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Metaverse Oriented Civic Learning in Civic Education: Integrating Augmented Reality, GCED, and Project Citizen to Strengthen Global Diversity Character

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Abstract: This article aims to develop and examine the integration of Augmented Reality (AR), Global Citizenship Education (GCED), and Project Citizen as a metaverse-oriented civic learning experience to strengthen Indonesian students' global diversity character. The study employed a Research and Development design using the ADDIE model and was implemented through trials in three junior secondary schools in Bandung, Indonesia. Data were collected through curriculum document analysis, questionnaires, in-depth interviews, expert validation, classroom implementation notes, and thematic analysis. The findings indicate that AR-GCED based on Project Citizen functions not merely as a media innovation, but as a pedagogical design that connects immersive visualization, value reflection, public inquiry, social dialogue, digital portfolios, and civic action. Visual, narrative, and interactive components, including global-issue videos, digital avatars, chatbots, digital portfolios, and written reflections, enabled students to engage with global diversity issues in more concrete, contextual, and participatory ways. The implementation indicated improvements in students' understanding of local-global relations, intercultural empathy, tolerance, global perspectives, anti-discrimination awareness, and civic participation. The main contribution of this article lies in the formulation of the Conceptual Framework of Metaverse-Oriented Civic Learning in Civic Education, which positions civic education as the core, civic knowledge, civic skills, and civic dispositions as the main competencies, pedagogical processes as the bridge for competence development, and the metaverse as a learning ecosystem that expands civic learning experiences. Thus, the metaverse is not positioned merely as a tool or digital medium, but as a pedagogical process capable of reaching the core of civic education.

Keywords: Augmented reality; Global citizenship education; Metaverse; Global diversity character; Civic education

1. Introduction

The development of globalization has placed Indonesian students within an increasingly interconnected social reality shaped by complex, fluid, and mutually influencing global dynamics [1-4]. In this context, education can no longer be limited to providing students with normative civic knowledge; it must also cultivate the character needed to understand diversity, respond to humanitarian issues, and participate responsibly in global society [5-7]. Global diversity character is therefore increasingly important, as students live in social spaces marked by cultural,

religious, linguistic, and identity pluralism, as well as cross-border flows of digital information [8-12].

In the Indonesian context, strengthening global diversity character has a strong philosophical foundation, as Pancasila places humanity, unity, justice, and respect for diversity at the core of national life [13-17]. Global diversity should not be understood as a foreign concept detached from national identity, but rather as a reflective extension of Pancasila values in an increasingly interdependent world [18-22]. Nevertheless, the enactment of diversity values among students continues to face serious challenges, as discrimination, intolerance, social stereotyping, exclusivism, digital polarization, and intolerant narratives remain present in students' social interactions [23-30].

The urgency of strengthening global diversity character is also reflected in various humanitarian problems, identity-based discrimination, climate change, migration, social inequality, and humanitarian crises. These issues show that students need the capacity to read global problems critically, empathetically, and multidimensionally [31-38]. Civic education, therefore, needs to broaden its orientation from forming nationally obedient citizens toward cultivating global citizens who understand the interconnections among local, national, and global issues [6,7,39].

Global Citizenship Education (GCED) offers a relevant pedagogical framework because it emphasizes the development of cognitive, socio-emotional, and behavioral dimensions in forming critical, caring, and responsible global citizens [5,6,40]. In Indonesia, GCED can strengthen Pancasila and Civic Education by broadening the range of issues addressed, deepening reflective learning experiences, and connecting Pancasila values with global humanitarian concerns [2,41,42]. However, the implementation of GCED in schools often remains conceptual, textual, and insufficiently connected to students' lived realities. This condition requires a pedagogical approach capable of transforming global knowledge into participatory, contextual, and action-oriented learning experiences [21,43-46].

Project Citizen is one relevant model for addressing this need because it positions students as active subjects who identify public problems, analyze policy alternatives, formulate solutions, and present recommendations in the form of civic action [47-49]. The model aligns with GCED principles, as it enables students to connect local issues with global concerns through inquiry, critical dialogue, collaboration, and social reflection [50-52]. Through Project Citizen, global diversity is not merely learned as a concept but practiced through public problem analysis and student engagement in developing solutions grounded in humanity, justice, and social responsibility [53,54].

At the same time, the growth of immersive technologies opens new possibilities for civic education to offer learning experiences that are more visual, interactive, and contextual [55-58]. Augmented Reality (AR) can display virtual objects within real-world environments, enabling students to understand abstract concepts through more concrete visual and interactive experiences [59-61]. In the context of GCED, AR has the potential to bring global issues such as humanitarian conflict, migration, discrimination, and climate change into the classroom through immersive experiences that stimulate empathy, reflection, and civic action [62-67].

This article positions AR as part of a new direction in metaverse-oriented civic learning. The metaverse is understood as an ecosystem of human technology interaction that connects physical and virtual spaces through immersive, interactive,

and realistic digital experiences [68-70]. Accordingly, the integration of AR into GCED-based Project Citizen can be understood as an initial step toward metaverse-oriented civic learning, namely a form of civic learning that combines physical reality, digital representation, immersive experience, value reflection, and students' social action [67,71-73].

Although the educational metaverse is frequently associated with persistent virtual worlds, embodied avatars, multi-user interaction, and immersive three-dimensional environments, contemporary scholarship increasingly recognizes that metaverse-based education should also be understood as an evolving pedagogical continuum rather than a fixed technological endpoint. Recent studies argue that immersive technologies—including augmented reality, virtual reality, artificial intelligence, digital avatars, and intelligent interactive systems—represent complementary technological layers that gradually contribute to the realization of metaverse learning ecosystems rather than functioning as isolated innovations. From this perspective, educational innovations should be evaluated not solely according to the completeness of their technological infrastructure, but also according to the extent to which they transform learning experiences into immersive, interactive, collaborative, and learner-centered pedagogical processes. Accordingly, this study intentionally positions Project Citizen-based AR-GCED as an initial pedagogical step toward metaverse-oriented civic learning, providing the conceptual foundation upon which more comprehensive metaverse environments may subsequently be developed.

Previous studies have discussed GCED, Project Citizen, AR, and the metaverse in education, yet a gap remains in integrating these four elements within a single pedagogical framework for strengthening global diversity character. Studies on GCED have largely emphasized global awareness, empathy, and social responsibility, while studies on Project Citizen have focused more on democratic participation and public problem-solving [6,39,47,53,74]. Meanwhile, research on AR in education has generally focused on enhancing motivation, conceptual understanding, and learning interactivity, and has not yet specifically positioned AR as an entry point toward metaverse-oriented civic learning that brings together epistemic, affective, and axiological dimensions in global civic education [61,75-77].

Existing AR-based educational models have predominantly emphasized immersive visualization, learning motivation, conceptual understanding, and user engagement. Although these contributions have demonstrated the pedagogical value of AR, they generally position immersive technology as an instructional medium rather than as an integrated pedagogical ecosystem. In contrast, the present study conceptualizes metaverse-oriented civic learning as a pedagogical architecture that systematically integrates immersive technologies with civic competencies, Global Citizenship Education (GCED), Project Citizen, reflective inquiry, digital interaction, and civic action. Accordingly, the proposed framework extends existing AR-based educational models beyond immersive visualization by positioning technology as a catalyst for the integrated development of civic knowledge, civic skills, civic dispositions, and global diversity character.

This article aims to develop and examine the integration of Augmented Reality, Project Citizen, and GCED as a metaverse-oriented civic learning experience to strengthen Indonesian students' global diversity character. This integration is not positioned merely as the use of technology in learning, but as a pedagogical design that connects immersive visualization, value reflection, public inquiry, and civic action. The main contribution of this article lies in the formulation of a metaverse-

oriented civic learning framework that expands civic education from a textual orientation toward learning experiences that are visual, immersive, reflective, participatory, and oriented toward civic action.

2. Materials and methods

2.1 Global Diversity Character and Global Citizenship Education in Indonesian Civic Learning

Global diversity character refers to a civic disposition that integrates knowledge of diversity, moral sensitivity toward difference, intercultural empathy, and the readiness to act fairly in plural and interconnected societies [8,10,78,79]. In civic education, global diversity should not be understood merely as a cognitive competence for recognizing differences in culture, religion, language, or social identity. Rather, it should be positioned as a character formation process that encompasses cognitive, socio-emotional, and civic behavioral dimensions [6,7]. Strengthening global diversity therefore requires education that cultivates tolerance, empathy, respect for human dignity, human rights literacy, and social responsibility as the foundation for living together in plural societies [80-83].

