., 2024).

3. METHOD

This study employed a qualitative research design, specifically utilising semi-structured interviews, to gather in-depth perspectives from key stakeholders. This approach allowed for a rich exploration of the ethical considerations surrounding equitable outcome-based education in metaverse environments, drawing on the lived experiences and expert opinions of participants. Specifically, the interviews aimed to address two primary research questions: 1) What ethical concerns do stakeholders (learners and educators) identify about implementing outcome-based education in metaverse environments, and 2) What design, policy, and pedagogical practices are recommended to mitigate inequities and value learners' rights and dignity. Thematic analysis was employed to systematically identify, analyse, and report patterns within the rich qualitative data gathered from the expert interviews, allowing for the emergence of key ethical considerations and recommended practices (Aydın, 2024). This rigorous analytical approach facilitated a deep understanding of the ethical landscape surrounding outcome-based education in the Metaverse, culminating in actionable insights for policy and design.

3.1 Participation Selection

Participants for this study were purposively selected based on their expertise and practical experience with extended reality technologies, specifically in the context of educational applications or platforms. This intentional sampling strategy aimed to recruit individuals with deep insights into both the technological capabilities and the pedagogical implications of XR in educational settings, ensuring a robust, informed perspective on the ethical considerations. The selection process specifically targeted experts involved in the design, development, or implementation of XR educational tools, thereby encompassing a broad spectrum of experiences and viewpoints (Yang et al., 2020). Given the focus on ethical considerations, participants were chosen for their demonstrated awareness of potential societal impacts and their engagement in discussions surrounding responsible innovation in immersive learning environments. This rigorous selection process aimed to capture a diverse range of perspectives from individuals with substantial knowledge, ensuring that the ethical complexities inherent in metaverse education were explored from multiple vantage points. Therefore, 11 XR experts among seven learners and four educators were selected for this study.

3.2 Data Collection

Data were collected through semi-structured interviews, allowing for an in-depth exploration of participants' experiences and perspectives regarding the ethical implications of outcome-based education within metaverse environments. Each interview was designed to be flexible, enabling the interviewer to pursue emerging themes and delve deeper into areas that are relevant to the research questions, such as the ethical considerations of data collection and interpretation within augmented reality learning analytics. Interviews typically lasted between 60 and 90 minutes and were conducted both physically and virtually

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via secure video conferencing platforms. All interviews were audio-recorded with the explicit consent of the participants and subsequently transcribed to ensure accuracy in data analysis. This approach allowed for the collection of rich qualitative data, capturing expert opinions and their practical recommendations for navigating ethical dilemmas in virtual immersive environments (Knapik, 2006). The data collection also aimed to uncover the experts' perspectives on the ethical challenges associated with the immense amount of data generated within the Metaverse, including issues related to data quality, capture, analysis, and storage.

3.3 Data Analysis

The transcribed interview data were subjected to an iterative thematic analysis (Braun & Clarke, 2006), following a six-phase approach to systematically identify, analyse, and report patterns within the data. This involved familiarization with the data, generation of initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the final report. The analytical process was inductive, allowing themes to emerge directly from the narratives of the XR experts rather than imposing pre-existing theoretical frameworks. Specifically, the analysis focused on identifying recurrent concerns, proposed solutions, and underlying principles articulated by participants regarding the equitable design, implementation, and assessment of OBE within immersive virtual spaces, particularly concerning potential privacy risks. A constant comparative method was employed to refine themes, ensuring they accurately reflected the breadth and depth of the participants' insights while also highlighting areas of divergence or contention. The findings from this analysis aim to contribute significantly to the ongoing discourse on responsible innovation in educational technology, providing a foundational understanding for the development of ethical guidelines and best practices for metaverse-based learning environments.

4. FINDING & DISCUSSION

This section presents the aggregated findings from the semi-structured interviews, enlightening the primary ethical concerns and recommended practices identified by XR experts regarding the implementation of outcome-based education within metaverse environments. These insights are organised around the two primary research questions, providing an understanding of the challenges and opportunities for fostering equitable rights in educational experiences in these evolving digital spaces. The findings highlight the critical importance of balancing technological innovation with ethical foresight to ensure that metaverse-based education serves all learners equitably. The thematic analysis revealed three primary ethical concerns: digital access inequities, bias in assessment algorithms, and privacy and data governance risk.

