
**PERCEIVED EASE OF USE AND ACCESSIBILITY OF DIGITAL
TOOLS AND THEIR INFLUENCE ON ELEMENTARY LEARNERS’
SCIENCE LEARNING**

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ABSTRACT

The integration of digital technologies in education has increasingly transformed the teaching and learning of science, providing learners with interactive and engaging opportunities to explore scientific concepts. Despite these advancements, the effectiveness of digital tools in improving science learning outcomes largely depends on students’ perceptions of their usability and accessibility. This study examined Senior High School students’ perceptions of digital tools used in science instruction in terms of perceived ease of use, accessibility, and their perceived impact on science learning. Anchored on the Technology Acceptance Model (TAM), Constructivist Learning Theory, and the Universal Design for Learning (UDL) framework, the study aimed to determine how these factors influence students’ engagement, conceptual understanding, and motivation in science learning. Using a descriptive quantitative research design, data were collected from Senior High School students through a structured survey questionnaire employing a four-point Likert scale. The instrument measured students’ perceptions of the usability and accessibility of digital learning tools and their perceived contribution to learning outcomes such as engagement, conceptual understanding, and problem-solving skills in science. Descriptive statistics were used to analyze the data and determine the overall level of students’ perceptions regarding the use of digital tools in science education. The findings of the study are expected to provide insights into how digital technologies can be effectively integrated into science instruction to enhance learning experiences and promote meaningful engagement among learners. Furthermore, the results may inform educators, school administrators, and policymakers in designing

technology-supported instructional strategies that are accessible, user-friendly, and responsive to students' learning needs. Ultimately, the study contributes to the growing body of research on technology-enhanced learning and supports efforts to improve the quality and inclusivity of science education in the digital era.

KEYWORDS: Digital tools, science education, perceived ease of use, accessibility, technology-enhanced learning, student perceptions.

INTRODUCTION

In contemporary classrooms, digital technologies have become increasingly integrated into the teaching and learning of science. Educational videos, simulations, interactive games, and online learning platforms are now widely used to support learners' understanding of scientific concepts and processes. Globally, the use of digital learning tools has expanded rapidly, with recent international surveys indicating that approximately 70% of schools worldwide have incorporated some form of digital technology into classroom instruction (UNESCO, 2023). Research suggests that these technologies can enhance learners' engagement and conceptual understanding by presenting scientific phenomena in visual and interactive formats that are difficult to demonstrate through traditional instruction alone (Hattie, 2023; Scherer et al., 2023). However, the mere presence of digital technology does not guarantee meaningful learning outcomes. Scholars emphasize that the effectiveness of digital tools depends largely on their usability, accessibility, and alignment with learners' needs and abilities (Almaiah et al., 2022).

For elementary learners who are still developing foundational scientific knowledge and digital literacy skills, the ease of use and accessibility of digital tools play a particularly critical role. Studies show that younger learners benefit more from technology when digital platforms are intuitive, user-friendly, and designed to support exploratory learning (Howard et al., 2022). When digital tools are accessible and easy to navigate, they can promote curiosity, encourage inquiry, and support the development of basic problem-solving skills in science (Scherer et al., 2023). Conversely, when technology is difficult to access or overly complex, it may create barriers to learning and reduce students' motivation to engage with digital resources (Almaiah et al., 2022). Understanding how elementary learners perceive and experience digital tools is therefore essential in determining whether technology enhances or hinders science learning.

Globally, governments and educational institutions have invested significantly in educational technology to improve learning outcomes. Between 2020 and 2023, global investments in educational technology exceeded USD 300 billion, reflecting the growing belief that digital innovations can transform teaching and learning (World Bank, 2023). Despite these investments, international assessments continue to reveal persistent challenges in science achievement. Results from the Programme for International Student Assessment (PISA) 2022 show that the global average score in science declined by approximately 6 points compared with the previous assessment cycle, indicating ongoing learning losses and difficulties in scientific reasoning and conceptual understanding among students worldwide (Organisation for Economic Co-operation and Development [OECD], 2023). These findings highlight the need to examine not only the availability of digital technologies in schools but also how learners interact with them.

