A Systematic Literature Review on the Development of Technology-Based Interactive Learning Modules for Students with Physical Disabilities

Desniar Desniar*, Nurhastuti Nurhastuti, Ahman Fauzan, Antoni Tsaputra

Universitas Negeri Padang, Prof. Dr. Hamka St., Padang, West Sumatera, 25171, Indonesia
*Corresponding author, email: desniar.spd@gmail.com

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Abstract
This study focused on the design and implementation of technology-based interactive learning modules for physically challenged students. It was based on the lack of organized and pedagogically meaningful digital learning modules in special education. The comparative analysis of citation data was performed in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses framework using bibliometric methodology. From a total of 142 records screened, we included 7 studies for qualitative synthesis. The results suggested that interactive learning technologies, such as assistive technology, web-based platforms, augmented reality, virtual reality, and motion-based systems, enhanced accessibility to learning material but also contributed positively with student engagement and skill development. These technologies contributed on cognitive and motor learning outcomes and created really inclusionary adaptive teaching environments. However, the findings also expose that most of studies have primarily focused on technology tools only rather than curriculum design according to structured instructional module. The authors suggested that ambitious interactive learning modules should be designed in a systematic and pedagogically integrated manner. Future research needs to focus on blending the unique aspects of instructional design with technological innovation in order to more readily promote effectiveness for practitioners working within special education.

1. Introduction

While the right to quality education is recognized globally, there is a persistent inequity across many learners, particularly those with physical disability (Abuya & Githinji, 2020). In special education settings, most, if not all, physically impaired students encounter multiple barriers. These barriers hinder access to instructional materials and activities, prevent the meaningful participation and integration of students, and impede the development of academic and motor skills (Oliva, 2016; Bani Odeh & Lach, 2024). Challenges of this magnitude call for the flexibility of teaching strategies and the utilization of evidence-based methods to attend to all learners and facilitate the practice of inclusive education (Nwachukwu et al., 2025; Nurhastuti, Tasha Dwilamiisa Putri, 2025).

The fast advancement of educational technology offers potential resolutions for many long-standing challenges (Almufarreh & Arshad, 2023; Safidon, 2024). The digital environments, assistive tools, and interactive media mentioned above have significant potential for enhancing the accessibility, engagement, and educational performance of learners with disabilities (McNicholl et al., 2021; Hamid et al., 2025). Numerous studies demonstrate how effectively used technology can enhance more balanced educational environments where engagement and communication have positive results and where learners are able to 'learn to' and 'learn how to' do their best (Hossain, 2025). The use of assistive technologies provides even more evidence of positive outcomes, though many of these successes are the result of more effective teacher training and greater organizational backing (support) (Nurhastuti et al., 2019). In addition, interactive learning environments have been shown to be beneficial to individual learning and social advancement when interactive learning environments are combined with collaborative and dialogic teaching (Rodríguez-Oramas et al., 2021; Navarro-Mateu et al., 2021). However, and regardless of the prior information, the design and gradual implementation of technology-based interactive learning modules for learners who experience physical disabilities has yet to be systemically studied (Donmez, 2024; Anastasios & Georgia, 2023). Theory has been practically deficient in the design of educational technology and the theory of assistive technology in relation to the instructional modules, separating multimedia, connotation, and the theory of instructional adaptation (Martin et al., 2020) in a dual approach. Finally, although technologies with motion elements have been studied due to their potential to aid the development of motor skills, the education of children with disabilities using such tools of technology has yet to be developed satisfactorily (Clark et al., 2021.

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The distance between technology and proper educational use of the same still remains an important talking point (Tsekhmister, 2021). Despite some initial studies examining these tools and technologies in Special Education, substantive research into the intellectual design principles of augmented-, virtual-reality, and tactile devices and their potential effects on cognition or motor skills has yet to be published (Fauzan et al., 2024). Large-scale barriers: access, teacher preparation, and the lack of a designed instructional methodology for technology use in special education are also hurdles (Starks & Reich, 2023).

Due to these gaps, a systematic and holistic review of the current literature is vital and timely. The current study aims to determine the existing research trends, evaluate effective instruction, and discuss the salient characteristics of optimal technology-based interactive learning systems for students with disabilities (Ashraf et al., 2021). Thus, this argument led to a Systematic Literature Review (SLR) that explores how these modules are developed and applied in the field of special education.

