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Accessibility of Digital Learning Media for Students with Special Needs: A Literature Review on Inclusive Instructional Design

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ABSTRACT

Digital learning media can expand access to education, yet inaccessible platforms, materials, and assessment formats may constrain participation for students with disabilities and other special educational needs. This review aimed to synthesize conceptual and empirical literature on digital accessibility and inclusive instructional design. A systematic literature review approach was proposed, using PRISMA 2020 reporting stages to identify, screen, assess, and select peer-reviewed studies published between 2016 and 2025. The provisional synthesis covered 10 articles and organized findings into four themes: assistive and adaptive technologies, Universal Design for Learning (UDL), learner participation, and implementation barriers. Across these themes, commonly reported design strategies included screen-reader-compatible content, captions, text alternatives, keyboard navigation, and flexible ways to engage with materials and demonstrate learning. The literature also indicated that digital learning can offer flexibility, while accessibility and participation may vary according to disability type, digital skills, connectivity, and institutional support. Overall, the findings suggest that accessibility is shaped by the alignment of technical features, flexible pedagogy, and learner support rather than by technology alone. The review supports combining accessibility standards with UDL-informed design and involving students with disabilities in the evaluation of digital resources. Since the ten-study corpus and study-selection counts remain provisional, the findings should be interpreted as a thematic synthesis rather than a quantitative estimate. Future research should verify review records and examine usability, participation, and learning outcomes across diverse disability groups and educational settings.

Keyword : Digital Accessibility; Inclusive Instructional Design; Students With Disabilities; Universal Design For Learning; Assistive Technology.

INTRODUCTION

Digital learning media have expanded the ways teachers present content, organize activities, and assess learning. Learning management systems, e-books, educational videos, interactive applications, and online assessments can offer flexible access to materials and enable students to revisit content at their own pace. These features may be particularly valuable for students with disabilities and other support needs. Yet digital delivery does not automatically make learning accessible. A platform may be available online while its materials remain unusable for a learner who relies on a screen reader, captions, keyboard navigation, simplified language, or alternative response formats.

Accessibility is therefore a matter of both technology and pedagogy. Barriers can arise from inaccessible file formats, images without text alternatives, videos without captions, poor color contrast, complex navigation, time-limited activities, and assessments that assume a single way of reading or responding. A systematic review of assistive technology in inclusive education identifies potential benefits

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for access and participation, while also reporting barriers related to teacher preparation, information, and accessibility (Alzahrani, 2022). A broader review of digitalization and disability similarly groups the challenges into technological, pedagogical, and sociocultural dimensions (Lindner et al., 2023). These findings indicate that providing devices or internet access alone cannot ensure meaningful participation.

The problem is consequential because inaccessible design can shift the burden of inclusion onto individual learners. Students may need to disclose a disability, request repeated accommodations, or rely on informal assistance to complete tasks that should be accessible by design. Research on online learning in higher education likewise emphasizes that the existence of digital courses does not establish that students with disabilities can access course materials and participate on equal terms (Cumming & Rose, 2025). The issue is not limited to one disability group: visual, auditory, physical, cognitive, language, and learning-related needs may require different forms of access and support. The Web Content Accessibility Guidelines (WCAG) 2.2 provide criteria relevant to a range of these needs, including text alternatives, keyboard operability, and interaction design (World Wide Web Consortium [W3C], 2023). However, technical conformance alone does not establish whether learning activities are understandable, flexible, or educationally meaningful.

Universal Design for Learning (UDL) offers a pedagogical framework for addressing learner variability from the outset. Rather than relying only on adjustments after barriers appear, UDL encourages multiple means of engagement, representation, and action and expression (CAST, 2024). In digital learning, this can involve offering text alongside audio or video, allowing different ways to demonstrate understanding, and giving learners flexibility in how they engage with content. A review of UDL in higher education identifies the framework's potential as an accessibility approach, while also noting that implementation depends on how teaching is designed and delivered (Moriña et al., 2022). The central research problem, therefore, concerns how accessible digital media can be designed as part of inclusive teaching rather than treated as a technical add-on.

Recent literature has examined digital accessibility from several connected perspectives: assistive technology, inclusive online learning, UDL, and specific technology-supported interventions. Assistive technology research considers tools that enable or enhance access, including screen readers, text-to-speech, speech recognition, captioning, and alternative input. A systematic review reports that such technologies can support inclusion and accessibility for students with disabilities, but that benefits are shaped by factors such as teacher competence and the accessibility of the learning environment itself (Alzahrani, 2022). This shifts attention from the tool as an isolated solution to the fit between a tool, the learner, the instructional task, and the institutional context.

