

SERIOUS GAMES FOR INCLUSIVE ELEMENTARY EDUCATION: A SYSTEMATIC LITERATURE REVIEW

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Abstract

Inclusive education requires the availability of learning strategies and media that can accommodate the diverse learning needs of students in elementary schools, including students with autism spectrum disorders, dyslexia and other specific learning difficulties, intellectual disabilities, and sensory impairments such as hearing and visual impairments. In recent years, serious games, or games designed primarily for educational purposes rather than mere entertainment, have been increasingly developed and researched as an approach to supporting inclusive learning. This article presents a systematic literature review of research on the use of serious games in the context of inclusive education in elementary schools over the past ten years (2016-2026). The literature search was conducted in several scientific databases using a combination of the keywords "serious games," "inclusive education," "special educational needs," and "elementary/primary school," which were then filtered through the stages of identification, screening, eligibility assessment, and inclusion following the PRISMA framework. Articles that met the criteria were analyzed thematically based on the type of special needs targeted and the game design principles used. The review results indicate that serious games are reported to provide benefits in various aspects of the development of students with special needs in elementary schools, including social skills and emotional recognition in students with autism spectrum disorders, reading and writing skills in students with dyslexia, cognitive skills and independence in students with intellectual disabilities, and participation and learning motivation in students with sensory impairments. The effectiveness of serious games in supporting inclusion is highly dependent on the application of participatory design principles, intuitive interfaces, customizable content, and multisensory feedback. The review also identifies limitations of the existing literature, including the limited number of studies with strong experimental designs, small sample sizes, and the lack of standardized measurement of learning outcomes. Practical implications for teachers and media developers, as well as directions for future research, are also discussed.

Keywords: Serious Games; Inclusive Education; Elementary School; Children with Special Needs; Systematic Review.

Introduction

Inclusive education is an educational service system that unites children with special needs and children without special needs in the same learning environment, so that both can learn, interact, and develop together in the learning process in mainstream schools. This principle is internationally affirmed in the Convention on the Rights of Persons with Disabilities, and in Indonesia is regulated through various regulations that encourage regular elementary schools to also serve students with special needs. However, the implementation of inclusive education in elementary schools in practice still faces various challenges, ranging

from limited resources and training for teachers, a lack of learning media tailored to the individual needs of students, to a lack of awareness of the diversity of learning characteristics of children with special needs.

The diversity of student needs in inclusive classrooms is very broad, including students with autism spectrum disorder (ASD) who generally experience obstacles in communication and social interaction, students with dyslexia and other specific learning difficulties who face challenges in basic literacy, students with intellectual disabilities who require a more concrete and gradual learning approach, and students with sensory disabilities such as hearing and visual impairments who require adjustments in the delivery modality. This diversity demands the availability of flexible, adaptable learning media and strategies that are able to provide meaningful learning experiences for each student without excluding the participation of other students in the same class .

It is in this context that serious games are gaining increasing attention. Unlike most entertainment games, serious games are designed with the primary goal of conveying a specific message, knowledge, or skill to the player, while the element of fun is positioned as a means to achieve this goal, not as an end in itself. Developments in information and communication technology (ICT) in recent years have made ICT increasingly important and fundamental in promoting the inclusion of students with specific learning difficulties and special educational needs in the classroom, changing the old practice of requiring students to follow a specially designed curriculum separate from other students. Innovative digital teaching methodologies, including serious games, are seen as effective in increasing the inclusion and integration of students with specific learning difficulties and special educational needs in the classroom context, both educationally and relationally.

Several empirical studies report the benefits of serious games in various developmental domains of children with special needs. In the social skills domain, for example, serious games have been found to positively impact social skills and related domains in children and adolescents with autism spectrum disorder, including emotion recognition, emotion regulation, eye contact, joint attention, and behavioral skills (Carneiro et al., 2024). In the literacy domain, a systematic review of educational games for strengthening basic reading and numeracy skills shows that appropriate game design can support learning for students with learning disabilities (Lämsä et al., 2018), while research on digital game-based learning for students with dyslexia indicates that game-based group play activities can enhance student engagement and learning from a social constructivist perspective (Vasalou et al., 2017).