Six research questions inform this review: (1) What are the most salient characteristics and design features of technology-based interactive learning modules for students with physical disabilities? (2) Which technologies and platforms are the most used in their development? (3) How effective are these modules in improving learning outcomes, motor skills, and pupil engagement? (4) How do these modules facilitate adaptive and inclusive pedagogies? (5) What challenges and constraints are faced in the development process and implementation of these modules (6) What is their impact?

This review integrates insights from the identified literature to inform theory building and empirical activity in special education. From a conceptualization perspective, it enhances better approaches for the constitution and development of interactive learning modules to be more conducive with students possessing physical impairments. In practice, it informs educators, instructional designers, and policymakers responsible for developing accessible, effective learning solutions through technology for these populations.

2. Method

2.1. Research Design

Thus, a Systematic Literature Review (SLR) and bibliometric analysis were used to comprehensively review technology-driven interactive learning modules for physically disabled learners (Kumar, 2023). The systematic review followed published PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, a well-established method to increase transparency, rigor and reproducibility at each stage of the review process (Zhang et al., 2020). Combining systematic review which offers a qualitatively richer synthesis of existing qualitative research with bibliometric analysis techniques motivated us to make an overarching two-fold analytical conclusion (Inci & Köse, 2024), with both SLR and bibliometric methods offering diverse insights into publication trajectories, foci and technological advances within the realm of special education.

2.2. Search Strategy

Peer-reviewed studies that were relevant for understanding the research focus were sourced through a systematic search of the literature on Scopus and Google Scholar (Haddaway et al., 2015). We chose these platforms because they have relatively large footprints dedicated to reporting high-quality international scholarship in the fields of education and educational technology (see also Davis & Carr, 2019). A combination of keywords using Boolean operators were devised to guide the search for accuracy and relevance related to the objectives of the study. The final search string was: ("interactive learning" OR "digital learning") AND ("physical disability" OR "motor impairment") AND ("special education") AND ("module" (filement) OR media.

The search was limited to Studies with full-text published in English. Due to the fast-moving landscape of educational technology, emphasis was placed on studies published within 10 years prior to this review so that contemporary developments and current evidence in this field would be captured.

2.3. Inclusion and Exclusion Criteria

Prior to the screening, clear inclusion and exclusion criteria were defined in order to hone in on relevant literature that was coherent and methodologically rigorous. We included studies that satisfied all of the following criteria: (a) they contained learners with physical disabilities or motor impairments, (b) focused on interactive learning modules, digital educational media or related technologies in special/inclusive education settings, (c) published as peer-reviewed journal articles and (d) their full texts were available in English. Studies were excluded if they did not (a) focus on a form of education, (b) only covered non-physical disabilities without applying to physical impairments or other forms of disability; (c) were a non-empirical work such as editorial pieces or opinion papers and/or d) insufficient methodological detail(s)/full-text access.

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2.4. Study Selection Process (PRISMA Framework)

The study selection process followed the four-step PRISMA framework: identification, screening, eligibility, and inclusion, assuring transparency in all decisions (Higginbotham et al., 2020; Rethlefsen et al., 2021). A search of selected databases (additional details provided in the Supplementary Material) resulted in 142 records. A further 130 records were retained for review after duplicates had been eliminated. Titles and abstracts were screened and 110 records that did not satisfied the focus of this study were excluded. 20 articles were included for full-text review, of these 13 articles were excluded primarily because they (a) had insufficient focus on physical disabilities (n = 5), (b) did not incorporate an interactive learning component, and/or (c) could not be adequately reported. As such, seven studies met all inclusion criteria and were included in the final qualitative summary (see Table 1).

Table 1. PRISMA Flow Summary

Stage PRISMA	Number of Records (n)
Identification (Records identified from databases Scopus, Google Scholar, etc.)	142 records identified
Records after duplicates removed	130 records (after duplicate removal)
Screening (Title & Abstract screening)	130 records screened
Records excluded (Title & Abstract screening)	110 records excluded
Eligibility (Full-text articles assessed)	20 articles assessed for eligibility
Full-text articles excluded (with reasons)	13 articles excluded
Included (Studies included in qualitative synthesis)	7 articles included

2.5. Data Extraction

Data relevant to each included study was systematically extracted using a pre-designed extraction form which guaranteed consistency, comparability and accuracy of all records. The variables extracted included the author(s), year of publication, title of research study, design of research study, primary focus or questions investigated in the study and key findings. We conducted this process in a standardized way, which set up for us a high-quality basis to compare studies and carry out a wide-reaching, evidence based synthesis of the available literature.

2.6. Data Analysis

The analytic approach integrated qualitative thematic synthesis with bibliometric methods, offering both interpretive richness and wide-ranging empirical coverage of the literature reviewed.