4.1 Digital Access Inequities

Learners raised concerns about the potential for exacerbating existing social inequalities if access to high-quality metaverse education remains limited to those with advanced technological resources. Digital access inequities remain a significant ethical concern, as disparities in internet connectivity, device availability, and digital literacy can exclude some populations from participating in metaverse educational initiatives (Ramos & Wilson-Kennedy, 2024). This digital divide threatens to worsen existing educational disparities, creating a new form of technological marginalisation that could affect learners from low socio-economic backgrounds and needy communities. Addressing these access challenges is paramount to upholding the principle of educational equity within the Metaverse, requiring targeted interventions and infrastructure development to bridge the technological gap (Wang et al., 2022). This necessitates comprehensive strategies, including subsidised access programs, community technology centers, and digital literacy training initiatives, to ensure that all learners, regardless of their socio-economic status, can equally benefit from the opportunities presented by metaverse education (Ghimire & Edwards, 2024) (Wang et al., 2022). Furthermore, the learners highlighted the potential for an immersive virtual environment to create new forms of harm, such as virtual sexual violence or harassment, which necessitates the development of robust safety protocols and clear reporting mechanisms. Thus, learners suggested the establishment of clear codes

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of conduct and moderation tools to protect learners from online abuse and ensure a safe and respectful virtual learning environment.

Educators articulated a range of ethical challenges, primarily centered on maintaining pedagogical integrity, ensuring equitable access, and adapting teaching methodologies for an immersive digital environment. They emphasised the difficulty of monitoring student engagement and academic honesty in virtual spaces, as traditional assessment methods may prove inadequate or easily avoided. Moreover, educators highlighted the ethical of professional development to adequately prepare faculty for the pedagogical shifts required by metaverse education, ensuring they can effectively leverage new tools while upholding academic standards. Learning materials for metaverse-based education are essential as they require careful consideration of instructional design principles adapted for immersive environments, along with adherence to accessibility standards to ensure inclusivity for all learners. This involves not only technical accessibility but also pedagogical strategies that accommodate diverse learning styles and potential cognitive loads associated with extended reality environments. The development of ethical guidelines for the integration of AI within these immersive educational settings is also crucial to prevent algorithmic bias and ensure equitable access to educational resources for all students.

4.2 Bias in Assessment Algorithms

Moreover, the ethical imperative to address algorithmic clarity in assessment within outcome-based education in the Metaverse is critical, given the profound impact these systems have on learners' academic directions and future opportunities. Algorithmic bias, as noted by various scholars, presents a significant risk, potentially leading to unfair or biased outcomes if not carefully managed through transparent design and continuous auditing. The interaction bias can manifest through the design of Artificial Intelligence (AI)-powered avatars, where certain levels of realism might affect cognitive load or engagement for diverse learners (Haynes, 2025). Moreover, the learners added that pervasive use of AI within Metaverse, while offering personalised learning pathways, introduces concerns about algorithmic bias and the potential for reduced critical thinking if learners become overly reliant on AI-driven solutions. This dependence could shape their cognitive processes, potentially reducing independent problem-solving and creative exploration. Moreover, the use of haptic feedback and other sensory technologies to enhance immersion could inadvertently lead to sensitive or altered perceptions of reality, particularly among younger learners who are still developing their understanding of physical and virtual boundaries. This necessitates careful consideration of the psychological impact of extended metaverse exposure on developing minds, particularly concerning the formation of self-identity and the distinction between virtual and real-world experiences. Additionally, the learners pointed out that the potential for addictive behaviours within highly immersive and gamified metaverse environments presents a significant ethical challenge, potentially diverting learners from real-world responsibilities and fostering unhealthy dependencies.

Educators, on the other hand, articulated concerns regarding the pedagogical efficacy of outcome-based education in a metaverse setting, questioning how to reliably assess complex learning outcomes that extend beyond learning memorisation in highly simulated environments. They also pondered the challenges of maintaining academic integrity and preventing over-reliance on AI-generated content or solutions within an environment where distinguishing human-generated work from AI assistance may become increasingly difficult (Zhai et al., 2024). Furthermore, educators expressed apprehension about the ethical implications of using AI for assessment, particularly concerning potential biases in algorithmic evaluations that could disproportionately affect certain student demographics or learning styles (Pitts et al., 2025). Concerns also emerged regarding the equitable provision of necessary hardware and robust internet connectivity, recognising that differences in access to high-fidelity virtual reality equipment could increase existing educational inequities (Wood, 2023). Moreover, the environmental impact of powering such resource-intensive virtual environments and their associated hardware also presents an ethical concern, particularly regarding sustainability and energy consumption in the context of global resource allocation. They also highlighted the importance of robust data security protocols to safeguard sensitive learner data within these expansive digital ecosystems.

