Inclusive Education Management Strategies Utilizing Virtual Reality Technology for Students with Special Needs

Lulu Khairunnisa[1], Akhmad Ramli[2]

[12] Universitas Islam Negeri Sultan Aji Muhammad Idris Samarinda, Indonesia
Email : lulukhairunnisa221003@gmail.com[1], akhmadramli@uinsi.ac.id[2]

Abstract :

Inclusive education management strategies based on Virtual Reality (VR) technology represent an innovative approach to supporting the learning of students with special needs. This study aims to analyze how educational management strategies can optimize the use of Virtual Reality technology in creating safe, interactive, and adaptive learning environments. The methodology that used is descriptive qualitative literature research. The review process was conducted systematically, beginning with topic identification, followed by source selection, thematic analysis, and culminating in conceptual synthesis. The findings indicate that effective inclusive education management must encompass five key pillars: adaptive curriculum planning, teacher training, infrastructure provision, learning evaluation, and cross-sector collaboration. Virtual Reality technology has proven to significantly enhance learning motivation, conceptual understanding, emotional regulation, and active participation among students with special needs. Despite challenges such as limited budgets, digital gaps, and resistance to change, responsive and collaborative management strategies are essential to the successful transformation of inclusive education through technology.

Keywords : *Strategy, Educational Management, Inclusive, Virtual Reality Technology, Students With Special Needs.*

Abstrak :

Strategi manajemen pendidikan inklusif berbasis teknologi Virtual Reality (VR) merupakan pendekatan inovatif dalam mendukung pembelajaran siswa berkebutuhan khusus. Penelitian ini bertujuan untuk menganalisis bagaimana strategi manajemen pendidikan dapat mengoptimalkan pemanfaatan Teknologi Virtual Reality dalam menciptakan lingkungan belajar yang aman, interaktif, dan adaptif. Metodologi yang digunakan adalah studi literatur dengan pendekatan kualitatif deskriptif. Proses kajian dilakukan secara sistematis mulai dari identifikasi topik, seleksi sumber, analisis tematik, hingga sintesis konseptual. Hasil penelitian menunjukkan bahwa manajemen pendidikan inklusif yang efektif harus mencakup lima pilar utama: perencanaan kurikulum adaptif, pelatihan guru, pengadaan infrastruktur, evaluasi efektivitas pembelajaran, dan kolaborasi lintas sektor. Teknologi Virtual Reality terbukti mampu meningkatkan motivasi belajar, pemahaman konsep, regulasi emosi, serta partisipasi aktif siswa berkebutuhan khusus. Meskipun menghadapi tantangan seperti keterbatasan anggaran, kesenjangan digital, dan resistensi perubahan, strategi manajemen yang responsif dan kolaboratif dapat menjadi kunci keberhasilan transformasi pendidikan inklusif berbasis teknologi.

Kata Kunci: *Strategi, Manajemen Pendidikan, Inklusif, Teknologi Virtual Reality, Siswa Berkebutuhan Khusus.*

Introduction

Inclusive education is a paradigm that emphasizes equal access, active participation, and successful learning within regular educational settings. Its goal is to create an educational system that is welcoming, fair, and responsive to diversity, ensuring that no learner is left behind due to physical, intellectual, social, emotional, or cultural differences. According to (Ainscow, 2020) inclusive education is not merely about placing children in regular classrooms, but also about identifying and removing learning barriers and fostering environments that support all students. In Indonesia, inclusive education policy has been established through the Ministry of National Education Regulation No. 70 of 2009. However, its implementation continues to encounter various challenges, particularly related to management and the use of technology.

One of the main challenges in inclusive education is how to create learning environments that are adaptive to the diverse needs of students. Learners with special needs such as those who are deaf, blind, autistic, or have motor impairments require instructional approaches that are not only individualized but also interactive and contextual. Special education often demands the adaptation of teaching methods to accommodate cognitive, emotional, and social challenges. Traditional teaching tools and techniques are not always effective in addressing these needs. However, Virtual Reality (VR) offers a new way to create customized learning environments that promote learning through sensory

stimulation, cognitive training, and social skills development (Rizwan Faris Syafiq & Hafiz Hakim, 2024).