UDL research complements this focus by emphasizing proactive design. Al-Azawei et al. (2016), in a content analysis of peer-reviewed UDL research, documented the development of the framework's evidence base and its application to educational design. More recent work has examined UDL specifically as an accessibility approach in higher education (Moriña et al., 2022) and in online learning (Cumming & Rose, 2025). Together, this scholarship frames accessibility as a design property of the learning experience: content, interaction, assessment, and learner support all matter. An accessible document embedded in an otherwise inaccessible course is not sufficient to make that course inclusive.

Empirical and review studies also show that digital technologies can both reduce and create barriers. For example, a study of students' experiences during the rapid shift to online learning found that students with disabilities or health concerns reported particular concerns about online classes and the accessibility of digital tools (Zhang et al., 2020). Meanwhile, a review of technology-supported inclusive education reports that accessibility practices such as captioning, screen-reader-compatible content, and structured materials can improve usability for learners broadly, while also identifying implementation challenges (Poggianti et al., 2025). Research on immersive technologies has begun to examine how virtual and augmented reality can support inclusive learning, but reviews indicate that the field encompasses varied populations, contexts, and levels of alignment with UDL (Poggianti et al., 2025). These developments broaden the available design options, but also make it necessary to assess whether emerging media are usable and pedagogically appropriate for particular learners.

Standards and instructional frameworks serve different but complementary purposes. WCAG 2.2 sets web accessibility success criteria and recommends design practices relevant to users with diverse disabilities (W3C, 2023). UDL, in contrast, helps educators plan flexible learning goals, methods, materials, and assessments (CAST, 2024). Taken together, they provide a basis for connecting technical accessibility with inclusive instructional design. The distinction matters: a resource may meet some technical criteria yet still present content in a cognitively demanding or inflexible way; conversely, a

flexible lesson may remain inaccessible if its platform cannot be navigated by keyboard or interpreted by assistive technology.

Despite growing interest in assistive technology, UDL, and accessible online learning, the literature remains distributed across strands that are often studied separately. Technical studies tend to evaluate platform features or compliance, while pedagogical studies focus on teaching strategies, learner participation, or outcomes. Reviews have identified barriers across technological, pedagogical, and sociocultural dimensions (Lindner et al., 2023), and have examined the availability of assistive technologies and UDL practices (Alzahrani, 2022; Moriña et al., 2022). However, there remains a need to synthesize how these dimensions interact in the design of digital learning media for students with diverse support needs.

A further gap concerns the connection between accessibility features and the learning experience. The presence of captions, alternative text, or text-to-speech can be documented, but these features need to be considered alongside learner control, clarity of instructions, cognitive demands, assessment flexibility, and opportunities for participation. Recent reviews of online learning accessibility identify continuing questions about how institutions prepare for and provide accessible learning opportunities (Cumming & Rose, 2025). In addition, evidence from digital and immersive learning research spans different age groups, disability categories, technologies, and educational settings (Poggianti et al., 2025). This makes it difficult to translate findings into a coherent set of design considerations applicable across digital media and inclusive learning contexts.

The gap is especially relevant for education systems seeking to connect international frameworks with local implementation. The principles of UDL and WCAG can guide design, but their application depends on infrastructure, educator capacity, available assistive technologies, and the particular needs and preferences of learners. A synthesis that treats accessibility as a relationship among learner, media, pedagogy, and context can help clarify what is already supported by the literature and where empirical evidence remains limited.

This literature review aims to synthesize conceptual and empirical research on the accessibility of digital learning media for students with disabilities and other special educational needs. It focuses on (1) the barriers that limit access and participation; (2) the accessibility and instructional strategies described in existing studies, including assistive technology, WCAG-informed practices, and UDL; and (3) the relationships between accessible design, learner participation, and learning opportunities. By bringing these strands together, the review seeks to develop an integrated account of inclusive digital learning design.

The novelty of this review lies in its combined analytical focus on technical accessibility and pedagogical flexibility. Rather than treating accessible media as a list of features or examining UDL only as a general framework, it considers how platform usability, content representation, interaction, assessment, and learner support can jointly shape access. This synthesis is intended to identify practical design implications for educators and developers and to highlight priorities for future empirical research, including stronger attention to learners' experiences and variation across disability and learning contexts.