In the Indonesian context, global diversity has strong philosophical legitimacy because Pancasila places humanity, unity, deliberation, social justice, and respect for diversity at the foundation of national life [15-18]. Global diversity does not stand in opposition to national identity; rather, it can be understood as an extension of Pancasila values in an increasingly interdependent world [19-21]. Indonesian nationalism within the framework of Pancasila is also humanistic and inclusive, as it opens space for dialogue between love of country, human solidarity, and global responsibility [18,42,84,85]. Indonesian students therefore need to be formed as Pancasila-based citizens who are rooted in national values while also being able to understand humanitarian issues, social justice, peace, sustainability, and human rights within a global horizon [2,86].

Global Citizenship Education (GCED) provides a relevant pedagogical framework because it understands citizenship not merely as a legal status within the state, but as a moral, social, and participatory awareness that individuals live within an interdependent global community [39,87-91]. UNESCO conceptualizes GCED through three main dimensions: the cognitive dimension, which concerns understanding local, national, regional, and global issues; the socio-emotional dimension, which develops empathy, solidarity, and a sense of belonging to a shared humanity; and the behavioral dimension, which emphasizes ethical, responsible, and effective action for a more peaceful, just, and sustainable world [6]. The OECD further strengthens this framework through the concept of global competence, which includes the ability to examine local and global issues, understand others' perspectives, interact openly across cultures, and act for collective well-being and sustainable development [7].

The relevance of GCED to Civic Education lies in their shared orientation toward forming citizens who are character-driven, responsible, inclusive, and capable of living in plural societies [24,41,92]. GCED enriches Indonesian civic education by bringing issues such as climate change, migration, social inequality, identity conflict, discrimination, human rights, and sustainability into learning while remaining rooted in Pancasila values [2,42,85,86]. However, the implementation of GCED in schools still faces challenges, as civic education often remains textual, normative, and insufficiently connected to students' lived experiences [21,41]. Strengthening global

diversity character therefore requires an approach capable of transforming values from conceptual knowledge into reflective, participatory, immersive, and action-oriented learning experiences [6,7,90].

2.2 Project Citizen as Participatory Pedagogy for Global Civic Action

Project Citizen is a participatory pedagogy that is highly relevant for strengthening GCED because it positions students as active agents in identifying public problems, selecting issues, collecting data and information, formulating solutions and action plans, developing portfolios, presenting their work, and reflecting on the learning process [47,53]. Within the context of GCED, Project Citizen functions not only as a project-based learning model, but also as a form of civic praxis that connects local issues with global concerns in reflective and responsible ways [50,51]. This model addresses a common limitation in civic education, where democratic values, justice, diversity, and social responsibility are often taught normatively without being grounded in concrete practical experience [44,45].

The integration of GCED into Project Citizen broadens the orientation of learning from civic knowledge toward global civic action. GCED provides a value foundation rooted in humanity, solidarity, sustainability, social justice, and respect for diversity, while Project Citizen offers a pedagogical procedure for translating these values into inquiry, dialogue, portfolio development, and civic action [6,46,52]. Through Project Citizen, global issues such as intolerance, discrimination, climate change, migration, social inequality, peace, and human rights can be reframed as public problems that are close to students' lives in schools, communities, and digital spaces [52,54]. In this way, students learn that global problems are not distant from their everyday realities, but are present in social relations, school policies, intergroup interactions, digital behavior, and concern for the surrounding environment [46,54].

Pedagogically, Project Citizen strengthens critical thinking, communication, collaboration, decision-making, and social responsibility by training students to become problem-solvers who analyze public issues, evaluate evidence, understand diverse perspectives, and engage in dialogue with stakeholders [47,54,93]. The model is also relevant to character education because students are not merely asked to choose correct answers; they are encouraged to weigh competing interests, understand the social consequences of policies, and make decisions based on justice, diversity, and humanity [94,95]. Thus, Project Citizen supports the formation of global diversity character through deliberative experiences that connect knowledge, empathy, moral reflection, and social responsibility [53].

In this article, Project Citizen is positioned as a method and a bridge between GCED and metaverse-oriented civic learning. GCED provides value orientation and a global perspective, Project Citizen offers an action structure that prevents learning from stopping at conceptual understanding or digital visualization, while AR enriches the learning experience through immersive visual representation. Through this integration, students do not simply observe global issues through technology; they process them through public problem analysis, group discussion, portfolio development, and social action [6,47,53]. Project Citizen therefore ensures that the integration of technology in civic education does not become a purely technological experience, but remains oriented toward character formation, democratic participation, and civic responsibility [44-46].

2.3 Augmented Reality and Metaverse-Oriented Civic Learning

The development of digital technology has transformed the ways students access, experience, and make sense of knowledge. The Fourth Industrial Revolution

has introduced artificial intelligence, big data, the Internet of Things, robotics, virtual reality, and augmented reality, pushing education to move beyond conventional instructional patterns toward more adaptive, interactive, visual, and technology-supported learning experiences [55,96]. In this context, technology should not be positioned merely as an instructional aid, but as part of a pedagogical ecosystem that shapes how students interact with knowledge, values, and social realities [57]. Accordingly, the integration of technology in civic education should not be directed only at increasing the attractiveness of learning, but also at strengthening reflection, participation, empathy, and civic action.

The metaverse has become an important concept in educational technology discourse because it offers a digital ecosystem that connects physical and virtual spaces through interactive, immersive, real-time, and collaborative experiences [97]. The term metaverse was introduced by Stephenson in *Snow Crash* to describe a large-scale virtual environment in which humans interact through digital avatars [68]. In contemporary developments, the metaverse is understood not as a single technology, but as an ecosystem that integrates virtual reality, augmented reality, artificial intelligence, internet connectivity, avatars, simulations, and virtual environments to create realistic and participatory digital experiences [69-72]. In civic education, this opportunity is significant because global issues such as identity conflict, discrimination, migration, climate change, and social injustice are often abstract and distant from students' immediate experiences, and therefore require visual, simulative, and reflective representations [67,98].

AR holds a strategic position within the framework of metaverse-oriented learning because it connects the real world with virtual objects simultaneously. AR enables students to remain within their physical environment while receiving additional information, objects, narratives, avatars, or digital simulations that enrich their perception and learning experience [59,60]. In learning contexts, AR helps make abstract concepts more concrete through visualization, direct interaction, and multimodal representations that are easier to understand [61,99-101]. In the context of GCED, AR can bring global issues such as humanitarian conflict, migration, climate change, discrimination, and social inequality closer to students in visual, narrative, and interactive ways, thereby stimulating curiosity, empathy, and moral reflection [62,64,65].

The strength of AR in civic education lies in its ability to connect digital visualization with value reflection and civic action. Global diversity issues that are usually delivered through texts, lectures, or discussion can be presented through visual-interactive experiences that allow students to observe, explore, interpret, and discuss problems more actively [59,61,99]. However, AR-based learning should not stop at the appeal of technological experience, because character formation requires cognitive, affective, reflective, and behavioral engagement [6,7,66,102]. AR therefore needs to be integrated with GCED as a value foundation and Project Citizen as an action structure, so that immersive experience can develop into global awareness, intercultural empathy, critical dialogue, portfolio development, and civic participation [47,53].

In this article, metaverse-oriented civic learning is understood proportionally as a form of civic learning that uses AR to create immersive digital experiences, integrates GCED to build a global value orientation, and employs Project Citizen to guide students toward civic action. AR-GCED based on Project Citizen can be positioned as an initial step toward metaverse-oriented civic learning because

it already contains the integration of physical and digital spaces, immersive visualization, interaction with digital objects, guided reflection, and social action based on public problems [67,70,71]. Thus, the theoretical contribution of this article lies in positioning AR not merely as a digital medium, but as an entry point toward civic learning that is visual, reflective, participatory, and transformative in strengthening global diversity character.

Unlike conventional AR-based learning models that primarily focus on enhancing visualization, motivation, or conceptual understanding, the proposed framework conceptualizes immersive technologies as pedagogically interconnected components within a metaverse-oriented learning ecosystem. Rather than treating AR, avatars, chatbots, and digital portfolios as isolated technological features, this framework integrates them with GCED values, Project Citizen pedagogy, reflective learning, and civic participation. Consequently, the contribution of this study extends beyond technological implementation by proposing a pedagogical architecture that explains how immersive technologies collectively support the formation of civic competencies within an evolving metaverse-oriented educational environment.

2.4 Methods

This study employed a Research and Development (R&D) design using the ADDIE model, which consists of the stages of Analysis, Design, Development, Implementation, and Evaluation. The ADDIE model was selected because it provides a systematic framework for guiding the development of learning design, beginning with needs analysis, followed by instructional design, the development of AR-GCED content, expert validation, limited trials, and evaluation of learning impact [103,104].

The study was implemented through limited trials at SMPN 2 Bandung, SMPN 12 Bandung, and SMPN 30 Bandung. Data were collected through curriculum document analysis, questionnaires, in-depth interviews, expert validation, and classroom implementation notes. These data were used to map learning needs, develop the Project Citizen-based AR-GCED design, and assess its feasibility and impact on students' understanding of global diversity issues, intercultural empathy, tolerance, global perspectives, and engagement in civic action.