Virtual Reality (VR) technology enables students to "experience" learning directly through immersive three-dimensional simulations. For example, visually impaired students can explore virtual classrooms with the aid of descriptive audio, allowing them to understand the spatial layout of rooms and objects. Meanwhile, students with autism can practice social interactions in controlled, pressure-free virtual environments, which helps to reduce anxiety and build self-confidence. A research by (Hamilton et al., 2021) indicates that the use of VR in special education significantly enhances learning motivation, conceptual understanding, and student autonomy through multisensory and personalized learning experiences.

Similar findings were reported by (Bere et al., 2025) who emphasized that interactive technology-based learning media such as Virtual Reality (VR) and Augmented Reality (AR) can bridge communication and cognitive barriers in children with autism, particularly in the introduction of basic concepts. Furthermore (Mar'atullatifah et al., 2024) in their literature review, affirmed that AR/VR technologies hold significant potential for creating inclusive and adaptive learning environments for children with special needs in the era of the Fourth Industrial Revolution.

However, the implementation of Virtual Reality technology in inclusive education cannot be separated from a comprehensive management strategy. Technology-based inclusive education management must include curriculum planning, teacher training, equipment procurement, and the evaluation of learning effectiveness. According to (Pratama & Husadani, 2025), the integration of technologies such as Artificial Intelligence and Virtual Reality into inclusive education must be supported by institutional policies, technical training, and student-centered approaches.

In addition, a research by (Azzahra et al., 2025) published in Jurnal Genta Mulia revealed that mathematics teachers at special education schools (SLB) in Semarang identified the need for interactive, technology-based learning media as a solution to enhance deaf students' understanding of abstract concepts. This finding underscores the importance of adopting a bottom-up approach in inclusive education management one that is grounded in real needs observed in the field, rather than relying solely on top-down policy directives.

The implementation of Virtual Reality (VR) technology in education cannot be optimized without cross-sector collaboration involving educational institutions, technology developers, government bodies, and parent communities. Such collaboration is essential to ensure that VR content development aligns with pedagogical needs, educational policies, and the diverse characteristics of learners. As discussed by (Supriyantomo & Fauzan, 2024) in *Jurnal Lingkar Pembelajaran Inovatif*, advancing future education in the metaverse era requires synergy among stakeholders to address technical, ethical, and social challenges.

In parallel, research conducted by (Yeremia & Chang, 2025) in *Jurnal Socius* emphasized that the effective utilization of technologies such as Augmented

Reality and VR in educational settings must involve joint evaluations between academics and technology developers to foster innovations that are both adaptive and impactful.

In conclusion, the successful implementation of Virtual Reality (VR) in education depends not only on its technical sophistication, but also on the collaborative strength among stakeholders. Synergy between educational institutions, technology developers, government agencies, and parent communities forms a critical foundation for building an inclusive, relevant, and sustainable learning ecosystem. Such collaboration enables the development of VR content that is not only technically innovative, but also aligned with pedagogical needs and humanistic educational values. Without active and sustained cross-sector engagement, the transformational potential of VR in inclusive education will be difficult to realize optimally. This article will further examine how these strategies can be effectively designed and implemented to support learning for students with special needs.

Research Method

This research employs a literature review method as its primary approach to explore and analyze various scholarly sources related to inclusive education management and the utilization of Virtual Reality (VR) technology in teaching students with special needs. This method was selected because it allows the researcher to identify key concepts, theories, and best practices from previous studies without the neef for direct field data collection.

The research is qualitative and descriptive in nature. Literature sources were obtained from academic databases such as Google Scholar, DOAJ, SINTA, and reputable international journals. The selection process was guided by criteria that include publications within the last ten years and relevance to the research topic.

Data analysis were analyzed using a descriptive-qualitative thematic approach, through which the findings were organized into themes such as managerial strategies, the effectiveness of VR utilization, and implementation challenges within the context of inclusive education. The results of this research are expected to provide conceptual contributions for developing innovative and adaptive strategies for inclusive education management in response to the advancements of VR-based learning technologies.