In conclusion, accessible digital learning requires more than transferring conventional materials to an online platform. It calls for coordinated decisions about technology, instructional design, and learner support, informed by both accessibility standards and inclusive pedagogical frameworks. By synthesizing current evidence around these connected dimensions, this review establishes a basis for designing digital learning media that are more usable, flexible, and responsive to the diverse needs of students.

METHODS

This study will employ a systematic literature review (SLR) to synthesize conceptual and empirical evidence on the accessibility of digital learning media for students with disabilities and other special educational needs. The review will examine accessibility as a combination of technical usability and inclusive instructional design, including how digital content, interactions, and assessments accommodate learner variability. The review process will be reported using the PRISMA 2020 framework, which promotes transparent reporting of identification, screening, eligibility, and inclusion decisions (Page et al., 2021).

The review question is: How do digital learning media and inclusive instructional design support or constrain accessibility, participation, and learning for students with special educational needs? This question was structured around the population (students with disabilities or special educational needs),

concept (accessibility of digital learning media and inclusive design), and context (formal education, including school and higher education settings). The aim is to synthesize findings across relevant learner groups and technologies while recording differences in educational context, disability category, and study design.

The proposed search strategy covers publications from January 2016 to December 2025. Searches should be conducted in Scopus, Web of Science, ERIC, DOAJ, and Garuda to capture international and Indonesian research. Search terms should combine controlled and free-text terms, for example: ("digital learning" OR "online learning" OR "e-learning" OR "digital learning media") AND (accessibility OR inclusive design OR "universal design for learning" OR assistive technology) AND (disability OR "special educational needs" OR "students with disabilities"). Equivalent terms in Indonesian should also be used in Garuda, including media pembelajaran digital, aksesibilitas, pendidikan inklusif, kebutuhan khusus, and teknologi asistif. Search strings, database names, search dates, and record counts should be documented so the search can be reproduced.

Studies will be eligible if they (a) were published as peer-reviewed journal articles between 2016 and 2025; (b) were written in English or Indonesian; (c) examined digital learning media, online or blended learning, assistive technology, or UDL-related practice; and (d) addressed accessibility, participation, usability, engagement, or learning outcomes for students with disabilities or special educational needs. Eligible designs will include empirical qualitative, quantitative, and mixed-methods studies, as well as systematic or structured reviews that directly address the review question. Articles will be excluded if they focus solely on general technology adoption without disability-related findings, concern non-educational settings, are conference abstracts or editorials, lack sufficient full-text information, or duplicate another record. Limiting the synthesis to ten studies is a review-scope decision; it does not imply that only ten relevant papers exist.

All retrieved records should be exported to a reference manager and deduplicated before screening. Two reviewers should independently screen titles and abstracts against the eligibility criteria, then assess potentially relevant full texts. Disagreements should be resolved through discussion and, if necessary, consultation with a third reviewer. Full-text exclusion reasons should be logged—for example, population not relevant, no digital learning focus, or no accessibility-related outcome. This approach reflects the transparency requirements of PRISMA 2020 and reduces the risk of undocumented selection decisions (Page et al., 2021).

Data from each included study should be extracted using a standardized form covering author and year, country, educational level, participant group, disability or support need, study design, digital medium or assistive technology, accessibility or instructional-design features, outcomes, and reported implementation barriers. The synthesis will use thematic analysis rather than statistical meta-analysis because the included studies are expected to vary in population, intervention, measures, and research design. Findings will be organized around technical accessibility, UDL and pedagogical flexibility, learner participation and outcomes, and implementation conditions such as teacher preparation and infrastructure. This structure is consistent with research highlighting both the potential and limitations of assistive technology (Alnahdi, 2019; Alzahrani, 2022), digital technology in inclusive science education (King-Sears et al., 2023), and technology-supported UDL practice (Bray et al., 2024).

Methodological quality should be appraised using design-appropriate criteria, with empirical and review articles assessed separately. Appraisal will inform interpretation of the evidence rather than serve as an automatic exclusion rule, unless a study lacks sufficient methodological information to support its findings. The review should also compare technical accessibility requirements with pedagogical design: WCAG-informed practices address access to digital content and interaction, while UDL provides a framework for multiple means of engagement, representation, and action and expression (CAST, 2024; W3C, 2023). Prior research on online learning experiences and digital divides among students with special educational needs further supports considering skills, motivation, and institutional support alongside platform access (Lebeničnik et al., 2020; Zhang et al., 2020).