Participants were recruited using purposive sampling because the study aimed to evaluate the feasibility and pedagogical implementation of the proposed learning model within authentic classroom settings. The participating schools were selected based on their willingness to implement AR-supported civic learning, the availability of the required technological infrastructure, and recommendations from local educational authorities. Students participated voluntarily with permission from the participating schools and classroom teachers. This recruitment strategy ensured that the implementation reflected realistic educational contexts appropriate for developmental evaluation rather than statistical generalization.

The implementation stage involved three junior secondary schools in Bandung. The developmental evaluation included 91 students who participated in the user experience assessment at SMPN 12 Bandung, while the classroom implementation and qualitative evaluation involved 27 ninth-grade students from the three participating schools, together with civic education teachers and expert validators. These participants contributed different forms of evidence according to the objectives of each ADDIE phase, including usability evaluation, classroom implementation, pedagogical validation, and qualitative reflection.

To avoid ambiguity, participants were involved in different phases of the ADDIE model. The 91 students participated in the user experience evaluation, whereas the 27

ninth-grade students were involved in the classroom implementation and qualitative evaluation. In addition, expert validators and civic education teachers participated exclusively in the validation and feasibility assessment phases.

Data were analyzed descriptively, qualitatively, and thematically. Descriptive analysis was used to identify learning needs and patterns in students' responses, while thematic analysis was used to interpret interview data, expert validation results, and students' learning experiences. The validity of the development process was strengthened through expert validation and iterative revisions, which indicated that Project Citizen-based AR-GCED learning was theoretically, pedagogically, and technologically feasible. Its implementation further demonstrated that the integration of AR, GCED, and Project Citizen can create visual, immersive, reflective, and participatory learning experiences for strengthening global diversity character.

Expert validation was conducted by six validators consisting of two civic education/GCED experts, two educational technology and augmented reality experts, and two experienced junior secondary school civic education teachers. The evaluation focused on four criteria: (1) content relevance and conceptual accuracy, (2) pedagogical appropriateness, (3) media design and usability, and (4) technical functionality. Feedback obtained from each validation stage was systematically incorporated through iterative revisions before the classroom implementation phase.

The quantitative evaluation focused primarily on descriptive indicators derived from user experience questionnaires, including students' learning interest, perceived usefulness, learning engagement, usability, comfort, and perceived content relevance. Rather than measuring intervention effectiveness, these indicators were used to evaluate the usability and pedagogical feasibility of the proposed AR-GCED model during the implementation phase. The quantitative findings were subsequently interpreted alongside qualitative evidence obtained from interviews, classroom observations, implementation notes, and expert validation through methodological triangulation, thereby providing a comprehensive assessment of the developmental process.

The validation process was conducted iteratively throughout the Development phase of the ADDIE model. Three groups of validators participated: (1) civic education and GCED experts who evaluated conceptual accuracy and content relevance, (2) educational technology and AR specialists who assessed interface design, usability, and technical functionality, and (3) experienced civic education teachers who evaluated classroom applicability and pedagogical feasibility. Feedback from each validation cycle was systematically incorporated into subsequent revisions before classroom implementation.

Because this study adopted a Research and Development (R&D) design, the objective of the implementation phase was to evaluate the feasibility, usability, and pedagogical validity of the developed learning model rather than to measure intervention effectiveness through experimental comparison. Therefore, the empirical findings were generated through methodological triangulation involving questionnaires, expert validation, classroom observations, implementation notes, interviews, and thematic analysis. Future studies employing quasi-experimental or experimental designs are needed to provide stronger statistical evidence regarding learning effectiveness.

3. Results and discussion

3.1. AR-GCED Design as a Metaverse-Oriented Civic Learning Experience

The findings show that Project Citizen-based AR-GCED was designed as

a civic learning experience that integrates values, technology, and social action. The development of AR-GCED involved two main dimensions: the conceptual-pedagogical dimension and the technical-productive dimension. The conceptual-pedagogical dimension served as the basis for designing learning experiences, competency structures, and the Project Citizen syntax, while the technical-productive dimension guided the development of visual, narrative, and interactive content. AR-GCED, therefore, was not positioned merely as a digital application, but as a pedagogical design that connects immersive experience, value reflection, and civic participation. This interpretation is consistent with the view that learning technologies become meaningful when they do not merely enhance visual appeal, but also strengthen active, contextual, and purpose-oriented learning experiences [57,61,67].

Conceptually, the AR-GCED design was developed through constructivist, participatory, and action-oriented approaches. The constructivist approach positions students as subjects who construct meaning through experience and reflection. The participatory approach provides space for students to engage in dialogue, collaborate, and participate in public problem-solving. The action-oriented approach emphasizes that GCED should not stop at understanding global issues, but should encourage ethical action and social participation [6,7,47,53]. Within this framework, AR-GCED can be understood as an early form of this pedagogical approach, combining immersive visualization, value reflection, and civic action within a single learning experience.

Figure 1 illustrates the relationship between GCED as a value foundation, Project Citizen as a pedagogical syntax, AR as an immersive medium, and global diversity character as the intended learning outcome. GCED provides value orientations such as humanity, empathy, tolerance, respect for diversity, and global responsibility. Project Citizen offers a learning sequence based on identifying public problems, collecting data, engaging in dialogue, developing portfolios, and carrying out civic action. AR provides visual and interactive representations that enrich the learning experience. The integration of these three elements reflects a shift from textual learning spaces toward hybrid learning spaces that connect the physical and digital worlds [6,7,68-70].

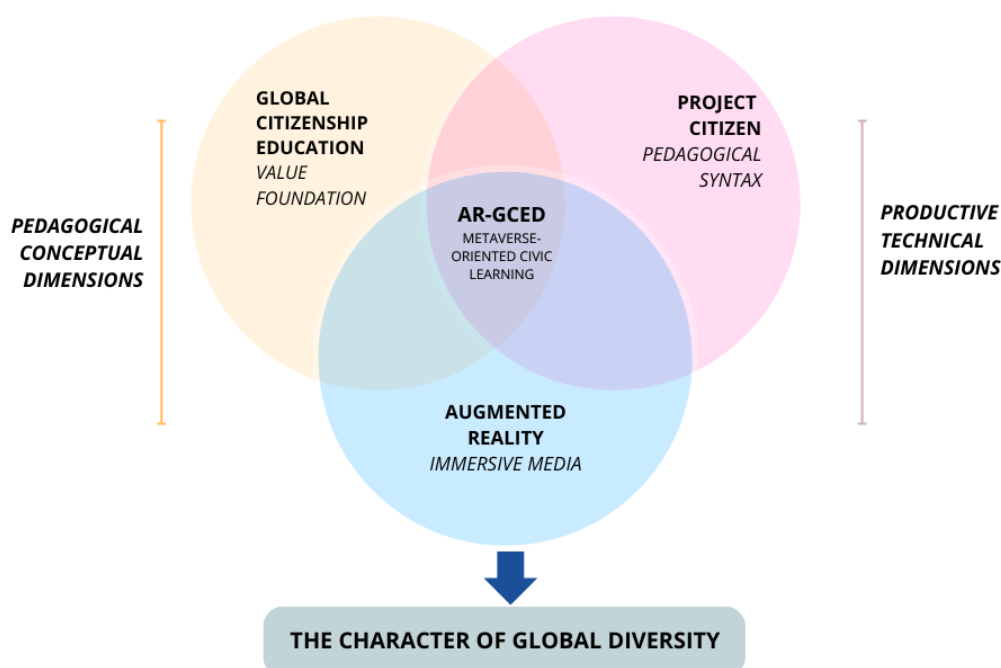


Figure 1. AR-GCED Design Framework as Metaverse-Oriented Civic Learning.

The initial needs analysis showed that the use of AR had a positive impact on the cognitive domain, but was not yet sufficiently effective in developing global diversity character in the affective and psychomotor domains. This finding became the basis for developing a more comprehensive AR-GCED design, as character learning cannot rely merely on introducing cultural objects or providing visual experience. It must also develop understanding, empathy, moral reflection, and social action. In this context, AR-GCED was developed in response to the limitations of AR use that remained focused on object visualization, shifting toward the use of AR as a reflective, participatory, and transformative pedagogical medium [59,61,67].

User experience data from 91 students at SMPN 12 Bandung indicated that AR has the potential to increase students' interest, comfort, engagement, and understanding in learning global diversity. However, the data also showed that usability and ease of use still need to be strengthened to make digital learning experiences more student-friendly. The summary of user experience findings is presented in **Table 1**. **Table 1** shows that students' experiences with AR were generally positive, particularly in terms of interest, perceived usefulness, engagement, and content relevance. Nevertheless, the findings on ease of use indicate that AR-based learning design must pay careful attention to accessibility, navigation, and user experience so that technology does not become a barrier to learning. From this pedagogical perspective, immersive experience should begin with student engagement, but it should not stop at visual enjoyment. Digital experience needs to be directed toward value understanding, reflection, dialogue, and social action [57,68-70].