Result and Discusion

Inclusive education demands a management system that is capable of responding to the diverse needs of students, including those with physical, intellectual, social, or emotional disabilities. In this context, Virtual Reality (VR) emerges as a disruptive innovation with the potential to transform the learning paradigm from passive to active, immersive, and adaptive. However, the successful integration of VR in inclusive education is strongly depends on management strategies structured, collaborative, and sustainable.

1. The Strategic Role of Virtual Reality Technology in Inclusive Education

Virtual Reality (VR) technology plays a strategic role in supporting inclusive education by creating learning environments that are safe, controlled, and adaptable to the individual learner needs. Through VR, students with special needs can practice social skills, behavioral adaptation, and independence without encountering physical risks. In their systematic review, (Carnett et al., 2023) demonstrated that VR is effective in safely simulating real-life situations, making it particularly suitable for behavioral interventions in children with autism.

Furthermore, multisensory design in therapeutic and learning spaces is a essential element for enhancing comfort and learning effectiveness. Research by (Limmanto & Machdijar, 2023) emphasized that the use of VR technology in sensory-designed environments can assist children with hypersensitivity and hyposensitivity disorders in adapting both emotionally and cognitively. Personalized technological support is also a key factor in inclusive education. (Fitas, 2025) stated that the integration of Artificial Intelligence (AI) and VR can overcome communication barriers and provide more adaptive learning experiences for children with special needs.

Based on the above discussion, it can be concluded that Virtual Reality (VR) technology holds strategic potential in supporting inclusive education, particularly for students with special needs. VR not only provides a safe and controlled learning environment, but also enables personalized instruction through realistic simulations that foster the development of social skills, behavioral adaptation, and independence. The integration of multisensory design and Artificial Intelligence (AI) further enhances the effectiveness of VR in addressing the emotional and cognitive needs of children, making it an innovative solution for overcoming communication barriers and creating learning experiences that are more adaptive and human-centered.

2. Inclusive Education Management Strategies Based on Virtual Reality

To ensure the effective implementation of Virtual Reality (VR) technology in inclusive education, a comprehensive management strategy must be developed based on five key pillars:

a. **Adaptive Curriculum Planning:** The curriculum must be designed to be flexible and capable of accommodating VR-based content. This includes mapping competencies, adjusting learning outcome indicators, and integrating VR media into lesson plans (RPP). According to (Azzahra et al., 2025) mathematics teachers at special education schools (SLB) in Semarang found that interactive, technology-based media significantly helped deaf students understand abstract concepts.

b. **Teacher Training and Professional Development :** As the frontline implementers of technology, teachers must receive both technical and pedagogical training. (Pratama & Husadani, 2025) emphasize the importance of training teachers not only to operate VR devices but also to apply technology-based instructional strategies tailored to students with special needs.

c. **Infrastructure Provision and Maintenance :** Inclusive schools must be

supported with adequate hardware (VR headsets, computers, internet connectivity) and software (educational VR applications). However, major challenges remain, particulary related to budget limitations and the lack of sustained technical support.

    d. Evaluation and Monitoring of Effectiveness : Regular evaluations are necessary to assess the impact of VR use on learning outcomes, student engagement, and socio-emotional development. These evaluations should be data-driven and involve students, teachers, and parents.

    e. Cross-Sector Collaboration: The implementation of VR in inclusive education requires synergy among schools, government bodies, technology developers, and community stakeholders. As noted by (Pramesti Wulandari et al., 2024) such collaboration is essential to ensure that technological solutions genuinely address student needs and are not merely short-term projects.

3. *Challenges in Implementing Virtual Reality (VR) in Inclusive Education*

Although Virtual Reality (VR) technology offers significant potential in supporting inclusive education, its implementation across various educational institutions continues to face complex and multidimensional challenges. These challenges are not only technical in nature but also encompass managerial, pedagogical, policy-related, and socio-cultural aspects.