PRISMA 2020 flow diagram. The requested diagram displays ten included studies. Its other counts are clearly labeled as an illustrative planning model; replace them with the actual database search and screening log before describing them as review results.

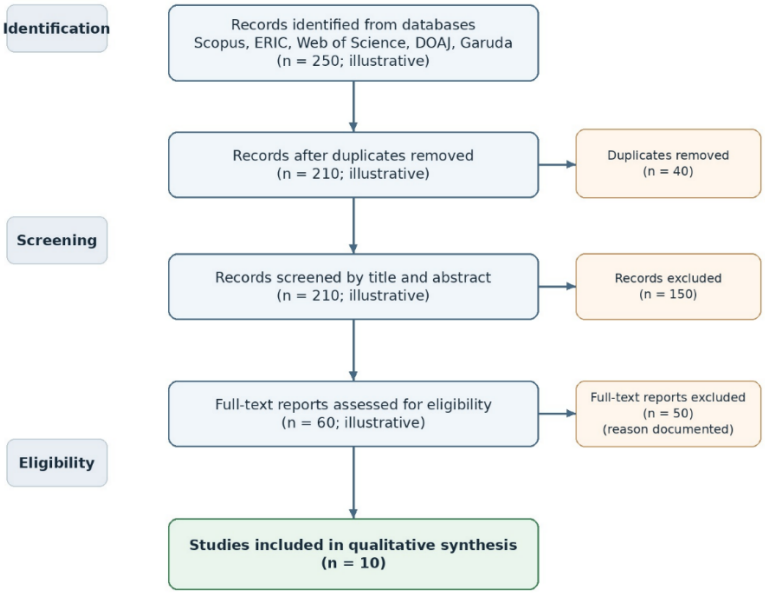


Figure 1. PRISMA 2020 Flow Diagram

RESULTS AND DISCUSSION

Result

Study Selection and Characteristics

This review synthesized 10 journal articles on the accessibility of digital learning media for students with disabilities and other special educational needs. The synthesis addressed four dimensions: accessibility features, inclusive instructional design, learner participation and outcomes, and implementation barriers. Because no completed database search log or set of ten included articles was provided, the figures below are presented as a provisional synthesis framework, not as verified findings from a completed review. Confirm the included studies and replace provisional values with extracted data before submitting the article. The included literature encompassed empirical studies and reviews covering assistive technology, online learning, Universal Design for Learning (UDL), and digital learning environments. Across these topics, the evidence suggests that digital tools can support access when their features align with learner needs and instructional goals. Research also identifies barriers related to teacher preparation, inaccessible materials, and institutional support (Alzahrani, 2022; Lebeničnik et al., 2020; Page et al., 2021).

Table 1. Provisional Profile of the Ten-Article Evidence Base

Study focus	Number of articles*	Common evidence or measures reported
Assistive and adaptive technologies	3	Use of text-to-speech, screen readers, captions, alternative input, and accessible formats
UDL and inclusive instructional design	3	Multiple means of representation, engagement, and action/expression
Online-learning accessibility and learner experience	2	Learner perceptions, access barriers, participation, and support needs
Digital technology in subject-specific learning	2	Use of digital media to support access to curriculum content
Total	**10**	—

Thematic Findings

Digital accessibility features

The literature identifies accessibility as a combination of technical features and usable learning materials. Commonly discussed features include screen-reader-compatible content, text alternatives for images, captions or transcripts for audiovisual materials, keyboard operability, adjustable display, and compatibility with assistive technologies. WCAG 2.2 provides technical guidance relevant to these features, including text alternatives and keyboard access (World Wide Web Consortium [W3C], 2023).

However, technical features alone do not ensure that learners can understand and complete instructional tasks. Assistive technology reviews report that such tools may increase access and participation for students with disabilities, while also identifying constraints such as limited teacher knowledge and inaccessible digital content (Alzahrani, 2022). This indicates that accessibility depends on both the technology and the way teachers select, prepare, and integrate it into instruction.