2.7. Qualitative Analysis

Thematic analysis was used to capture repeated patterns, similar essences and material/theme from each of the included studies. The analysis focused on four broad categories as follows: (a) Design and structure of interactive learning modules,(b) Types of technology used and their educational purpose, (c) Cognitive, motor, engagement learning outcomes reported in the articles; and d) Implementation challenges or successes faced in special education contexts. In conclusion, this comprehensive review has revealed some key themes in the existing literature and emphasized opportunities for future work.

2.8. Bibliometric Analysis

Bibliometric analysis was also conducted to provide supplementary data and broader context to the qualitative aspects of the analysis. It compared the annual publication trends over a period of time by isolating some core topics such as assistive technology, interaction tools & motor skills development and technological modalities including augmented reality, interactive learning & web-based with variances in movement. The combination of qualitative synthesis with bibliometric methods facilitated a broader perspective, on the evolution of the field and, most importantly, on the central contributions of studies that have been conducted in recent decades.

2.9. Validity and Reliability

To increase the overall methodological rigor of the review, multiple complementary methods were used throughout the entire research process. All procedures adhered to PRISMA guidelines, guaranteeing that this process was systematic, transparent and reproducible. Only studies meeting strict and has these lists criteria were included in the synthesis, ensuring the precision of inclusion regarding quality. A systematic method of data extraction was applied and transparently reported to limit the opportunity for selective reporting or reporting bias. The restriction on peer-reviewed articles with free full-text available may have been another limitation that limited the robustness of our review.

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3. Results and Discussion

3.1. Results

The results for this study have been described in two analytical chapters, which are linked. The first is a bibliometric analysis, which communicates a quantitative overview of publication trends, world regions and relative prevalence of key themes (subtopics) over time. The second type is a Systematic Literature Review (SLR) which provides a qualitative summary of selected studies and further insights into the unique and aggregated findings. Integrating these methods leads to a more complete and multifaceted understanding of the evidence base for technology-based interactive learning modules for students with physical disabilities.

This bibliometric demonstrates the central scholarly nature by indicating core publications, contributing countries and emerging thematic areas thus it illuminates the intellectual structure of the field. In contrast, the SLR reviews specific trends across studies including study designs, technologies, learning outcomes and implementation challenges. Together, these findings offer a comprehensive evidence base to help identify existing gaps and inform future directions for research.

3.1.1. Bibliometric Analysis Results

3.1.1.1. General Research Performance

The general research performance reflects the overall scope, productivity, and impact of studies in the field of technology-based interactive learning for students with physical disabilities, including key indicators such as publications, authorship, and citation patterns (see Figure 1). The literature on D4A has 142 documents published in 114 sources type together with the document written by authorship of this field by 492 researchers only. A total of 26243 references indicate a high 114 citations per document and overall research impact clearly showing the increasing interconnected knowledge (networked knowledge) in the area. The most prominent, of which is the compound annual growth rate across the period: 16.23% not only remains stable but matures (in situ) as relative to research and development momentum driving long-established path dependency mapping special education scholarship within ecologies increasingly sensitive to educational technology becoming an exogenous variable acting on learning contexts at scale.

Figure 1. Main Information

3.1.1.2. Annual Scientific Production

There is a significant increase in research outputs from 2016 to the present (October 2024), indicating a growing scholarly interest in the integration of technology within special education for students with physical disabilities (see Figure 2). The data indicate a consistent and notable increase in publication output from 2016 through October 2024, reflecting a growing scholarly interest in the intersection of technology and special education for learners with physical disabilities. This upward trend suggests an expanding recognition of the role of digital innovations in addressing long-standing educational barriers, particularly for underserved populations. The growth in research output can be attributed to two primary factors: the rapid advancement of digital technologies enabling more flexible, interactive, and accessible learning environments, and the increasing global commitment to inclusive education. Although a slight decline in publication output is observed in the most recent year, this should be interpreted cautiously, as it is likely influenced by delays in database indexing and publication processes rather than a substantive decrease in research activity.