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4.3 Privacy and Data Governance Risk

Learners expressed significant concern regarding their digital autonomy and data privacy within metaverse educational platforms, with concern about pervasive tracking of their academic progress and personal interactions. They also voiced concerns about the potential for behavioral manipulation through gamified learning elements and the erosion of genuine social interaction in favor of simulated experiences (Kaddoura & Husseiny, 2023). Furthermore, learners highlighted anxieties about the long-term psychological effects of extensive metaverse engagement, including potential addiction or detachment from physical reality, and the implications of persistent digital identities on personal development. A significant concern among learners was also the potential for their personal data, including biometric information and academic performance metrics, to be collected and exploited by third parties without their explicit consent or clear understanding of its usage (Mónaco & Sacchi, 2023). Moreover, the potential for digital avatars, which can reflect aspects of a user's identity, to be leveraged for monitoring emotional signs and expressions further amplifies privacy concerns and the potential for a reduction in authentic interaction. The ethical implications extend to the potential for exploratory data collection through biometric sensors embedded in virtual reality devices, which could capture sensitive physiological and emotional responses without explicit consent or adequate oversight. Such concerns underscore the critical need for robust data governance frameworks, transparent data handling practices, and clear consent mechanisms to protect learners' digital rights within metaverse educational environments.

Furthermore, the educators indicate that the power dynamic between educational institutions and learners requires careful consideration of informed consent, especially when sensitive personal and biometric data are continually collected and analysed within these immersive environments. This dynamic underscores the critical need for transparent data handling practices and robust ethical frameworks to ensure that learners understand the implications of their participation and can exercise meaningful control over their digital identities and personal information. The educators highlighted that navigating the complexities of intellectual property and data ownership within the Metaverse presents significant challenges, particularly concerning user-generated content and the commercialisation of educational resources. They suggested that there is a need for clear policies regarding content creation and distribution, and mechanisms for dispute resolution and fair compensation for creators.

5. CONCLUSION

This paper has explored the ethical considerations surrounding the implementation of Outcome-Based Education (OBE) within metaverse environments, drawing insights from diverse stakeholders. The findings underscore the urgent need for a multi-faceted approach involving thorough design, robust policy, and innovative pedagogical practices to ensure equitable outcomes and safeguard learner autonomy in these emergent digital spaces. Future research will focus on empirical validation of the proposed mitigation strategies through case studies and pilot programs within active metaverse learning platforms, alongside longitudinal studies to assess the long-term ethical implications for diverse learner populations. Furthermore, the development of comprehensive ethical frameworks specifically tailored to metaverse education, incorporating principles of digital human rights and algorithmic fairness, will be crucial in guiding future innovations. This ongoing investigation seeks to establish a foundational understanding of the ethical landscape, thereby informing the development of best practices and regulatory measures to ensure the Metaverse serves as an equitable and empowering educational frontier for all. Moreover, continuous interdisciplinary collaboration among technologists, educators, ethicists, and policymakers will be essential to proactively address unforeseen ethical dilemmas as metaverse technologies evolve. For instance, institutions should establish data governance committees for data and privacy. The insights gained from this study will be instrumental in shaping the ethical governance and responsible innovation of OBE in the Metaverse, ensuring that technological advancements align with human-centered values and promote equitable access to quality education. This will foster a learning environment that not only leverages the immersive potential of the Metaverse but also upholds the highest standards of ethical responsibility and social equity (Girvan & Savage, 2012). This will involve iterative refinement of design principles, policy

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frameworks, and pedagogical strategies to adapt to the evolving capabilities and societal implications of metaverse technologies (López-Belmonte et al., 2023; Mystakidis, 2022). This holistic approach will ensure that the Metaverse genuinely enhances educational outcomes for all learners, particularly within outcome-based frameworks, by proactively addressing potential pitfalls and leveraging its unique affordances for equitable learning.

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CONFLICT OF INTEREST STATEMENT

The authors agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts, and declare the absence of conflicting interests with the funders.

AUTHORS' CONTRIBUTIONS

Aidrina Sofiadin solely designed and carried out the research, wrote and revised the article.

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