Table 1. Summary of User Experience Components in the Use of AR for Global Diversity Learning.

Main Component	Indication of Findings	Pedagogical Meaning
Learning interest and emotion	Students showed positive emotional responses and perceived learning as more engaging.	AR can increase motivation and improve the learning atmosphere.
Perceived usefulness	Students viewed AR as helpful for understanding global diversity and global issues.	AR strengthens initial understanding of abstract concepts.
Learning engagement	Students were more active when using AR and responding to visual-interactive content.	AR encourages engagement in learning.
Usability and comfort	The application was relatively comfortable to use, although ease of use still needs improvement.	AR design needs to consider accessibility, navigation, and usability.
Content relevance	Information was perceived as relevant, interactive, and supportive of global diversity learning.	AR content aligns with the needs of value-based and global issue learning.

In addition to user experience data, the AR-GCED design was developed through the mapping of visual, narrative, and interactive elements against GCED domains. This mapping shows that each technological element in AR-GCED carries a pedagogical function in strengthening students' cognitive, socio-emotional, and behavioral dimensions. **Table 2** further shows that AR-GCED has a pedagogical structure that extends beyond the mere presentation of digital media. Visual elements make global issues more concrete, narrative elements guide students' value reflection,

and interactive elements encourage inquiry and documentation of civic action. Thus, immersive technology becomes meaningful when it is organized within a framework of values, pedagogy, and civic participation [6,7,47,53,59,61].

Table 2. Mapping of Visual, Narrative, and Interactive Elements in the AR-GCED Design.

Design Element	Pedagogical Function	GCED Domain	Meaning in Metaverse-Oriented Civic Learning
Global-issue videos	Present global issues in concrete and contextual ways.	Cognitive	Build immersive issue visualization.
Digital avatar	Guide students and model empathy.	Socio-emotional	Create dialogic human–technology interaction.
UI/UX design	Facilitate access and improve learning comfort.	Cognitive and socio-emotional	Create a user-friendly digital experience.
Avatar dialogue	Foster moral reflection, empathy, and global perspectives.	Socio-emotional	Encourage guided reflective interaction.
Digital portfolio	Direct students toward public problem analysis and solutions.	Behavioral	Connect digital experience with civic action.
Data-search chatbot	Support information exploration and digital literacy.	Cognitive	Support inquiry in an interactive learning environment.
Digital reflection	Strengthen value internalization and follow-up planning.	Socio-emotional and behavioral	Connect immersive experience with character transformation.

Beyond demonstrating the feasibility of integrating AR, GCED, and Project Citizen, these findings also contribute to the evolving discourse on educational metaverse research. Existing metaverse studies frequently emphasize technological sophistication, including virtual reality, persistent virtual environments, and multi-user interaction. In contrast, the present findings suggest that the educational value of metaverse-oriented learning should primarily be understood through pedagogical transformation rather than technological complexity. The integration of immersive visualization, reflective inquiry, civic dialogue, and participatory action illustrates that foundational metaverse characteristics may emerge through pedagogically meaningful learning experiences even before fully immersive virtual ecosystems are implemented. Consequently, this study extends current metaverse literature by proposing a pedagogically grounded interpretation of metaverse-oriented civic education.

The theoretical advancement proposed in this study therefore differs from previous AR-based educational research. Earlier studies generally evaluate AR as an instructional technology that improves visualization, engagement, or conceptual understanding. In contrast, the present framework positions immersive technologies as pedagogically interconnected components that collectively support reflective inquiry, collaborative learning, civic participation, and character formation. This shift from technology-centered implementation toward pedagogy-centered integration represents the principal contribution of the proposed metaverse-oriented civic learning framework.

Figure 2 presents the flow of AR-GCED learning experiences, beginning with exposure to global issues through AR, followed by dialogue with avatars, public problem identification, group discussion, portfolio development, value reflection, and civic action planning. Within the Project Citizen framework, students learn to identify

problems, search for data and information, examine alternative solutions, develop action plans, and present their ideas. Within the GCED framework, students learn to understand global issues, develop empathy, appreciate different perspectives, and build social responsibility. Within metaverse-oriented learning, students learn through a digital environment that is visual, interactive, reflective, and connected to real action [6,7,47,53,68-70].

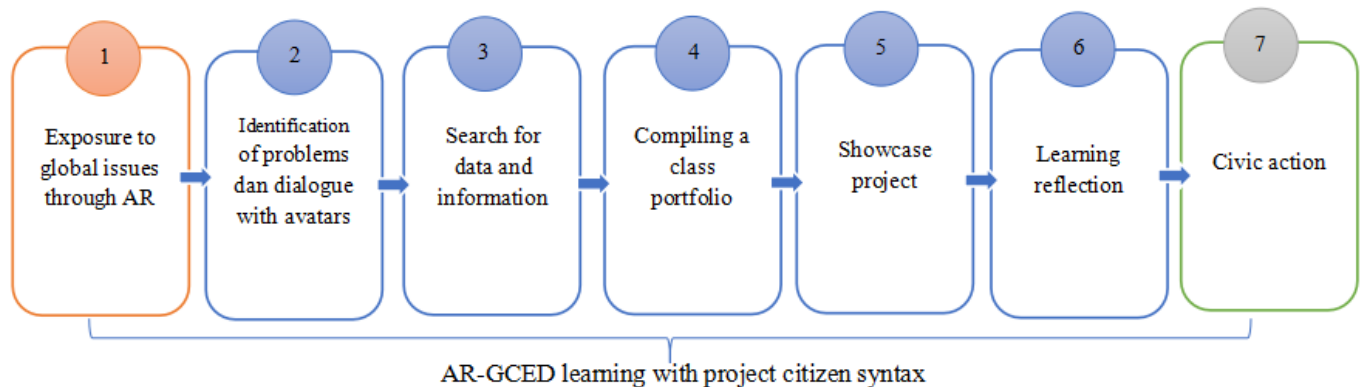


Figure 2. Flow of AR-GCED Learning Experiences Based on Project Citizen.

The AR-GCED design reflects four main principles of the proposed framework. First, immersive issue visualization refers to the use of AR to present global issues visually and contextually. Second, guided reflective interaction refers to the use of avatars, dialogue, chatbots, and digital navigation to guide students' reflection. Third, participatory civic inquiry refers to the use of Project Citizen to direct students toward public problem analysis and civic dialogue. Fourth, civic action documentation refers to the use of digital portfolios and written reflections to document the learning process and its outcomes. These four principles show that AR-GCED does not merely provide digital experience, but also directs students toward concrete civic practice [6,7,47,53,59,61].

The discussion of these findings reveals three main forms of coherence in the AR-GCED design. First, normative coherence is reflected in the design's grounding in Pancasila values, particularly humanity, unity, social justice, and respect for diversity. Second, pedagogical coherence is reflected in the integration of GCED as a value foundation, Project Citizen as a participatory syntax, and AR as an immersive medium. Third, empirical coherence is reflected in the fact that the design was formulated based on needs analysis, user experience data, and the mapping of learning elements. This coherence is important to ensure that technological innovation does not emerge from technological assumptions alone, but from students' needs and real learning contexts [6,7,13,57].

Thus, Project Citizen-based AR-GCED can be positioned as an initial step toward metaverse-oriented civic learning. This form of learning cannot yet be called a full metaverse because it does not involve an extensive three-dimensional virtual ecosystem, multi-user social avatars, or large-scale virtual interaction. However, the AR-GCED design already contains early elements that align with a metaverse orientation, including the integration of real and digital spaces, immersive visualization, avatar use, digital interaction, chatbots, digital portfolios, and experience-based reflection. This design transforms global diversity learning from a textual-conceptual approach into a learning experience that enables students to see

issues, discuss values, develop empathy, formulate solutions, and document civic action [67-70].

3.2. Development of Visual, Narrative, and Interactive Content for Global Diversity Learning

The findings show that the development of AR-GCED content followed a structured and layered design process grounded in GCED pedagogical principles and the Project Citizen syntax. Digital content in AR-GCED was not positioned merely as a visual supplement, but as a technological representation system that gradually helps students build understanding, socio-emotional sensitivity, and ethical decision-making. All visual elements, narrative flows, and user interactions were designed to support the strengthening of global diversity character through learning experiences that are informative, immersive, reflective, dialogic, and participatory [6,7].

The content development process began with the preparation of a learning storyboard. The storyboard functioned not only as a visual design plan for AR assets, but also as a pedagogical structure to ensure that every scene, avatar narrative, and student interaction followed the inquiry flow of Project Citizen. The learning sequence was organized into three main stages: identifying and selecting problems, collecting information and developing portfolios, and conducting showcase and reflection. This structure shows that the development of AR-GCED content did not follow a purely technological logic, but rather the logic of civic learning based on public problems, critical analysis, and social action [47,53].