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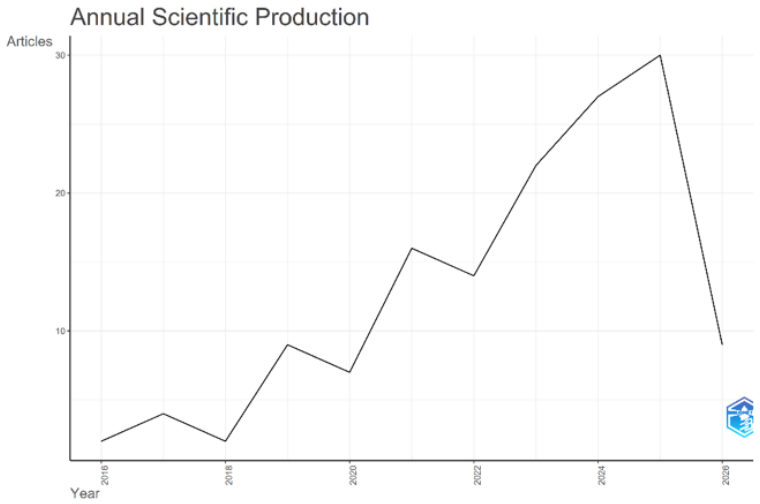

Figure 2. Annual Scientific Production

3.1.1.3. Most Relevant Sources

The analysis of the most relevant sources identifies the key journals that contribute to the development and dissemination of research in this field, highlighting the concentration of publications within specific academic outlets (see Figure 3). The quantitative analysis of publication sources reflects that this field process is published in limited numbers of journals, also identify significant development centers. The most productive journals are Education and Information Technologies and Frontiers in Psychology, with 4 publications each, followed by Interactive Learning Environments & Journal of Computer Assisted Learning. These journals are largely focused on educational technology and cross-disciplinary approaches to cognition, pedagogy and technology in learning. Our most recent investigation indicates a trend toward the publication of multidisciplinary studies at the intersection of interactive technology and special education in venues that emphasize elements of invention combined with practical educational science a reflection of values that are increasingly central to the discipline itself, marrying blended pursuits that balance abstracted developments in higher-order technology with verified practices for effective teaching methods.

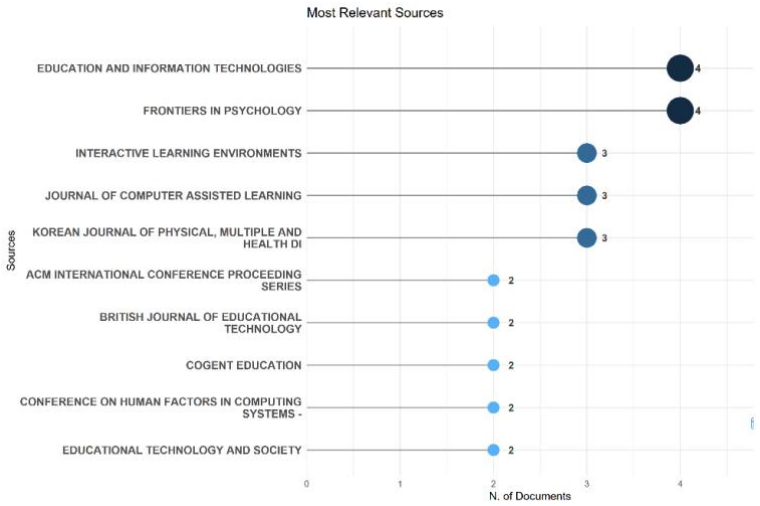

Figure 3. Most Relevant Sources

3.1.1.4. Country Contributions and Collaboration

The analysis of country contributions and collaboration illustrates the geographical distribution of research outputs and the extent of both national and international partnerships within the field (see Figure 4). The publications across regions followed a typical clustering, in where the US was ranked top with a total N = 1078 contributions, followed by China and Spain. Countries such as Indonesia, Australia and Turkey contribute to this trend — displaying a diversity of research activity in countries identifying with the international appeal of technology-mediated learning for physically impared students around the globe. The analysis presents an overall balanced mixture, based on the majority of SCPs and cross-border collaborative MCPs59 in terms of individual publication (SCP) and international Publication (MCP) to investigate publication behavior. Despite some transnational partnerships, however, most studies are still sufficiently nationally focused to imply that widespread international collaboration has not yet taken place. This points toward a need for advancing

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methodologically pluralistic, more coordinated cross-national research infrastructures that give consideration to flying results into contexts across organizations and cultures.