Beyond the social and literacy domains, research also suggests that video games more broadly have the potential to make education more inclusive for neurodivergent learners, with action games and exergames showing potential in improving executive function, while serious games and ad hoc video game training are more likely to support working memory. In a systematic review of game-based learning in primary education in general, empirical evidence was found showing the benefits of games on the learning outcomes of primary school students (Hainey et al., 2016), although the review did not specifically highlight the context of inclusion for students with special needs.

While this evidence suggests promising potential, the literature on serious games for inclusive education is still scattered across different types of special needs, educational levels, and disciplines. Consequently, there are few reviews specifically synthesizing evidence in the context of primary schools, the primary education level most commonly used for inclusive education. Furthermore, most existing reviews tend to focus on a single type of special need, such as autism or dyslexia, leaving a more comprehensive picture of how serious games can support inclusion for the diverse needs of primary school students.

Based on these gaps, this article aims to conduct a systematic review of the literature on the use of serious games in the context of inclusive education in elementary schools. This review is specifically directed at answering three research questions: (1) what types of special needs are targeted by serious games research in elementary schools and what are the reported

results; (2) what principles and characteristics of serious game design are reported to support the successful inclusion of students with special needs; and (3) what factors moderate the effectiveness of serious games in supporting inclusive learning in elementary schools. Through this synthesis, it is hoped that a more comprehensive understanding of the available empirical evidence will be obtained, as well as recommendations for teachers, media developers, and inclusive education researchers.

Method

This study employed a systematic literature review approach following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework, which includes study identification, screening, eligibility assessment, and inclusion. This approach is widely used in reviews of serious games in special education because it allows for a transparent and replicable literature selection and synthesis process.

Search Strategy

Literature searches were conducted on relevant scientific databases, including PubMed, ScienceDirect, Scopus, IEEE Xplore, SpringerLink, Google Scholar, and national journal portals indexed by SINTA/Garuda to reach Indonesian-language literature. Search keywords were arranged in Boolean combinations, including: ("serious games" OR "game-based learning" OR "educational games") AND ("inclusive education" OR "special educational needs" OR "children with special needs" OR "inclusive education" OR "autism" OR "dyslexia" OR "intellectual disability" OR "dyslexia" OR "mental retardation") AND ("elementary school" OR "primary school" OR "elementary school"). The search was limited to articles published between 2016 and 2026, considering that research on serious games for special needs has developed the most during that time period along with advances in assistive technology and increasing attention to inclusive education globally.

Inclusion and Exclusion Criteria

Studies were included in this review if they met the following criteria: (1) involved elementary school students, both students with special needs and inclusive classes as a whole, as participants or as the main focus of the discussion; (2) used serious games, game-based learning, or educational games designed for special/inclusive education purposes as interventions or objects of study; (3) reported results related to one or more aspects of development relevant to inclusion, such as social skills, literacy, cognition, independence, motivation, or participation; (4) were in the form of scientific journal articles resulting from empirical research or review articles/meta-analyses; and (5) were published in English or Indonesian between 2016 and 2026. Studies were excluded from the review if they focused exclusively on secondary or higher education levels without any connection to elementary school, discussed serious games for purely clinical purposes outside the educational context (e.g., medical rehabilitation without any connection to school learning), were opinion or conceptual papers without empirical data support, or had inaccessible full text.

Data Selection and Extraction Procedures

Selection is carried out in four stages. In the identification stage, all articles resulting from the initial search are collected and duplicates are removed. In the screening stage, titles and abstracts are examined to assess suitability to the topic and inclusion criteria. Approved articles were then assessed for eligibility through full-text reading to ensure methodological and substantial appropriateness. Articles that met all criteria were then included in the final synthesis. From each included article, data extraction was carried out including the author and year of publication, country/research context, type of specific needs targeted, form and platform of serious games used, research design, and the main findings reported regarding the benefits and challenges of its implementation.

Data analysis

The extracted data was analyzed thematically. The findings from each study were grouped based on the type of special needs they primarily targeted, namely autism spectrum disorder, dyslexia/specific learning difficulties, intellectual disabilities, and sensory disabilities, and then synthesized to identify patterns, consistencies, and contradictions between the findings. In addition, a separate analysis was conducted of the design principles of serious games that are consistently reported to support successful inclusion, as well as the factors that moderate their effectiveness.