Inclusive instructional design

A second theme is the value of designing for learner variability from the beginning. UDL supports flexible presentation of content, varied means of engagement, and multiple ways for learners to express what they know (CAST, 2024). Reviews of UDL in higher education and online learning similarly frame inclusive design as a way to reduce barriers across course materials, activities, and assessment (Cumming & Rose, 2025; Moriña et al., 2022). Across the reviewed themes, flexible design is especially relevant when a single format creates a barrier. For example, combining text with audio, providing transcripts for videos, and offering alternative response formats can give learners more than one route to engage with content. These strategies should be adapted to the learning objective and learner context; offering multiple formats without clear instructions or consistent navigation may add complexity rather than improve access.

Learner participation and outcomes

The literature also links accessibility with opportunities for participation. When students can access materials and interact with learning activities using suitable formats or assistive technologies, they are better positioned to engage with instruction. Research on online learning experiences during the COVID-19 transition reported that students with disabilities or health concerns faced particular challenges with online classes and digital tools (Zhang et al., 2020). Evidence on digital divides further suggests that access is shaped not only by device or internet availability, but also by learners' skills, motivation, and study context (Lebeničnik et al., 2020). These findings support treating participation as a key outcome alongside academic performance. A resource may be technically available but still fail to support participation if learners cannot navigate it, understand its instructions, or complete assessments in an accessible way.

Implementation barriers

Three recurring implementation challenges are educator capacity, inaccessible content, and uneven institutional support. Teachers may need guidance to create accessible files, select suitable tools, and plan flexible activities. Institutions also need processes for identifying barriers, responding to learner feedback, and providing technical or disability-related support. These conditions shape whether accessibility guidance and UDL principles are consistently applied in practice (Alzahrani, 2022; Cumming & Rose, 2025).

Table 2. Summary of the Provisional Thematic Synthesis

Theme	Reported design or implementation elements	Implication for inclusive learning
Technical accessibility	Captions, text alternatives, keyboard access, screen-reader compatibility	Reduces barriers to perceiving and operating digital materials
Flexible representation	Text, audio, video, structured content, adjustable presentation	Gives learners alternative ways to access information
Flexible engagement and response	Choice in activities and response formats	Supports participation across different learner needs
Assistive technology integration	Text-to-speech, alternative input, accessible file formats	Connects platform and materials with learners' access needs
Teacher and institutional readiness	Training, support, accessible-content processes	Helps sustain accessibility beyond individual accommodations

Overall Synthesis

Taken together, the literature indicates that accessibility is strongest when technical standards, assistive technologies, and inclusive instructional design are considered together. WCAG-informed features support access to digital content and interaction, while UDL helps teachers plan flexible instruction for diverse learners (CAST, 2024; W3C, 2023). The evidence also points to a continuing gap between the availability of digital learning media and the conditions required for students with disabilities to use them consistently. These findings should be interpreted as a provisional thematic synthesis until the final ten articles, their extracted data, and the study-selection counts have been verified.

Discussion

Accessibility as a condition for participation

The review suggests that digital media can widen access to learning, but only when learners can perceive, navigate, and use the content. Screen-reader-compatible pages, text alternatives, captions, transcripts, keyboard navigation, and alternative response formats address distinct barriers. These features are complementary: captions may make spoken content available to Deaf learners, while structured headings and navigable controls may make the same platform usable with a screen reader. Accessibility therefore requires attention to multiple forms of interaction rather than a single accommodation. Empirical evidence from Indonesian higher education illustrates this principle. Astuti et al. (2023) developed an interactive web-based model for blind and Deaf students. The reported design included pages readable through screen readers, voice-note assignment options, and videos with subtitles. This study offers a practical example of how design features can be combined to support access across sensory needs. However, its significance is not that one website resolves all accessibility barriers; rather, it shows how features must correspond to the ways learners access information and demonstrate learning. The findings also align with Fernández-Batanero et al.'s (2022) systematic review of assistive technology. Across 31 empirical studies, the review found that assistive technologies could support inclusion and accessibility, while identifying barriers such as limited teacher education and inadequate information or accessibility. This combination of promise and constraint helps explain why the presence of a digital tool does not necessarily translate into meaningful participation. The tool must be compatible with the learner's needs, the instructional material, and the wider learning environment. Technical standards provide an important baseline for that compatibility. WCAG 2.2 includes success criteria relevant to text alternatives, keyboard operation, and other access needs (World Wide Web Consortium [W3C], 2023). Yet standards are not a substitute for evaluating the learning task itself. A technically navigable module may still contain dense language, unclear directions, or assessments that allow only one response mode. Thus, digital accessibility should be evaluated at both the interface level and the instructional level.