Figure 3 presents the initial interface of the AR-GCED application, featuring illustrations of student collaboration, discussion activities, mobile device use, and idea mapping. From the outset, this interface constructs the meaning of Project Citizen as collaborative and participatory learning. The initial design applied the principles of clarity, emotional resonance, and youth-friendly design through bright colors, soft animation, modern typography, and icons familiar to junior secondary school students. Within the framework of metaverse-oriented civic learning, this initial interface serves as an entry point into a digital learning space that combines visual atmosphere, action orientation, and user engagement [59,61].



Figure 3. Initial Menu Display of AR-Based Project Citizen.

The development of visual elements in AR-GCED was directed toward presenting global diversity issues in concrete ways. Global-issue videos, digital avatars, interactive illustrations, interface colors, navigation icons, and bubble texts were developed to help students understand complex global problems such as climate crisis, socio-economic inequality, intolerance, humanitarian crises, and digital ethics. Through AR visualization, these issues could be brought closer, made more vivid, and become easier for students to interpret. Thus, the visual elements of AR-GCED do not merely enhance the application's appearance; they build immersive issue visualization as the basis for global civic understanding [6,7,59,61,105].

Figure 4 shows the opening video feature and digital avatar in the application. The avatar was used to provide guidance, support reflection, and connect students with the stages of Project Citizen. It did not merely deliver technical instructions, but also embedded global citizenship messages, such as invitations to understand global issues and seek solutions as global citizens. From a metaverse perspective, the avatar functions as a pedagogical agent that strengthens human–technology interaction in more personal, dialogic, and emotionally engaging ways [68-70].

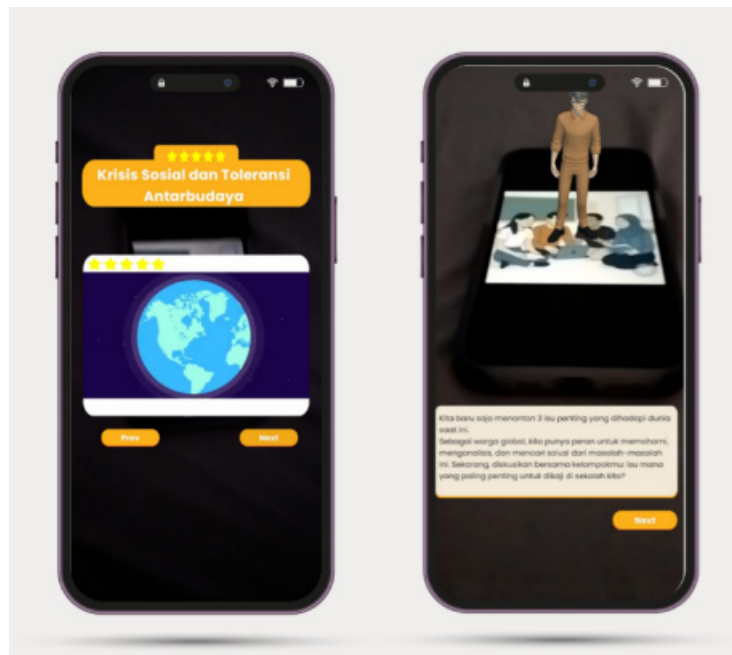


Figure 4. Opening Video and Avatar Display in the AR-Based Project Citizen Application.

The narrative content in AR-GCED was developed through a progressive dialog bubble mechanism, in which instructional text appears gradually in response to user interaction. This mechanism was intended to maintain students' focus, reduce cognitive load, and ensure that the learning flow was not interrupted as students moved from one stage to the next. The avatar narrative also introduced the Project Citizen portfolio structure, which includes problem explanation, analysis of alternative policies, policy proposals, and action plans. In this way, narrative content became a bridge between the digital experience within the application and the civic products students developed in the classroom [6,53,61].

Table 3 shows that avatar dialogue does not function merely as technical instruction, but also as a pedagogical instrument that guides students toward issue awareness, value reflection, digital literacy, collaborative work, and civic action.

Within the framework of metaverse-oriented civic learning, avatar dialogue can be understood as a form of guided reflective interaction, namely digital interaction that guides students not only to view content, but also to interpret, discuss, and transform it into civic decision-making. Thus, digital narratives in AR-GCED become a bridge between immersive experience and the formation of global civic awareness [6,7,47].

Table 3. Examples of Avatar Dialogue and Pedagogical Functions in AR-GCED.

Learning Stage	Example of Avatar Dialogue	Pedagogical Function	GCED Domain
After watching global-issue videos	“We have just watched three important issues facing the world. As global citizens, we need to understand and seek solutions to these problems. Discuss: which issue is most relevant to examine in our school?”	Stimulates global issue awareness, initial sensitivity, and group discussion.	Cognitive and socio-emotional
Group discussion guidance	“Explain why this problem is important to discuss. Use the chatbot to search for initial information and prepare a short presentation to convince the class.”	Activates digital literacy, argumentation, collaboration, and issue-selection skills.	Cognitive
Information gathering	“Find supporting data from various sources. Compare the information you find and select the most relevant data for your portfolio.”	Encourages information literacy, critical reasoning, and evidence selection.	Cognitive
Portfolio development	“Organize your findings into the portfolio panels. Explain the problem, existing policies, alternative solutions, and your group’s proposed action.”	Connects digital inquiry with Project Citizen products.	Cognitive and behavioral
Showcase and reflection	“Present your solution to your classmates. Listen to their feedback, then reflect on what you can do as global citizens.”	Encourages public communication, moral reflection, and commitment to action.	Socio-emotional and behavioral

In addition to avatar dialogue, AR-GCED interactivity was developed through a data-search chatbot, learning-stage navigation buttons, portfolio upload features, and digital reflection. The chatbot helped students search for initial information, identify keywords, and obtain supporting materials for group discussion. The navigation feature helped students understand the Project Citizen sequence step by step. The portfolio upload feature documented group work, while digital reflection encouraged students to write about their experiences, the values they learned, and their follow-up plans. Thus, interactivity in AR-GCED was not merely technical, but carried a civic function because it helped students move from information exploration toward reflection and action [59,61,67].

The development of AR-GCED content also involved expert validation to ensure its substantive, media, and pedagogical feasibility. Validation was conducted by civic education/GCED experts, learning media and AR technology experts, and teachers as classroom practitioners at the junior secondary school level. The validation results showed that the AR-GCED content was feasible because the material aligned with

GCED principles, the global issues were relevant, the Project Citizen stages were appropriate, and the values of Pancasila, empathy, tolerance, and diversity were reflected in the videos, avatars, and learning instructions. From the media perspective, the UI/UX design, colors, icons, and integration of videos, avatars, and bubble texts were considered attractive and easy to understand. From the classroom practice perspective, teachers viewed the application as helpful for guiding students through Project Citizen, increasing motivation, encouraging discussion, and supporting project-based civic education.

Nevertheless, the validation results also identified several aspects that required improvement. Civic education/GCED experts emphasized the need to sharpen global issues so that students' analysis would be more focused, strengthen values in avatar dialogues, and add local contextual examples to help students connect global issues with everyday experience. Media experts highlighted the need to simplify navigation, add Indonesian subtitles to English-language videos, and optimize file size, audio format, video compression, and device compatibility. These inputs indicate that metaverse-oriented learning cannot be evaluated only in terms of visual appeal and interactivity; it must also be substantively relevant, pedagogically safe, easy to use, inclusive, and appropriate to students' characteristics [57,61].

The discussion of the validation results reveals three main strengths in the development of AR-GCED content. First, the content has substantive strength because it integrates global issues, Pancasila values, empathy, tolerance, and diversity into videos, avatars, and learning instructions. Second, it has visual-interactive strength because the UI/UX design, icons, colors, videos, avatars, and bubble texts create a learning experience that is attractive and easy to follow. Third, it has pedagogical strength because the Project Citizen structure helps teachers and students organize learning around public problems, group discussion, portfolios, and action plans. These three strengths show that AR-GCED is not merely a technological product, but a learning design that integrates civic substance, immersive media, and pedagogical practice [59,61,67].

From a metaverse perspective, the development of visual, narrative, and interactive content in AR-GCED reveals several foundational elements of metaverse-oriented civic learning. These elements include the digital representation of global issues through videos and AR visuals, the presence of a digital avatar as a narrative and emotional guide, staged interaction through progressive dialog bubbles, chatbots, navigation, and portfolio uploads, as well as the connection between digital space and the physical classroom through discussion, portfolios, and Project Citizen showcases. Thus, AR-GCED cannot yet be claimed as a full metaverse, but it already possesses characteristics of learning toward the metaverse because it combines digital visualization, avatars, user interaction, value reflection, and civic action [68-70].