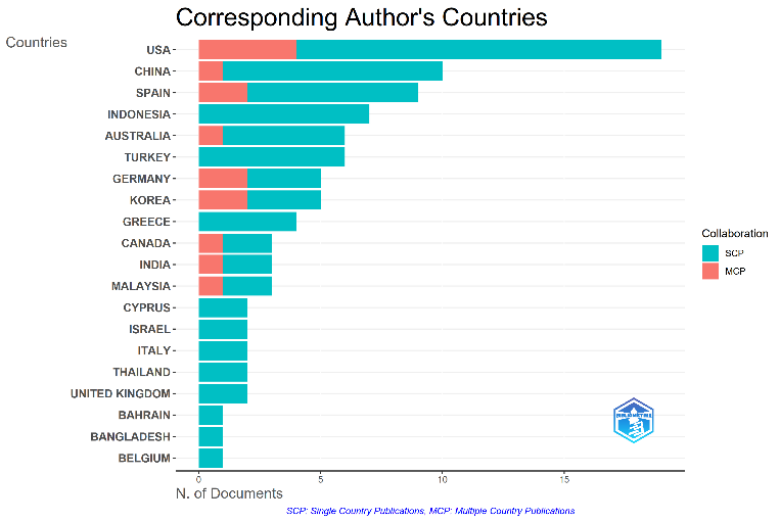

Figure 4. Corresponding Author's Countries

3.1.1.5. Keyword Co-occurrence Analysis

The keyword co-occurrence analysis reveals the dominant research themes and conceptual relationships within the field, highlighting the interconnectedness of key topics and emerging areas of study (see Figure 5). A co-occurrence network of keywords reveals core thematic areas that define the intellectual structure of the field. Familiar themes include those focused on various learner-centered (e.g., students, teaching, and education) areas; disability/special education-related issues; immersive technologies that includes augmented or virtual reality; and assistive technology in general. These dominating clusters show that the current research mainly concerns learner-centered pedagogies and innovative technology integration in teaching-learning practices. In particular, usage rates for terms associated with interactive learning modules are low indicating that even advances designed to structure the modular integrated instructional design process of highly effective forms of teaching remain underused in the literature. This gap reinforces evidence for the need for this review and indicates an avenue for promising future research in instructional design on special education.

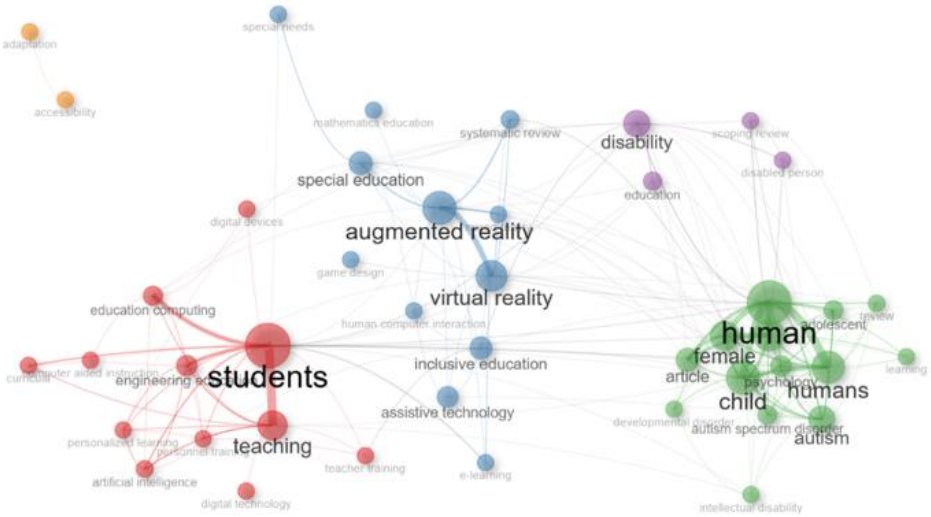

Figure 5. Keyword Co-occurrence Analysis

3.1.2. Systematic Literature Review Results

Through a PRISMA-guided selection and screening process, seven articles were identified that met all eligibility criteria for the qualitative analysis (see Table 2). The variety of methods represented in these studies ranged from systematic reviews to qualitative studies, content analyses to R&D frameworks. This range presents

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a broad, epistemologically diverse perspective on the design, deployment and effect of technology-based interactive learning modules for students with physical disabilities, expanding the review's interpretive breadth.