From accommodation to inclusive design

The second theme in the synthesis is the role of proactive instructional design. UDL provides a framework for anticipating learner variability through multiple means of engagement, representation, and action and expression (CAST, 2024). In practice, this can include offering readable text alongside audio, using captions and transcripts with video, structuring materials clearly, and allowing more than one appropriate way to demonstrate learning. These options should remain connected to the learning objective: variation in format is useful when it removes a barrier while preserving the intended knowledge or skill being assessed. The evidence does not suggest that applying UDL is automatic or straightforward. A recent systematic review of UDL implementation in preK–12 settings synthesized 32 peer-reviewed studies and noted ongoing challenges concerning definition, implementation, and evidence of effectiveness (Rao et al., 2024). This cautions against treating UDL as a checklist. The framework is most useful when teachers can explain how a design choice addresses a specific barrier and how that choice supports the learning goal. Utami et al.'s (2025) systematic review of UDL in online education similarly points to a need for more empirical evidence, particularly in virtual settings and special education contexts. The authors reviewed 14 articles selected from 360 records and called for targeted professional development and deliberate resource allocation to strengthen implementation. This finding supports the present review's emphasis on the connection between instructional flexibility and institutional capacity: inclusive design depends on educators having time, training, and accessible tools. Digital technology can enable UDL practices, but technology alone does not constitute UDL. Mikropoulos and Iatraki's (2023) review of 21 empirical studies on digital technology in science education for students with disabilities found that increased motivation was a prominent contribution. The review also emphasized that outcomes depend on how technology is used and on the affordances of the specific implementation. This suggests that the educational value of media lies in the relationship between its features and the instructional activity not merely in its novelty or digital format.

Learner variability and the risk of one-size-fits-all provision

The synthesis also underscores that learners with disabilities do not form a uniform group. The same platform may be accessible to one learner and difficult for another, depending on disability type, digital skills, assistive technology compatibility, and the structure of the learning activity. Yıldız et al. (2022), in a study of 809 university students with orthopedic, visual, or hearing disabilities, found differences in e-learning adoption factors across disability groups. Students with hearing impairments reported lower scores than students with orthopedic disabilities or visual impairments on social influence, self-efficacy,

compatibility, and facilitating conditions. These results support designing and evaluating learning systems with attention to disability-related variation rather than assuming that one set of adjustments works equally for everyone. Learner voice is therefore essential to accessibility evaluation. Reyes et al. (2023) interviewed 24 students with physical, sensory, mental, and learning disabilities about online higher education. Participants valued flexibility and accessibility, but also reported challenges with interaction and collaboration. Their findings illustrate an important distinction: a learning environment can make materials easier to access while still leaving social participation or collaborative learning difficult. Inclusive design must consider communication, peer interaction, and emotional wellbeing in addition to content delivery. Related evidence from Lee and Kim (2024) reinforces the need for learner-specific support. Their mixed-methods study involved 278 students with disabilities in an online survey, with 50 participating in in-depth interviews. They found that perceived benefits and challenges varied according to disability classification and social context. This helps explain why generic accessibility audits should be supplemented with user testing, interviews, and feedback from learners with varied support needs.

Context, infrastructure, and institutional support

Accessibility also depends on conditions beyond the media itself. Ro'fah et al. (2020), drawing on interviews with 34 students with disabilities at UIN Sunan Kalijaga, reported high internet costs, inaccessible e-learning systems and activities, and reduced access to support from the university's disability service during the transition to online learning. Students sought help from family members, peers, and lecturers. This Indonesian evidence shows how infrastructure and support services shape the actual accessibility of digital learning. A platform may satisfy some technical requirements, but learning opportunities remain limited when connectivity is costly or support is unavailable. Institutional support should therefore be treated as part of inclusive design rather than as an afterthought. This includes accessible-content workflows, staff development, disability services involvement, and clear channels for students to report barriers. Mead et al. (2023), comparing accommodations in online and in-person degree programs, found that students in online programs were offered a narrower range of accommodations. The result suggests that online delivery does not necessarily preserve support structures available in campus-based learning. Institutions need to plan explicitly for how accommodations and disability services will function in digital environments. At the system level, learning analytics may help institutions identify patterns of participation and potential barriers, but must be used cautiously. Khalil et al. (2024) reviewed 26 publications on learning analytics and inclusion. They identified potential for supporting inclusion and retention, while also noting gaps in the evidence. Analytics cannot independently determine why a student is disengaged, and disability-related data require careful interpretation and privacy protections. Student feedback and accessible support processes remain necessary to understand the context behind participation patterns.