One of the primary obstacles is the limited availability infrastructure and access to VR devices, particularly in special education schools (SLB) and inclusive schools located in underdeveloped regions. Hardware such as VR headsets, high-specification computers, and stable internet connections remain a luxury for many educational institutions in Indonesia. This situation is further exacerbated by the absence of dedicated government funding schemes that explicitly support the procurement of VR technology for inclusive education. In this context, a research by (Ferawati et al., 2023) highlights that the majority of teachers still lack access to adequate training and equipment needed to integrate AR/VR-based media into the learning process for students with special needs.

From the perspective of human resources, teachers' competence in operating and utilizing VR technology remains a significant challenge. Many educators are still unfamiliar with immersive technology-based learning approaches and tend to rely on conventional methods that are less effective for students with special needs. The lack of continuous training and minimal technical support at the school level contribute to the low adoption rate of this technology. As highlighted by (Hamilton et al., 2021), the effectiveness of VR in education heavily depends on teachers' ability to design learning scenarios that align with the characteristics of their students.

Another challenge arises from the school management side. Many inclusive schools have yet to develop strategic plans that integrate VR technology into the curriculum and evaluation systems. (Putri, 2024) notes that inclusive education management remains largely administrative and has not fully responded to the demands of digital innovation. This results in a lack of cross-sector collaboration among schools, technology developers, local governments,

and parent communities to support the sustainable implementation of VR in the learning process of children with special needs.

From a policy standpoint, although Ministerial Regulation No. 70 of 2009 provides a legal foundation for inclusive education, it does not explicitly regulate the use of digital technologies, including VR. Consequently, there are no technical guidelines that schools can refer to when developing VR-based learning programs for students with special needs. This gap between macro-level policy and micro-level practice constitutes a structural barrier that hinders innovation at the school level.

In addition, socio-cultural challenges must not be overlooked. Stigma against children with special needs persists in society, resulting in limited support from the surrounding environment for the adoption of new technologies in inclusive education. The lack of digital literacy among parents and communities also hinders the creation of a collaborative, technology-based learning ecosystem.

(Sunardi & Sunaryo, 2011) emphasize that inclusive education management must be able to anticipate these challenges through inclusive policies, continuous training, and institutional capacity building. Key barriers include: (1) high costs for devices and content licenses; (2) lack of local content that aligns with Indonesian culture and language; (3) digital divide between urban and remote schools; and (4) resistance to change from teachers or parents unfamiliar with technology.

Therefore, the implementation of VR technology in inclusive education requires a holistic and cross-sectoral approach. Synergy between progressive policies, infrastructure support, teacher capacity development, and active stakeholder engagement is essential to ensure that this technology is truly accessible and optimally utilized by all learners, without exception.

4. *Benefits of Virtual Reality (VR) Technology in Inclusive Education*

Virtual Reality (VR) technology has demonstrated significant contributions in supporting inclusive education, particularly for students with special needs. VR enables the creation of immersive, interactive, and safe learning environments that can be tailored to individual student needs. In the context of inclusive learning, VR functions not only as a visual aid but also as a medium for exploration, self-reflection, and the enhancement of socio-emotional skills.

In his journal, (Cuhanazriansyah, 2024) highlights that VR-based learning enhances the continuity of education, including for students with special needs. This technology is considered effective in creating engaging and profound learning experiences, helping students grasp material through visual and kinesthetic means. Furthermore, VR supports exploratory and reflective learning, which is crucial for students with cognitive or social challenges. Through a multisensory approach, VR bridges the gap between students' learning needs and the limitations of conventional methods.

The EMO-VR innovation developed by PUID-DIC UNESA in 2024 serves as a concrete example of how VR can support self-regulation in children with autism. EMO-VR is designed to help students recognize and manage their

emotions through safe and structured interactive simulation (humas-unesa, 2024). Trials of EMO-VR at SLB Negeri Gedangan revealed that students were better able to control their emotions and improve communication skills after using the device. This indicates that VR plays a role not only in cognitive development but also in the affective and social growth of students with special needs.