Table 2. Summary of Selected Studies

Author & Year	Title	Research Design	Focus RQ	Key Findings
(Fernández-Batanero et al., 2022)	Assistive Technology for the Inclusion of Students with Disabilities: A Systematic Review	Systematic Literature Review (PRISMA, 31 articles)	How does assistive technology impact the inclusion of students with disabilities?	Assistive technology enhances access, participation, and inclusion of students with disabilities; however, challenges remain, such as limited teacher training and restricted access to technology.
(García-Carrión et al., 2018)	Interactive Learning Environments for the Educational Improvement of Students With Disabilities in Special Schools	Qualitative study (case study, interviews, and focus group discussions)	How do interactive learning environments improve the quality of learning for students with disabilities?	Interactive learning environments improve academic outcomes, social interaction, and inclusion through collaboration and dialogic learning.
(Shin et al., 2023)	A Content Analysis of Research on Technology Use for Teaching Mathematics to Students with Disabilities	Content analysis (488 studies)	What are the trends in the use of technology in teaching students with disabilities?	Technologies such as applications, visual tools, and artificial intelligence are increasingly used and are effective in enhancing mathematics learning.
(Kalemku, 2025)	Trends in Instructional Technologies Used in Education of People with Special Needs	Systematic review and content analysis (128 articles)	What are the trends in instructional technologies for students with special needs?	Technologies such as augmented reality (AR), virtual reality (VR), and technology-based learning are widely used to improve social and communication skills.
(Bossavit, 2023)	Motion-Based Technology to Support Motor Skills Screening in Developing Children: A Scoping Review	Scoping review (PRISMA, 164 studies)	How is motion-based technology used to support motor skills development?	Motion-based technology is effective for assessing and developing motor skills, although its application remains limited in scope.
(Kamalı-Arslantaş & Özkaya, 2026)	Design, Development, and Usability of a Web-Based Animated Teaching Package for Individuals with Intellectual Disability	Research and Development (design, development, and usability testing)	How is the design and usability of web-based learning media for individuals with intellectual disabilities?	Animation-based learning media improve understanding, engagement, and usability for students with intellectual disabilities.

3.1.3. Thematic Analysis of Findings

3.1.3.1. Types of Technologies Utilized

The complete studies analysed above demonstrate just how much technology is getting used all through unique education, and highlight that the area continues to grow. These include augmentation items, AR and VR encounters, interactive body-based frameworks as well as computerized learning devices that can be applied either online or modular for education. Most importantly, AR/VR and of course the motion technologies are not only able to enhance cognitive abilities but also motor skills (which can help children with physical disabilities a lot). This helps makes them well-suited towards these learners, due in large part to their multisensory and embodied qualities.

3.1.3.2. Effectiveness of Technology-Based Learning

Many of the studies looking at technology-enhanced learning have a positive and statistically significant effect on educational outcomes. The contributions which have been documented are quantifiable success in educational settings, elevated involvement in risk-taking endeavours, advanced physical dexterity and refined social exchange. Interactive Learning Environments famed for exposing peers of Collaborated Learning wherein you can advance together with your learning Edutech especially when in collaborative environments within

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Active Learning and Shared Knowledge. These characteristics together enable delivery of an inclusive, adaptive and student-specific learning environments that is consistent with the core principles behind effective practice special education.

3.1.3.3. Research Gap: Limited Focus on Structured Instructional Modules

While the use of educational technology in special education is becoming more common, research continues to focus on single tools or stand-alone platforms. We know of very few explorations with complete instructional models. It is important to mention that, few of the studies define interactive learning modules as rigorous and formal theoretically based systems. This is particularly relevant in research geared towards students with physical disabilities, as well-designed integrated instructional modules have the ability to maximise learning, facilitate adaptive teaching methods and align technological affordances with meaningful student achievement.

3.1.3.4. Challenges and Limitations

Numerous ongoing and interrelated systemic barriers have been noted in the literature regarding ineffective technology integration into special education. Meaningful issues include specifications of teacher skills to use technology purposefully and pedagogically, limited access to digital infrastructure and resources, and a persistent gap between effective instructional design and actual technology implementation. Compounding these issues is the absence of established pedagogical frameworks which could inform educators in a more consistent practice-based evidence of technology integration. In summary, these obstacles indicate a need for more coherent, equitable and pedagogically informed strategies to technology-enhanced learning. And these kinds of approaches should be focused on using special education environments to more effectively achieve the instructional purpose, rather than a tendency toward certain novel elements of technology.

3.2. Discussion

This is a critically reflective paper exploring the design and delivery of technology-enabled interactive learning modules for students with physical disabilities (Verdonck et al., 2019). This film, presented after: A UNESCO-UNEVOC Webinar on Inclusive Quality Education and Disability Roozbeh Ghaffari UNICAMP Brazil Both bibliometric analysis and a systematic literature review identify a few trends in instructional design, technology use, learning outcomes of the attainable and quality education for individuals with special needs (ISNs), and challenges faced in special education 1–4. With this approach, a thorough knowledge of the field develops with proof.