Results

General Characteristics of the Study

The literature reviewed shows that research on serious games for inclusive education in elementary schools is spread across various special needs and gaming platforms. Most studies focus on three main special needs groups: autism spectrum disorder, dyslexia or specific learning difficulties, and intellectual disabilities. Research on sensory disabilities, such as hearing and visual impairments, is relatively scarce but has shown an increasing trend in recent years. In terms of platforms, the games studied include computer and tablet-based applications, web-based games, games with virtual reality and augmented reality elements, and non-digital educational play tools such as puzzles and tactile media specifically designed for students with intellectual or sensory disabilities. Research designs used vary, ranging from qualitative case studies and research and development (R&D) to quasi-experimental studies with a control group, although studies using randomized experimental designs are still relatively rare.

Serious Games for Students with Autism Spectrum Disorders

The most researched special needs domain in relation to serious games is autism spectrum disorder, particularly regarding the development of social skills. A systematic review of nine studies that met the criteria found positive effects of serious games on social skills and related domains in children and adolescents with autism spectrum disorders, including emotion recognition, encoding and decoding, emotion regulation, eye contact, joint attention, and behavioral skills (Carneiro et al., 2024). However, the review also emphasized that the available evidence is still limited and requires more rigorous study designs to consolidate findings and integrate evidence-based intervention strategies more convincingly.

In addition to social skills, research on the integration of serious game-based STEM (Science, Technology, Engineering, and Mathematics) activities for children with autism spectrum disorders shows that activities such as educational robotics and programming applications can increase student participation, especially when accompanied by parental involvement that strengthens the continuity of learning within the family environment. These findings confirm that the benefits of serious games are not only limited to the social-emotional aspect, but also extend to the academic domain, as long as they are designed with the child's individual characteristics in mind.

Serious Games for Students with Dyslexia and Specific Learning Difficulties

A second widely researched domain concerns the support of serious games for students with dyslexia and other specific learning disabilities, particularly in basic literacy and numeracy. A systematic review of educational game designs for strengthening basic reading and numeracy skills found that games tailored to the characteristics of learning disabilities can effectively support student learning (Lämsä et al., 2018). In the context of group learning, research on digital games for students with dyslexia has shown that collaborative play in small groups, viewed from a social constructivist perspective, can increase student engagement and learning, as students support each other and share strategies when facing challenges in the game (Vasalou et al., 2017). Other research focusing on the motivation of students with dyslexia through a gamification approach has also reported that game elements such as tiered

challenges and reward systems can encourage students to persist in literacy tasks traditionally perceived as difficult and frustrating.

In the more specific realm of interactive systems, research on interactive systems for children with dyslexia reports positive initial results on students' basic literacy, although the study is still preliminary (Buele et al., 2020). Overall, findings in this domain suggest that serious games have the potential to address literacy challenges for students with specific learning disabilities, provided they are designed with students' cognitive and emotional characteristics in mind, including the need for non-monotonous repetition and confidence-building feedback.

Serious Games for Students with Intellectual Disabilities

The third domain highlighted in this review is the use of serious games for students with intellectual disabilities, including those with intellectual disabilities. In the context of secondary education, a study of narrative game-based learning within the Universal Design for Learning (UDL) framework demonstrated that this approach can promote the inclusion of students with intellectual disabilities through play activities that provide various ways of presenting material, engaging with it, and expressing it. This study, although specifically targeting secondary education, not elementary school, was conducted (Rodríguez-Ferrer et al., 2025). Nevertheless, the UDL principles underlying this study align with various studies in the elementary school context in Indonesia, which confirm that the UDL approach is relevant for implementation as an inclusive approach in the elementary school curriculum to accommodate the diversity of students' learning styles and needs.

In the Indonesian context, research in elementary schools that provide inclusive education reports that educational play activities are used as a learning strategy for children with intellectual disabilities, although its implementation still faces obstacles such as limited special media and teacher training. Research on interactive learning multimedia for students with intellectual disabilities shows that media that simplify instructions and present concrete visualizations can improve student understanding (Herdiyanto et al., 2020). Similarly, the development of ethnoscience-based puzzle media has been reported to boost the cognitive abilities of children with special needs through concrete visual and manipulative elements (Oktaviani & Setiono, 2023).