The validation results also show that a metaverse orientation in civic education must pay attention to accessibility and inclusivity. The need for Indonesian subtitles in English-language videos indicates that immersive experience is not automatically inclusive if it is not aligned with students' language abilities. Problems with AR files that could not be accessed on several devices also show that AR development must consider technological compatibility to avoid creating unequal learning experiences. Therefore, metaverse-oriented civic learning should be built on pedagogical and ethical principles: it must be accessible, user-friendly, relevant to students, and attentive to the diverse technological conditions of schools [57,61].

These findings indicate that the educational significance of immersive

technologies lies not simply in increasing interactivity but in structuring meaningful learning experiences that facilitate reflection, inquiry, and civic engagement. Rather than functioning as isolated digital features, avatars, chatbots, and digital portfolios collectively operate as pedagogical mechanisms that mediate the development of civic competencies. This perspective reinforces recent arguments that the educational metaverse should be interpreted as a learning ecosystem in which technological affordances support pedagogical objectives instead of becoming educational goals themselves. Accordingly, the contribution of AR-GCED lies not merely in integrating digital features into civic education, but in demonstrating how immersive technologies can be pedagogically orchestrated to strengthen global diversity character through reflective, participatory, and action-oriented learning experiences [6,7,47,53,59,61].

3.3. AR-Assisted Project Citizen Implementation and the Transformation of Students' Global Diversity Character

The findings show that the implementation of Project Citizen-based AR-GCED functioned as a civic learning process that combined digital interaction, critical dialogue, moral reflection, and civic action. The implementation was conducted in three junior secondary schools in Bandung and involved 27 ninth-grade students aged 14–15 years. Students did not merely interact with AR content; they also engaged in a series of Project Citizen activities, including selecting diversity-related issues in their surroundings, conducting field observations, interviewing informants, developing arguments and solutions, and presenting civic portfolios. These findings indicate that AR-GCED does not place technology at the center of learning, but rather uses it as a trigger for civic experience that strengthens students' engagement in understanding and responding to global diversity issues. This interpretation is aligned with GCED principles, which emphasize the integration of knowledge, attitudes, and action, and with Project Citizen, which positions students as active subjects in public problem-solving [6,7,47,53].

NVivo coding analysis of GCED learning experiences through AR-based Project Citizen at SMPN 2 Bandung, SMPN 12 Bandung, and SMPN 30 Bandung revealed several themes, including the development of social virtues, showcase experiences, research experiences, interaction with AR features, Project Citizen implementation, the impact of AR as a learning medium, and increased empathy through GCED learning. During implementation, 90% of informants showed a positive response tendency toward the use of AR as a learning medium. These positive responses emerged through improved understanding of global issues, more concrete conceptual visualization, and higher learning motivation identified in interview and observation data. The findings suggest that AR can strengthen students' engagement because it presents objects, cultures, and situations in more vivid ways than textual learning [59,61,67].

The findings also reveal variations in learning experiences across the three schools. At SMPN 2 Bandung, students were more actively engaged with avatars and AR videos, making learning feel more lively. At SMPN 12 Bandung, AR visualization helped students understand the complexity of global issues more deeply. At SMPN 30 Bandung, the chatbot feature attracted greater attention because it allowed students to interact directly with learning materials. These variations show that AR-GCED implementation is contextual and shaped by student characteristics, technological readiness, and classroom interaction patterns. Metaverse-oriented learning cannot be understood as a single uniform design, but rather as a digital learning experience that must be adaptive to user contexts, devices, and learning environments [57].

Table 4 shows that AR-GCED is not merely a visual medium, but a learning ecosystem that connects digital representation, social inquiry, dialogue, and civic portfolios. From the perspective of the proposed framework, the ability to connect local and global issues is important because immersive technology can present global issues visually and interactively. However, such experiences become pedagogical only when they are directed through Project Citizen toward problem identification, research, solution development, and showcase activities as forms of democratic education grounded in participation [6,7,47,53,68-70].

Table 4. Dynamics of Project Citizen-Based AR-GCED Implementation in Three Schools.

Implementation Site	Most Salient Feature /Process	Main Finding	Pedagogical Meaning	Meaning in Metaverse-Oriented Civic Learning
SMPN 2 Bandung	AR avatars and videos	Students were more active with AR avatars and videos, making learning feel more lively.	Avatars and videos strengthened students' attention, interest, and initial understanding.	Shows the role of digital representation and immersive visualization in building civic engagement.
SMPN 12 Bandung	Visualization of global issues through AR	AR visualization helped students understand the complexity of global issues more deeply.	AR helped make abstract issues such as diversity, inequality, and global crises more concrete.	Affirms the function of AR as immersive issue visualization.
SMPN 30 Bandung	Chatbot and digital interaction	The chatbot was engaging because students could interact directly with learning materials.	The chatbot supported information exploration, digital literacy, and learning autonomy.	Shows the function of digital interaction as part of guided reflective interaction.
All schools	Project Citizen	Students selected issues, conducted observations, interviewed informants, formulated solutions, and presented portfolios.	Project Citizen connected digital experience with inquiry, collaboration, and civic action.	Shows that metaverse-oriented experiences need to be directed toward participatory civic action.

The impact of implementation on students' understanding of global diversity was evident in their ability to understand the relationship between local and global diversity, develop awareness of global interconnectedness, identify global issues, and formulate the meaning of global diversity. NVivo analysis showed that the local-global diversity relationship emerged as the most prominent theme, while the definition of global diversity was relatively less dominant than the other aspects. This finding indicates that students understand global diversity more easily when the concept is connected to local experiences, concrete issues, and social realities close to their lives. Thus, AR-GCED learning helped students move from conceptual understanding toward relational understanding, namely the ability to see the connection between diversity in their immediate environment and broader global problems [6,7].

From the perspective of metaverse-oriented civic learning, the ability to connect

the local and the global is important because immersive technology can present global issues visually and interactively, but civic meaning only emerges when students relate those representations to their own social experiences. Thus, AR does not merely present global issues digitally; it also helps students build a bridge of meaning among local experience, value reflection, and global awareness [68-70].

The impact of implementation was also visible in the transformation of global diversity character. Project Citizen-based AR-GCED learning encouraged the strengthening of tolerance, empathy, global perspectives, social justice, anti-discrimination awareness, interreligious harmony, and appreciation of cultural plurality. This transformation shows that AR-GCED does not only generate understanding of global issues, but also encourages changes in students' dispositions and attitudes toward diversity. This discussion is consistent with GCED, which positions the socio-emotional dimension as the foundation for building empathy, solidarity, and a sense of belonging to shared humanity. It is also consistent with character education theory, which emphasizes the integration of moral knowledge, moral feeling, and moral action [6,106].

Table 5 shows that the transformation of global diversity character emerged across cognitive, socio-emotional, and behavioral dimensions. The cognitive dimension was reflected in improved understanding of global issues and local-global relations. The socio-emotional dimension appeared in the development of empathy, tolerance, and appreciation of cultural plurality. The behavioral dimension was evident in students' engagement in problem analysis, solution development, portfolio preparation, and Project Citizen showcase activities. Thus, the impact of AR-GCED learning was not limited to the knowledge domain, but also reached students' moral dispositions and action orientation. This finding is consistent with UNESCO's GCED framework, which positions education as a process that develops knowledge, values, attitudes, and action in an integrated way, and with the OECD's emphasis that global competence includes the ability to understand global issues, appreciate others' perspectives, interact across cultures, and act for collective well-being [6,7].

Table 5. Impact of AR-GCED Implementation on Students' Global Diversity Character.

Impact Dimension	Indication of Findings	Form of Transformation	Pedagogical Interpretation
Understanding of global issues	Students understood diversity issues, global crises, and local-global interconnectedness.	Strengthening of global civic knowledge.	AR helped make global issues concrete, while GCED provided a value framework for interpreting them.
Intercultural empathy	Students showed sensitivity toward different groups and humanitarian issues.	Strengthening of socio-emotional dispositions.	AR visualization and Project Citizen discussions strengthened reflective and empathetic experiences.
Tolerance and anti-discrimination	Students began to understand the importance of respecting differences and rejecting discrimination.	Strengthening of pro-diversity attitudes.	Issue-based learning helped students see the social consequences of intolerance.
Global perspective	Students connected local issues with global problems.	Expansion of civic horizons.	GCED helped students understand global interdependence.

Continuation Table:

Impact Dimension	Indication of Findings	Form of Transformation	Pedagogical Interpretation
Civic participation	Students developed solutions, portfolios, and presented their ideas.	Strengthening of civic action.	Project Citizen transformed understanding and attitudes into social action.
Moral reflection	Students reflected on the values learned and the actions they needed to take.	Strengthening of value internalization.	Reflection connected digital experience with character formation.