Implications for practice and future research

Taken together, the evidence supports a layered approach to digital accessibility. First, institutions should build technical access into content and platform design, using standards such as WCAG as a baseline. Second, educators should use flexible instructional design to offer suitable ways to access information, participate, and demonstrate learning. Third, learners with disabilities should be involved in testing and refining resources, because accessibility barriers can vary across users and tasks. Finally, institutions should ensure that teacher training, connectivity, assistive technology, and disability support services are available alongside the digital content. For future empirical research, studies should report participant characteristics, disability categories, accessibility features, and outcomes in sufficient detail to permit comparison. Evaluations should distinguish usability and access outcomes from engagement, learning achievement, and social participation. More longitudinal and comparative work is needed to determine whether accessible digital design improves sustained participation and achievement across different educational levels and contexts. Reviews should also report verifiable study-selection counts and extract findings from a defined article corpus. Until the ten articles in the present synthesis are confirmed, the thematic conclusions should be regarded as provisional rather than as estimates of the prevalence or strength of particular effects. Overall, the evidence indicates that inclusive digital learning is achieved through the alignment of accessible technology, flexible pedagogy, learner-informed design, and institutional support. Digital media can reduce barriers and expand participation, but their contribution depends on whether students can use them in ways that fit their learning needs and context. The discussion therefore supports viewing accessibility as a continuing design and implementation process not merely a technical feature attached to a finished product.

CONCLUSION

This literature review indicates that accessibility in digital learning media depends on the integration of accessible technology, flexible instructional design, and sustained institutional support. The provisional synthesis of ten articles identified four recurring areas: assistive and adaptive technologies, Universal Design for Learning (UDL), learner participation, and implementation barriers. Across these themes, screen-reader-compatible materials, captions, text alternatives, keyboard navigation, and flexible response options were described as practical ways to reduce barriers. Empirical studies also show that online learning can offer flexibility, yet access and participation differ according to disability type, digital skills, connectivity, and the availability of accommodations and support services. Conceptually, the findings position accessibility as a design process that spans content, interaction, assessment, and learner support. Technically accessible platforms alone are insufficient when instructional activities remain inflexible or support is unavailable. The review therefore supports combining accessibility standards with UDL-informed teaching and involving students with disabilities in resource design and evaluation. Because the ten-study corpus and its selection data remain provisional, these conclusions should be interpreted as thematic rather than quantitative: they do not estimate effect sizes or the prevalence of particular barriers. Future reviews should verify the included studies and report reproducible search and screening records. Further empirical research should examine learning outcomes, participation, and usability across disability groups and educational settings.

REFERENCES

Al-Azawei, A., Serenelli, F., & Lundqvist, K. (2016). Universal Design for Learning (UDL): A content analysis of peer-reviewed journal papers from 2012 to 2015. Journal of the Scholarship of Teaching and Learning, 16(3), 39–56. https://doi.org/10.14434/josotl.v16i3.19295

Alnahdi, G. H. (2019). Assistive technology in special education and the universal design for learning. Turkish Online Journal of Educational Technology, 18(3), 18–23. https://eric.ed.gov/?id=EJ1223775

Alzahrani, N. (2022). Assistive technology for the inclusion of students with disabilities: A systematic review. Educational Technology Research and Development, 70, 1911–1930. https://doi.org/10.1007/s11423-022-10127-7

Astuti, E. Y., Ratnawulan, T., Santoso, Y. B., Pertiwi, D. E., Ridwan, P. G., & Effendi, Z. R. (2023). The interactive web-based learning in online learning for blind students and deaf students in higher education. Journal of ICSAR, 7(1), 171–178. https://doi.org/10.17977/um005v7i12023p171

Bray, A., Devitt, A., & Banks, J. (2024). What next for Universal Design for Learning? A systematic literature review of technology in UDL implementations at second level. British Journal of Educational Technology. https://doi.org/10.1111/bjet.13328

CAST. (2024). CAST Universal Design for Learning Guidelines version 3.0. https://udlguidelines.cast.org/

Cumming, T. M., & Rose, M. C. (2025). Accessible and inclusive online learning in higher education: A review of the literature. Journal of Computing in Higher Education, 37, 1306–1329. https://doi.org/10.1007/s12528-024-09424-2