The results show that most used multimedia elements, structural interactivity and learner-centered design (interactive learning) module are popular. To show the learners with disabilities (visually impaired people as well as those suffering from motor impairments), visual aids, animations and easy navigation interfaces have also been proposed in reviewed studies. These characteristics play an important role in the educational process: facilitate understanding, decrease barriers to participation, and empower learners by granting them a more flexible interactive response from the content (Ng et al., 2018). In addition, interactive environments promote collaboration and discussion which lead to measurable improvements in academic achievement as well as enhancing students' teamwork and communication skills.

One of the major sources of tension is that although these benefits have been evidenced, many studies concentrate on technology more than evidence of sound pedagogy and therefore are less than encouraging. While the literature tends to leigh out unique digital tools or platforms, they often are not anchored in existing instructional models or learning theories. This implies that beyond sound pedagogical principles, the arguments made by service professionals about the merits of new technologies are often salient motivators in decisions to construct interactive learning modules suggesting a structural imbalance calling for critical scrutiny (Selwyn, 2021). If we work smarter to align technological capacities more systematically and with intention to instructional design, the pedagogical alignment becomes a governing principle instead of an afterthought.

The studies reviewed represent a diverse technological area that includes assistive devices and web-based platforms, augmented reality (AR), virtual reality (VR), and interactive motion-based systems (Matter et al., 2017). AR/VR and motion systems hone in on cognitive skills and motor skills. These systems assist learners in having more engaging physical interactions with the digital environments, modelling practice where embodied experience strength provides motor skill and coordination capacity to evaluation modes leading to increased realism of instruction than what is currently achieved. On the other hand, a web-based course is preferable because it provides distinct powers of broader reach and more importantly educational flexibility that allows students to learn at their chosen pace, independently and often virtually anywhere. These in particular are very helpful for those that are physically challenged, who might find it difficult to take part in conventional classrooms.

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The findings of these summarized studies are consistent, showing that technology-based interactive learning has a connection to a variety of positive consequences such as improvement in academic performance, motivation and student engagement, physical development / motor skills, and social interactions. Such environments also provide opportunities for the active and purposeful engagement deemed necessary for deep learning. This is crucial for students with disabilities, who may have been excluded from traditional instruction. But studies show that the effectiveness of these technologies is not only a function of the tools, but also on the quality of instructional design, teachers' pedagogical skills, and institutional resources (Chai et al., 2019). This shows that technology is only successful when integrated to enhance good teaching, not replace it.

These findings highlight the importance of interactive learning modules for adaptive and inclusive education. This autonomy of action for students with physical disabilities when accessing content and participating in activities that technology allows because it enables personalized learning experiences according to profiles and needs. The ability of assistive technologies to connect learners and promote reflection and collaboration stimulates constructive engagement by multiple types of learners (Jeong & Hmelo-Silver, 2016). However, the complex task of creating a digital infrastructure, providing fair access to technology or investing in upskilling your own teachers has kept these advantages out of reach and had its primary impact where it is least needed.

We find a stable constellation of systems problems that signal systemic failure in the field. This includes the inappropriate training of educators on how to use educational technologies, absence of sufficiently adequate digital resources, persistent misalignment between pedagogies and types of technology tools used as teaching enhancement, and many developmental frameworks for designing and implementing such modules remaining unestablished/ widely undocumented. All these issues reflect an even larger structural issue: technology always moves faster than pedagogy and professional education or the institutions that prepare students. The broader consequence of this gap is that it risks leaving even the newest of new tools sterile in education, unless we pay careful attention to the work of building capacity over time. Second, this study points a missing but crucial line of research despite a large body of literature discussing educational technology as part of learning systems and assistive technologies in general, comparatively few studies systematically conceptualizes, designs, and develops interactive tools for integrated instruction systems. That absence is especially pronounced in research with students who have physical impairments (Haegele et al., 2022). This is also in support of our bibliometric analysis that indicates a present orientation toward technology adoption and tool evaluation as opposed to educational design or module development. These qualitative and quantitative results together point to the need for addressing this gap, with justification for future research in this area.

The current review highlights that research should shift away from technologies alone and look towards designing integrated interactive learning modules based upon educational understanding targeted at our students with physical disabilities. Future research should target motor skills development in digital learning environments, which are an important but neglected aspect of holistic education for these individuals. And you still need to invest in collaboration between teachers, instructional designers and technologists and researchers. This type of collaboration is critical to transforming technological innovation into practical, scalable solutions for special education contexts.