The NVivo thematic analysis shows that students' understanding of global diversity developed through an interconnected network of themes: understanding global diversity, awareness of global interconnectedness, local-global relations, identification of global issues, empathy, tolerance, global perspective, anti-discrimination, interreligious harmony, and appreciation of cultural plurality. These thematic connections affirm that character transformation does not emerge automatically from the use of technology, but from the integration of digital experience, social dialogue, value reflection, and Project Citizen action. In this study, AR therefore functions as a pedagogical enhancer, a technology that strengthens value learning and civic action rather than becoming the goal of learning itself [57,59,61].

The implementation evaluation revealed several technical limitations that need attention, including accessibility constraints, device compatibility, application restrictions such as family link, unclear video quality, application errors, and the need to continuously point the camera at the marker. These findings indicate that the success of AR-GCED learning is determined not only by pedagogical quality, but also by technological readiness, user experience design, and device compatibility. Future development therefore needs to optimize application stability, strengthen accessibility, simplify technical guidance, and consider designs that are more stable, inclusive, and user-friendly [57,61].

Overall, the implementation of Project Citizen-based AR-GCED shows that the proposed approach can strengthen global diversity character when immersive technology is connected with value reflection and social action. AR helps students see global issues concretely, GCED helps them interpret those issues through the values of humanity and diversity, and Project Citizen helps them transform understanding and attitudes into civic action. In the context of this article, the main contribution of AR-GCED implementation lies in demonstrating that metaverse-oriented civic learning is not only about immersive digital space, but also about how such space can move students toward empathy, tolerance, global perspectives, and civic action [6,7,47,53].

3.4. Conceptual Framework of Metaverse-Oriented Civic Learning in Civic Education

The findings of this study show that the integration of Project Citizen-based AR-GCED does not merely produce digital learning media, but also forms a new pattern of civic learning experience that connects immersive visualization, value reflection, social dialogue, and civic action. At the design stage, AR-GCED was developed by integrating GCED, Project Citizen, and Augmented Reality to strengthen global diversity character. At the development stage, visual and narrative content, avatars, chatbots, digital portfolios, and written reflections were designed to help students understand global issues more concretely. At the implementation stage, students

did not only use technology; they also identified public problems, engaged in group discussion, searched for data and information, developed portfolios, presented ideas, and reflected on values. These findings indicate that immersive technology can function beyond a mere instructional aid when it is situated within a pedagogical design oriented toward civic competencies [57,59,61,67].

In the context of civic education, technology is often understood as a supporting medium. However, within the proposed framework, technology becomes part of the learning experience by connecting physical and digital realities, presenting visual representations of public issues, facilitating interaction, supporting reflection, and guiding students toward civic action [68-70]. For this reason, the metaverse in civic education needs to be understood as a pedagogical ecosystem rather than simply as a technological device.

This conceptual framework places civic education at the core of learning. The use of the metaverse, AR, avatars, chatbots, simulations, and digital portfolios must ultimately return to the main purpose of civic education: forming citizens who are intelligent, participatory, responsible, and characterized by strong civic values. Branson argues that civic education rests on three major competencies: civic knowledge, civic skills, and civic dispositions [107]. These three competencies provide the foundation for designing metaverse-oriented civic learning, as learning should not only strengthen students' knowledge, but also develop participatory skills and civic character.

Within this framework, civic knowledge refers to students' ability to understand concepts, values, public issues, global diversity, human rights, democracy, social justice, and the relationship between local and global problems. Through metaverse-oriented civic learning, civic knowledge is not acquired only through texts and teacher explanations, but also through visual experience, simulations, digital representations, and more concrete exploration of issues. This is consistent with GCED, which emphasizes the importance of understanding local, national, regional, and global issues as interconnected [6,7].

Civic skills refer to students' ability to use civic knowledge to think critically, collect data, engage in dialogue, analyze public problems, assess alternative solutions, formulate recommendations, present ideas, and design civic actions. In this study, these skills were developed through pedagogical processes based on inquiry, discussion, portfolios, and showcase activities. Thus, metaverse-oriented civic learning does not merely provide immersive digital experiences; it also guides students to use those experiences for public problem-solving and civic participation [47,53].

Civic dispositions refer to civic character traits such as empathy, tolerance, responsibility, social care, respect for diversity, anti-discrimination, solidarity, and commitment to justice. The implementation findings show that Project Citizen-based AR-GCED learning strengthened intercultural empathy, tolerance, global perspectives, and appreciation of plurality. This indicates that metaverse-oriented civic learning has the potential to engage students' affective dimension because immersive technology can bring humanitarian issues closer to students, while pedagogical processes guide those experiences into value reflection and social action [6,7,106,108,109].

Based on this analysis, this article positions the metaverse as an outer ecosystem that surrounds and accommodates the entire civic education process. Within it, there is a pedagogical concept that directs the use of technology so that it does not stop as a tool, but becomes part of the learning process. This pedagogical layer includes

approach, theory, and strategy, which serve to bridge the metaverse ecosystem and the core of civic education. In other words, the metaverse becomes meaningful when it is able to reach the core of civic education, namely the formation of civic knowledge, civic skills, and civic dispositions [6,7,57,107].

Figure 5 presents a layered conceptual framework. At the core lies civic education as the central orientation of learning. The next layer contains the three main competencies of civic education: civic knowledge, civic skills, and civic dispositions [107]. The following layer represents approach, theory, and strategy as pedagogical concepts that develop these three competencies. This layer shows that metaverse-based civic learning still requires theoretical foundations, pedagogical approaches, and learning strategies so that technology does not stand alone. The outermost layer is the metaverse ecosystem, a learning ecosystem that surrounds the entire process through metaverse activities [59,68-70].

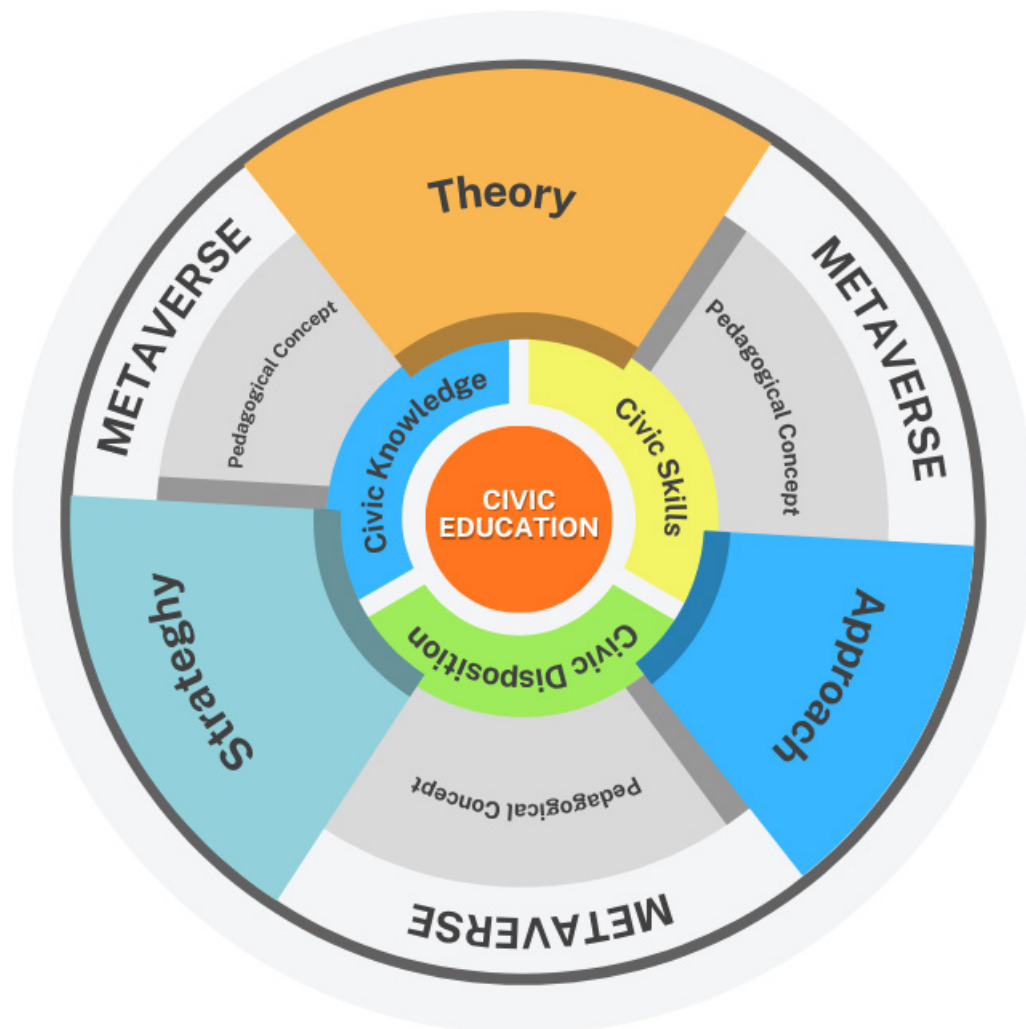


Figure 5. Conceptual Framework of the Metaverse-Oriented Civic Learning in Civic Education.