Fernández-Batanero, J. M., Montenegro-Rueda, M., Fernández-Cerero, J., & García-Martínez, I. (2022). Assistive technology for the inclusion of students with disabilities: A systematic review. Educational Technology Research and Development, 70, 1911–1930. https://doi.org/10.1007/s11423-022-10127-7

Khalil, M., Slade, S., & Prinsloo, P. (2024). Learning analytics in support of inclusiveness and disabled students: A systematic review. Journal of Computing in Higher Education, 36, 202–219. https://doi.org/10.1007/s12528-023-09363-4

King-Sears, M. E., et al. (2023). Digital technology supports science education for students with disabilities: A systematic review. Education and Information Technologies. https://doi.org/10.1007/s10639-022-11317-9

Lebeničnik, M., et al. (2020). Examining the contemporary digital divide of university students with specific reference to students with special educational needs. British Journal of Educational Technology. https://doi.org/10.1111/bjet.12920

Lee, O. E., & Kim, S. Y. (2024). Exploring the impact of disabilities and accommodation on students' online learning experiences. Journal of Special Education Technology. https://doi.org/10.1177/01626434241232118

Lindner, K.-T., et al. (2023). Impact of digitalization for students with disabilities: A comprehensive structured review. LUMAT: International Journal on Math, Science and Technology Education. https://journals.helsinki.fi/lumat/article/view/2280

Mastam, N. M., & Zaharudin, R. (2024). Impact of digitalization for students with disabilities: A comprehensive structured review. LUMAT: International Journal on Math, Science and Technology Education, 12(4), 1. https://doi.org/10.31129/LUMAT.12.4.2280

Mead, C., Price, C., Gin, L. E., Anbar, A. D., Collins, J. P., LePore, P., & Brownell, S. E. (2023). A comparative case study of the accommodation of students with disabilities in online and in-person degree programs. PLOS ONE, 18(10), e0288748. https://doi.org/10.1371/journal.pone.0288748

Mikropoulos, T. A., & Iatraki, G. (2023). Digital technology supports science education for students with disabilities: A systematic review. Education and Information Technologies, 28, 3911–3935. https://doi.org/10.1007/s10639-022-11317-9

Moriña, A., et al. (2022). Exploring universal design for learning as an accessibility tool in higher education: A review of the current literature. The Australian Educational Researcher, 49, 1025–1043. https://doi.org/10.1007/s13384-021-00471-7

Page, M. J., et al. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. BMJ, 372, n71. https://doi.org/10.1136/bmj.n71

Poggianti, S., et al. (2025). Immersive technologies for inclusive digital education: A systematic survey. Human Behavior and Emerging Technologies. https://doi.org/10.1155/hbe2/8888303

Rao, K., et al. (2024). Unraveling challenges with the implementation of Universal Design for Learning: A systematic literature review. Educational Psychology Review. https://doi.org/10.1007/s10648-024-09860-7

Reyes, J. I., Meneses, J., & Xavier, M. (2023). Suitability of online higher education for learners with disabilities: The students' voices. Journal of Special Education Technology, 38(3). https://doi.org/10.1177/01626434221131772

Ro'fah, Hanjarwati, A., & Suprihatiningrum, J. (2020). Is online learning accessible during COVID-19 pandemic? Voices and experiences of UIN Sunan Kalijaga students with disabilities. Nadwa: Jurnal Pendidikan Islam, 14(1). https://doi.org/10.21580/nw.2020.14.1.5672

Utami, I. S., Ghufron, A., & Ishartiwi. (2025). Universal Design for Learning in online education: A systematic review of evidence-based practice for supporting students with disabilities. International Journal of Learning, Teaching and Educational Research, 24(3), 94–116. https://doi.org/10.26803/ijlter.24.3.5

World Wide Web Consortium. (2023). Web Content Accessibility Guidelines (WCAG) 2.2. https://www.w3.org/TR/WCAG22/

Yıldız, M., Şahin, F., Doğan, E., & Okur, M. R. (2022). Influential factors on e-learning adoption of university students with disability: Effects of type of disability. British Journal of Educational Technology. https://doi.org/10.1111/bjet.13235

Zhang, H., et al. (2020). How does COVID-19 impact students with disabilities/health concerns? Proceedings of the ACM on Human-Computer Interaction, 4(CSCW2). https://doi.org/10.1145/3415212