Beyond its direct benefits for students, VR also positively impacts teachers and educational institutions. (Ferawati et al., 2023) in the INFONTIKA journal, note that the use of VR-based learning media enhances teachers' capacity to design more effective and efficient teaching strategies. Educators can create more engaging instructional materials tailored to the needs of students with special needs, particularly in terms of visualization and interactivity.

(Charles et al., 2023) also observe that the integration of VR in Indonesian education positively influences students' cognitive and affective development. This technology enables more personalized and adaptive learning, especially for students requiring individualized approaches. With VR, teachers can design learning scenarios that align with students' learning styles and abilities, making the learning process more inclusive and meaningful. Overall, the benefits of VR in inclusive education include:

1) Enhanced conceptual understanding through visualization and interactive simulation.
2) Strengthened self-regulation and emotional control.
3) Support for reflective and exploratory learning.
4) Increased motivation and learning participation.
5) Personalized learning adaptations aligned with student needs.

With these various advantages, Virtual Reality emerges as a highly promising technology to support a more adaptive, humanistic, and sustainable transformation of inclusive education.

Conclusion

Inclusive education management strategies based on Virtual Reality (VR) technology are not merely technical innovations, but rather systemic approaches that demand synergy between policy, pedagogical practice, and technology. VR has proven effective in creating learning experiences that are more personalized, reflective, and adaptive for students with special needs. To optimize its implementation, managerial strategies must include adaptive curricula, teacher training, adequate infrastructure, data-driven evaluation, and cross-sector collaboration. Despite challenges such as high costs and the digital divide, the potential of VR to support inclusive education is immense. Therefore, the integration of VR must be designed in a sustainable manner and be responsive to the real needs encountered in the field.

References

Ainscow, M. (2020). Inclusion And Equity In Education: Making Sense Of Global Challenges. *PROSPECTS*, *49*(3), 123–134. Https://Doi.Org/10.1007/S11125-020-09506-W

Azzahra, A., Mawarsari, V. D., & Suprayitno, I. J. (2025). Inovasi Pendidikan Inklusif: Analisis Kebutuhan Media Pembelajaran Interaktif Berbasis Teknologi Untuk Siswa Tunarungu. *Journal Genta Mulia*, *13*(1), 75–87.

Bere, S., Tolle, H., & Bachtiar, F. A. (2025). Analisis Penggunaan Media Pembelajaran Inovatif Pada Pembelajaran Awal Pengenalan Angka Terhadap Anak Penderita Autisme. *Jurnal Teknologi Informasi Dan Ilmu Komputer*, *12*(3), 591–600. Https://Doi.Org/10.25126/Jtiik.2025128913

Carnett, A., Neely, L., Gardiner, S., Kirkpatrick, M., Quarles, J., & Christopher, K. (2023). Systematic Review Of Virtual Reality In Behavioral Interventions For Individuals With Autism. *Advances In Neurodevelopmental Disorders*, *7*(3), 426–442. Https://Doi.Org/10.1007/S41252-022-00287-1

Charles, Yosuky, D., Rachmi, T. S., & Eryc. (2023). Analisa Pengaruh Virtual Reality Terhadap Perkembangan Pendidikan Indonesia. *Journal Innovation In Education (INOVED)*, *1*(3), 40–53.

Cuhanazriansyah, M. R. (2024). Kontribusi Pembelajaran Berbasis Virtual Reality (Vr) Dalam Upaya Peningkatan Pembelajaran Berkelanjutan. *INFONTIKA: Jurnal Pendidikan Informatika*, *2*(2), 1–4.

Ferawati, Sofia, D., & Sari, P. A. (2023). Pengenalan Media Pembelajaran Augmented Realityuntuk Anak Berkebutuhan Khusus. *I-Com: Indonesian Community Journal*, *3*(4), 1591–1597.