The metaverse does not stand outside civic education as an additional tool; rather, it becomes a learning environment that can accommodate the formation of civic competencies. Civic education remains the core; civic knowledge, civic skills, and civic dispositions serve as the main outcomes; approach, theory, and strategy function as pedagogical bridges; and the metaverse ecosystem becomes an

experiential space that expands the learning process. Thus, this framework shows that the metaverse can reach the core of civic education when it is designed as a value-driven pedagogical process, rather than merely as a digital medium [57,61,67,107].

The conceptual framework proposed in this study intentionally adopts an evolutionary perspective of educational metaverse development. Instead of defining the metaverse as a binary condition in which learning either fully exists within or outside a virtual world, this framework conceptualizes metaverse-oriented civic learning as a gradual pedagogical evolution. Immersive technologies such as augmented reality constitute foundational components that progressively expand toward more sophisticated metaverse ecosystems incorporating virtual reality, artificial intelligence, persistent virtual environments, multi-user collaboration, embodied avatars, and intelligent learning agents. Consequently, the framework emphasizes pedagogical transformation rather than technological completeness, positioning immersive learning experiences as the primary pathway toward future metaverse-based civic education.

The findings extend previous AR-based educational research by positioning immersive technologies within a broader pedagogical architecture rather than treating AR as an instructional medium alone. In the proposed framework, AR provides immersive visualization, GCED establishes the value orientation, and Project Citizen connects digital experience with inquiry, reflection, and civic action. This integration demonstrates that immersive civic learning can be understood as a pedagogical continuum in which technology supports the development of civic knowledge, civic skills, and civic dispositions. Accordingly, the novelty of this study lies not in introducing a new immersive technology, but in explaining how existing technological affordances can be pedagogically orchestrated within a coherent civic learning ecosystem to strengthen global diversity character and civic participation.

Conceptually, this framework provides a basis for understanding how future civic education learning may move from using technology as a supporting tool toward employing the metaverse as a learning ecosystem. Within this ecosystem, students do not merely receive civic information; they experience issues, build understanding, develop empathy, engage in dialogue, formulate solutions, and take civic action. The conceptual contribution of this article therefore lies in affirming that the metaverse in civic education is not merely a tool, medium, or visual technology, but a pedagogical process capable of accommodating the integrated development of civic knowledge, civic skills, and civic dispositions.

This study provides important theoretical and practical implications for the advancement of civic education in the digital era. Theoretically, it contributes to the literature by proposing a Metaverse-Oriented Civic Learning Framework that integrates Augmented Reality (AR), Global Citizenship Education (GCED), and Project Citizen within a unified pedagogical model. The findings demonstrate that immersive technologies can function not only as instructional tools but also as learning ecosystems that support the development of civic knowledge, civic skills, and civic dispositions. Practically, the study offers educators an innovative approach to transforming civic education into a more engaging, reflective, and participatory learning experience. Through immersive visualization, digital interaction, and civic action projects, students are encouraged to develop global perspectives, intercultural empathy, tolerance, and active citizenship.

Beyond its current implementation, the proposed framework also provides a practical roadmap for the progressive development of metaverse-oriented civic

learning. Future versions may incorporate collaborative virtual classrooms, real-time avatar interaction, AI-driven virtual agents that provide personalized learning support, and persistent learning environments that enable continuous civic collaboration beyond the physical classroom. Such developments would further strengthen students' opportunities to engage in authentic, collaborative, and immersive civic learning experiences while preserving the pedagogical principles of Global Citizenship Education and Project Citizen.

This evolutionary perspective demonstrates that the proposed framework is intentionally designed as a flexible pedagogical architecture capable of accommodating future technological innovations without fundamentally altering its civic education objectives.

From a policy perspective, the findings highlight the need for educational policies that support the integration of emerging technologies into civic and character education. Policymakers should encourage the adoption of metaverse-oriented learning approaches while investing in digital infrastructure, teacher training, and equitable access to technology. Such support is essential to ensure that technology-enhanced civic learning can effectively foster global competence, democratic participation, and social responsibility among students. Consequently, this study reinforces the importance of aligning technological innovation with pedagogical objectives and national educational goals to prepare future citizens for increasingly interconnected and diverse global societies.

4. Conclusion

This study concludes that the integration of Augmented Reality (AR), Global Citizenship Education (GCED), and Project Citizen successfully creates a metaverse-oriented civic learning experience that strengthens students' global diversity character. The integration of these three components goes beyond technological innovation by providing an immersive, reflective, participatory, and action-oriented learning environment. Through the use of global-issue visualizations, digital avatars, chatbots, digital portfolios, and Project Citizen activities, students were able to understand the interconnections between local and global issues in more concrete and meaningful ways. The implementation of the model enhanced students' understanding of global diversity, broadened their global perspectives, and fostered intercultural empathy, tolerance, anti-discrimination awareness, and appreciation of cultural plurality. These findings demonstrate that digital technology can serve as an effective medium for civic and character education when it is embedded within a well-designed pedagogical framework.

Furthermore, this study contributes to the development of the Conceptual Framework of Metaverse-Oriented Civic Learning in Civic Education, which positions civic education as the core of the learning process, supported by the development of civic knowledge, civic skills, and civic dispositions. Within this framework, the metaverse is not viewed merely as a technological tool or digital medium, but as a pedagogical ecosystem that expands learning experiences through immersive digital environments connected to value reflection and civic action. The framework highlights that the effectiveness of metaverse-oriented learning depends on the integration of technology, pedagogical strategies, and civic education objectives. Although the implementation encountered several technical challenges, including device compatibility and accessibility issues, the AR-GCED model based on Project Citizen demonstrates strong potential as an emerging model of civic learning that

links digital experiences with character formation, democratic participation, and responsible global citizenship.

Importantly, the proposed framework differs from conventional AR-based educational models in both purpose and pedagogical structure. Existing AR-based approaches commonly emphasize visualization, motivation, engagement, or conceptual understanding, whereas the present framework integrates AR with GCED and Project Citizen to connect immersive visualization with civic knowledge, civic skills, civic dispositions, reflective inquiry, and civic action. AR therefore functions as an immersive entry point rather than the pedagogical endpoint. This distinction positions the proposed framework as a pedagogically grounded architecture in which immersive technologies are organized around civic education objectives and character formation, rather than being treated as standalone technological innovations.

This study has several limitations that define the boundaries of its findings. First, the geographical context was restricted to three junior secondary schools in Bandung, Indonesia. Although these schools provided authentic classroom settings for developmental evaluation, the findings may not be directly transferable to schools with different cultural, socioeconomic, technological, or educational characteristics. Second, the schools and participants were selected using purposive sampling based on their willingness to implement AR-supported civic learning, technological readiness, and recommendations from local educational authorities. Although appropriate for an R&D study, this strategy limits representativeness and prevents statistical generalization to the wider population of junior secondary students. Third, the classroom implementation was limited in scale and duration, involving 27 ninth-grade students across the three schools. The findings should therefore be interpreted primarily as evidence of pedagogical feasibility, usability, and learning experience rather than definitive evidence of intervention effectiveness. Fourth, the current implementation represents an initial pedagogical step toward a metaverse-oriented learning ecosystem rather than a full metaverse environment. It did not involve persistent three-dimensional virtual environments, large-scale multi-user interaction, or fully integrated AI-driven learning agents. Consequently, the findings should not be interpreted as evidence of the effectiveness of a fully developed educational metaverse. Finally, because the study did not employ a quasi-experimental or experimental design with pre- and post-intervention measurements, causal claims regarding changes in students' global diversity character cannot be established. Future research should therefore involve multiple regions, more diverse school characteristics, larger and systematically selected samples, longitudinal designs, and controlled quantitative evaluations to examine the transferability, effectiveness, and sustainability of the proposed framework.

Although the implementation provided encouraging evidence regarding students' engagement, empathy, global awareness, and civic participation, the present study did not employ a quasi-experimental or experimental design with pre- and post-intervention measurements. Consequently, statistical significance testing and effect size estimation were beyond the scope of this developmental research. Future studies are therefore encouraged to evaluate the proposed framework using controlled experimental designs, larger samples, longitudinal observations, and quantitative analyses to establish the magnitude and sustainability of learning outcomes.

Future research should extend the implementation of metaverse-oriented civic learning across diverse geographical regions, school types, cultural contexts, and educational levels. Studies should also consider larger and more systematically

selected samples to strengthen the transferability of findings. Longitudinal and quasi-experimental designs are recommended to examine the sustainability and magnitude of changes in students' civic knowledge, civic skills, civic dispositions, and global citizenship competencies.

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