3.3. Implications

The findings of this study provide several important implications for theory, educational practice, and future research in special education. From a theoretical perspective, this review strengthens the understanding that technology-based interactive learning modules should not merely focus on technological innovation, but also integrate pedagogical principles, instructional design, and adaptive learning approaches. The study highlights the importance of combining assistive technology with structured instructional frameworks in order to create meaningful and inclusive learning experiences for students with physical disabilities.

From a practical perspective, the findings indicate that interactive technologies such as assistive devices, web-based learning platforms, augmented reality (AR), virtual reality (VR), and motion-based systems can improve accessibility, participation, engagement, and learning outcomes among students with physical disabilities. Therefore, educators and instructional designers are encouraged to develop learning modules that are flexible, interactive, and aligned with students' individual needs and abilities. Schools and educational institutions should also provide continuous teacher training and technological support to ensure effective implementation of digital learning environments in special education settings.

In terms of policy implications, this review emphasizes the necessity of improving digital infrastructure, equitable access to educational technologies, and institutional support for inclusive education. Policymakers should prioritize investment in adaptive educational technologies and professional development programs to reduce barriers experienced by students with disabilities. In addition, collaboration among teachers, researchers, software developers, and policymakers is essential to create sustainable and scalable interactive learning systems.

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Finally, this review also contributes to future research directions by identifying the need for more empirical studies focusing on structured interactive learning modules specifically designed for students with physical disabilities. Future studies should investigate long-term effectiveness, usability, pedagogical integration, and the development of motor and cognitive skills through technology-enhanced learning environments.

3.4. Limitations

The limitations of this study should be interpreted as an inherent part of the systematic synthesis process undertaken. This review was restricted to studies published in English and indexed in selected databases, particularly Scopus and Google Scholar, which may have resulted in the exclusion of relevant studies available in other languages or alternative databases. Furthermore, the number of studies that met all inclusion criteria was relatively limited, with only seven articles included in the final qualitative synthesis, thereby constraining the broader generalizability of the findings across diverse educational and cultural contexts .

In addition, the heterogeneity of the included studies in terms of research designs, technological interventions, and participant characteristics posed challenges for conducting systematic comparisons. Variations in instructional approaches, types of technology, and implementation settings may have influenced the consistency and comparability of the reported outcomes, requiring cautious interpretation of the synthesized findings. Another important limitation lies in the orientation of the existing literature itself, which predominantly emphasizes the effectiveness of technological tools rather than the development of comprehensive instructional modules grounded in robust pedagogical frameworks. As a result, empirical evidence concerning long-term instructional effectiveness and meaningful curriculum integration remains limited.

Moreover, this review primarily focused on students with physical disabilities, which limits the extent to which the findings can represent the needs and learning experiences of individuals with other types of disabilities. Therefore, future systematic reviews are strongly recommended to incorporate a wider range of disability categories and more diverse educational contexts in order to strengthen the evidence base and support the advancement of inclusive, technology-enhanced learning.

4. Conclusion

A systematic literature review and bibliometric analysis of the Development and Implementation of Technology-based Interactive Learning Modules for Students with Physical Disabilities: A Solution to Digital Divide The results reveal that educational technologies support in offering access to learning, fostering engagement with the learning content and developing various cognitive and motor skills. The research further demonstrates that the use of multimedia-enriched learning platforms complemented by assistive devices and technological advancements like augmented reality (AR), virtual reality (VR) and motion systems cultivate purposeful pathways for inclusive and differentiated education. They promote individualized learning and assist to eliminate barriers that would otherwise make mere participation in school activity for physically challenged students so difficult. However, the study demonstrates that there is a relative over-focus in the literature on technological tools and less attention on structured and pedagogical principled interactive modules. The integration of instructional design and technology included as well. However, barriers like poor teacher training, lack of infrastructure and limited access to Internet services have hindered effective use. Impact This work illustrates the importance of developing future research that is systematic, interactive and feedback driven which integrates technological innovation in an effective pedagogical manner. It also shows that it is important to develop motor skills within the digital environment, something very important for students with physical disabilities. In summary, this study advances knowledge in special education by synthesizing data on the evidence base and identifying potential future directions for research and practice. Insights to help educators, researchers and policy-makers create learning solutions that are more effective, equitable and rich in technology.

Author Contributions

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Declaration of Conflicting Interests

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Data Availability

The datasets generated during and/ or analyzed during the current study are available from the corresponding author on reasonable request.

Declaration on AI Use

The authors declare that no artificial intelligence (AI) or AI-assisted tools were used in the preparation of this manuscript.

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