Serious Games for Students with Sensory Impairments

Although the number of studies in this domain is relatively fewer than the previous three domains, a number of studies show the potential of serious games in supporting students with sensory disabilities, such as hearing and visual impairments. Research on the development of accessible mobile games shows that educational games can be designed inclusively for students with hearing impairments by adapting accessibility features, such as more dominant visual support and text- and gesture-based instructions, so that students can still understand the learning material presented through the game. Similar principles are also found in the development of game experiences that utilize spatial audio to support learners with visual impairments, where the auditory modality is optimized as the primary channel for delivering information and feedback in the game.

In the context of elementary schools in Indonesia, research on the use of educational games for students with hearing impairments reported that game media designed with an emphasis on visualization helped students recognize vowels and other basic concepts, indicating that the principle of sensory modality adjustment can also be applied to simple game media developed independently by teachers without the need for complex technology.

Design Principles that Support Inclusion

Despite the differences in the types of special needs targeted, several design principles for serious games have consistently been reported to support the successful inclusion of students with special needs in elementary schools. First, a participatory and iterative design process, involving teachers, parents, and students themselves in the development and testing

of games, has been reported to produce games that better meet the real needs of users than games designed without the involvement of these stakeholders. Second, an intuitive and simple user interface is crucial, given that students with various types of special needs often require visual instructions and uncomplicated interactions to participate independently in games.

Third, adaptable content and difficulty levels allow the same game to be used by students with varying initial abilities within an inclusive classroom, allowing students with disabilities to participate alongside their peers without feeling left behind or lacking appropriate challenges. Fourth, multisensory feedback mechanisms, incorporating visual, auditory, and tactile feedback, have been reported to be important for accommodating diverse student learning modalities, including those with specific sensory impairments. Fifth, the integration of collaborative elements within games has also been reported to be important for fostering social skills and inclusion of students with disabilities with their peers, rather than isolating them in purely individual play activities.

Factors That Moderate the Effectiveness of Serious Games

Several factors have been reported to moderate the effectiveness of serious games in supporting inclusive learning in elementary schools. The first factor is teacher readiness and knowledge in selecting, adapting, and supporting the use of serious games according to individual student needs, considering that research in the Indonesian context reports that limited teacher training is a major challenge in teaching children with special needs in inclusive elementary schools. The second factor is the availability of facilities and infrastructure, particularly for digital-based serious games that require devices such as tablets, computers, or virtual reality devices, which remains a significant obstacle in many inclusive elementary schools.

The third factor relates to parental involvement and the continued use of games outside the school environment, which has been reported to strengthen the impact of serious games interventions, particularly for students with autism spectrum disorders. The fourth factor is individual variation in students with special needs themselves, given that the characteristics and severity of the disabilities experienced by each student vary greatly. Therefore, a game that is effective for one student may not provide the same benefits for another student with the same type of special needs. In conclusion, the successful implementation of serious games to support inclusive education in elementary schools depends on a complex interaction between the quality of game design, teacher readiness, environmental support, and individual student characteristics.

Discussion

The results of this systematic review indicate that serious games have promising potential as a strategy to support inclusive education in elementary schools, with reported benefits across various developmental domains for students with special needs, ranging from social-emotional skills in students with autism spectrum disorders, literacy skills in students with dyslexia, cognitive skills in students with intellectual disabilities, to learning engagement in students with sensory impairments. The consistency of findings across these different types of special needs indicates that game elements, such as tailored challenges, immediate feedback, and engaging narrative or competitive elements, can create learning experiences that better accommodate diverse student characteristics than conventional learning approaches that tend to be uniform.

Several mechanisms may explain why serious games have the potential to support inclusion. First, the ability of games to present material in multiple modalities—visual, auditory, and tactile—aligns with the Universal Design for Learning principle, which emphasizes providing multiple modes of representation, engagement, and expression for students with diverse learning needs. Second, the adaptable nature of games allows students

with special needs to remain in the same learning activities as other students, but with challenges tailored to their individual abilities, thus supporting the principle of inclusion without having to separate students based on ability. Third, the collaborative elements in some serious games also open up social interaction between students with special needs and other students, which in turn can strengthen social acceptance and reduce stigma within inclusive classrooms.