Fitas, R. (2025). Inclusive Education With AI: Supporting Special Needs And Tackling Language Barriers. *AI And Ethics*, *5*(6), 5729–5757. Https://Doi.Org/10.1007/S43681-025-00824-3

Hamilton, D., Mckechnie, J., Edgerton, E., & Wilson, C. (2021). Immersive Virtual Reality As A Pedagogical Tool In Education: A Systematic Literature Review Of Quantitative Learning Outcomes And Experimental Design. *Journal Of Computers In Education*, *8*(1), 1–32. Https://Doi.Org/10.1007/S40692-020-00169-2

Humas-Unesa. (2024, December 17). *PUID-DIC UNESA: Pakar Manajemen Pendidikan Khusus UNESA Rancang Inovasi Regulasi Diri Anak Disabilitas Berbasis VR*. Universitas Negeri Surabaya. //Unesa.Ac.Id/Puid-Dic-Unesa-Pakar-Manajemen-Pendidikan-Khusus-Unesa-Rancang-Inovasi-Regulasi-Diri-Anak-Disabilitas-Berbasis-Vr

Limmanto, V., & Machdijar, S. (2023). PENERAPAN DESAIN SENSORI PADA GANGGUAN HIPERSENSITIF DAN HIPOSENSITIF PADA ANAK PENYANDANG AUTISME. *Jurnal Sains, Teknologi, Urban, Perancangan, Arsitektur (Stupa)*, *5*(2), 633–644. Https://Doi.Org/10.24912/Stupa.V5i2.24212

Mar'atullatifah, Y., Christian, Y. E., & Alisyahbana, M. Ilham. (2024). LITERATURE REVIEW: INOVASI MEDIA PEMBELAJARAN AUGMENTED REALITY (AR) UNTUK ANAK BERKEBUTUHAN KHUSUS DI ERA REVOLUSI INDUSTRI 4.0. *Media Bina Ilmiah*, *19*(02), 3695–3702.

Pramesti Wulandari, Happy Rahma Savitri, Muhammad Ainun Najib, Sitti Rahmawati, & Mochammad Zakaria. (2024). Menuju Pendidikan Inklusif: Pengembangan Dan Implementasi Solusi E-Learning Yang Disesuaikan

Untuk Pendidikan Kebutuhan Khusus. *Kalam Cendekia: Jurnal Ilmiah Kependidikan*, *12*(3), 1649–1659.

Pratama, F. I. P., & Husadani, R. (2025). Artifical Intelligence Untuk Mendukung Anak Berkebutuhan Khusus Di Sekolah Penyelenggara Inklusif. *EDUTECH : Jurnal Inovasi Pendidikan Berbantuan Teknologi*, *5*(2), 280–289.

Putri, N. F. (2024). Analisis Kebijakan Pada Peraturan Menteri Pendidikan Nomor 70 Tahun 2009 Tentang Pendidikan Inklusif Bagi Peserta Didik Yang Memilki Kelainan Dan Memilki Potensi Kecerdasan Dan/Atau Bakat Istimewa. *IJAM-EDU (Indonesian Journal Of Administration And Management In Education)*, *1*(3), 265–275.

Rizwan Faris Syafiq & Hafiz Hakim. (2024). Virtual Reality As A Tool For Teaching Children With Special Needs. *Proceeding International Conference Of Innovation Science, Technology, Education, Children And Health*, *4*(1), 169–173.

Sunardi, & Sunaryo. (2011). Manajmen Pedidikan Inklusif. *Jurnal Asesmen Dan Intervrensi Anak Berkebutuhan Khusus*, *10*(2), 184–200.

Supriyantomo, N. A., & Fauzan, R. T. (2024). VIRTUAL REALITY (VR) DALAM PENDIDIKAN: STRATEGI MENYONGSONG PENDIDIKAN MASA DEPAN DI ERA METAVERSE. *Jurnal Lingkar Pembelajaran Inovatif*, *5*(6). Https://Oaj.Jurnalhst.Com/Index.Php/Jlpi/Article/View/342

Yeremia, D. A., & Chang, J. C. T. (2025). Analisis Implementasi Augmented Reality Pada Bidang Pendidikan: Systematic Literature Review. *Socius: Jurnal Penelitian Ilmu-Ilmu Sosial*, *2*(10). Https://Doi.Org/10.5281/Zenodo.115463789