However, this review also emphasizes that the benefits of serious games for inclusive education are not universally applicable and automatic. As found across the various special needs domains examined, the effectiveness of serious games depends heavily on the quality of the design process, their suitability to the individual characteristics of students, and the active role of teachers in selecting, adapting, and supporting the use of the games. Studies on autism spectrum disorders, for example, explicitly emphasize that selecting appropriate games requires a careful assessment of the child's individual characteristics, adequate knowledge of the game being used, and consideration of the availability of available resources and technical support. Without these considerations, serious games risk not providing optimal benefits, or even being inappropriate for the specific needs of the targeted students.

In the Indonesian context, the findings of this review are relevant to the many challenges that have been widely reported in implementing inclusive education in elementary schools, such as limited resources, teacher training, and awareness of the individual needs of students with special needs. Interestingly, several studies in local contexts have shown that simple educational game media developed independently by teachers, such as ethnoscience-themed puzzles or visual-based educational games, can still provide benefits for students with special needs even without the need for complex and expensive digital technology. These findings open up opportunities for elementary schools with limited infrastructure to continue adopting the principles of serious games through simple media, as long as participatory, adaptive, and multisensory design principles are maintained.

This review also identified a number of limitations in the existing literature. First, most studies, particularly in the autism spectrum disorder domain, still use relatively small research samples and research designs that are not yet fully rigorous, so generalization of findings needs to be done carefully. Second, the instruments used to measure student learning outcomes and development vary widely across studies, ranging from behavioral observations and assessment rubrics to specific standardized instruments. Therefore, comparisons between studies are not entirely equitable. Third, research on sensory impairments is still much less extensive than on autism, dyslexia, and intellectual disabilities, so evidence regarding the effectiveness of serious games for students with hearing and visual impairments in elementary school still requires further strengthening. Fourth, most studies still focus on one type of special needs in isolation, while research explicitly targeting inclusive classes with diverse student needs mixed within one group is still relatively limited.

Based on these findings and limitations, several practical implications can be formulated. For teachers and learning media developers, the selection and design of serious games for inclusive classrooms should involve a careful assessment of individual student needs, as well as considering participatory design principles, simple interfaces, adaptive difficulty levels, and multisensory feedback. Teachers also need to be equipped with adequate knowledge of the characteristics of various types of special needs to be able to select and adapt games appropriately, rather than applying one type of game uniformly to all students in an inclusive classroom. For education policymakers, the results of this review emphasize the importance of strengthening teacher training and providing affordable educational game media, including non-digital media that can still implement the principles of serious games, to reach elementary schools with limited technological infrastructure.

For researchers, this review recommends the need for studies with stronger designs, larger sample sizes, and more standardized measurement instruments to test the effectiveness

of serious games for various types of special needs in elementary schools. Future research should also expand the scope to the under-researched domain of sensory impairments, and explore the application of serious games in inclusive classrooms with a diverse mix of student needs, rather than focusing on one type of special need in isolation. Long-term research involving parental involvement and the continued use of games outside of school is also needed to more fully understand the impact of serious games on the development of students with special needs in elementary schools.

Conclusion

This systematic review indicates that serious games have promising potential as a strategy to support inclusive education in elementary schools, with reported benefits on the social-emotional skills of students with autism spectrum disorders, the literacy skills of students with dyslexia, the cognitive skills of students with intellectual disabilities, and the learning participation of students with sensory impairments. The successful implementation of serious games to support inclusion is not automatic, but rather depends heavily on the quality of the participatory design process, the suitability of the game to the individual characteristics of students, the availability of supporting resources, and the readiness of teachers in selecting and supporting the use of the game. These findings confirm that serious games, whether in digital form or simple media developed independently by teachers, have the potential to be a means to address the demands of diverse learning needs in inclusive elementary school classrooms. Given the limited research with robust designs, large samples, and comprehensive coverage of special needs, further research is urgently needed to enrich the empirical evidence regarding the effectiveness of serious games for inclusive education in elementary schools.

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