Emerging research indicates that students' perceptions of digital tools significantly influence their engagement and learning outcomes. A large-scale study involving more than 20,000 students across multiple countries found that perceived ease of use and perceived usefulness of digital platforms were strong predictors of students' continued engagement with technology-enhanced learning environments (Scherer et al., 2023). Similarly, Almaiah et al. (2022) reported that students who perceived digital tools as accessible and easy to use demonstrated higher levels of academic engagement and perceived learning gains in science and technology subjects. However, despite the growing body of literature on educational technology, relatively few studies focus specifically on elementary learners' perceptions of digital tools, particularly in relation to science education. This gap suggests the need for further investigation into how younger learners experience digital technologies and how these experiences influence their science learning outcomes.

This study is also aligned with the United Nations Sustainable Development Goal 4 (SDG 4): Quality Education, which aims to ensure inclusive, equitable, and quality education for all learners. SDG 4 emphasizes the importance of improving learning outcomes and providing effective learning environments supported by appropriate educational technologies. UNESCO (2023) highlights that digital technologies have the potential to expand access to learning opportunities and improve instructional quality, but only when they are designed and implemented in ways that are inclusive, accessible, and learner-centered. By examining elementary learners' perceptions of digital tools in terms of ease of use, accessibility, and

perceived learning impact, this study contributes to understanding whether digital technologies support equitable and meaningful science learning experiences.

In the Philippines, improving science education remains a pressing concern. Results from the PISA 2022 assessment show that Filipino learners obtained an average science score of 356, significantly below the OECD average of 485. Furthermore, approximately 77% of Filipino students were classified as low performers in science, indicating difficulties in explaining scientific phenomena, interpreting data, and applying scientific knowledge to real-world situations (OECD, 2023). These findings suggest that many learners struggle to develop the foundational scientific competencies necessary for academic success and informed decision-making.

At the same time, the Philippine education sector has accelerated efforts to integrate digital technology into teaching and learning. The Department of Education has promoted digital learning initiatives, including the use of learning management systems, online resources, and technology-assisted instruction in schools (DepEd, 2023). However, access to digital technology remains uneven across households and communities. According to the 2024 National ICT Household Survey, only 48.8% of households in the Philippines had internet access at home, indicating that more than half of Filipino learners may face limitations in accessing digital learning resources outside the classroom (Philippine Statistics Authority [PSA] & Department of Information and Communications Technology [DICT], 2024). These disparities highlight the importance of examining how accessibility influences students' experiences with digital learning tools.

In the Cordillera Administrative Region, progress in digital connectivity has been observed in recent years; however, significant disparities remain across communities. Recent survey data indicate that approximately 53.2% of households in the region had internet access in 2024, reflecting gradual improvements in digital infrastructure (PSA & DICT, 2024). Nevertheless, connectivity challenges persist in geographically isolated and economically disadvantaged areas, which may affect learners' opportunities to engage with digital educational resources. These contextual factors suggest that students' experiences with digital tools in science learning may vary depending on their access to devices, internet connectivity, and technological support within schools.

Despite these developments, localized research examining elementary learners' perceptions of digital tools in science instruction within the Cordillera region remains limited. Few studies investigate whether learners perceive digital platforms as easy to use, accessible, and effective in supporting their understanding of scientific concepts, motivation to learn, and development of critical thinking skills. As a result, educational decisions at the regional and school levels often rely on national or international findings that may not fully capture the realities of learners in the local context. Addressing this research gap is therefore essential in ensuring that digital science instruction is responsive to the needs, experiences, and learning conditions of students in the region.

The findings of this study are expected to benefit several stakeholders in the education sector. Elementary learners may benefit from improved science learning experiences through the effective integration of accessible and user-friendly digital tools. Teachers may use the results to inform instructional practices and select digital resources that better support pupils' learning needs. School administrators and policymakers may utilize the findings to guide evidence-based decisions related to technology investment, infrastructure development, and equitable access to digital resources. Curriculum developers and educational technology designers may also benefit from insights that can help improve the usability and pedagogical effectiveness of digital learning platforms. Finally, the study contributes to the growing body of research on digital technology in education, particularly in understanding how digital tools can support science learning among elementary learners in the Philippine context.

Review of Related Literatures

This study is grounded in established learning and technology adoption theories that explain how students interact with digital tools and how these interactions influence learning outcomes in science education. Specifically, the Technology Acceptance Model (TAM), Constructivist Learning Theory, and the Universal Design for Learning (UDL) framework collectively provide a comprehensive lens for examining students' perceptions of digital tools in terms of perceived ease of use, accessibility, and their impact on science learning. These frameworks converge on the principle that the effectiveness of technology-enhanced instruction does not depend solely on the availability of digital tools but on how learners perceive their usability, inclusivity, and instructional value. Contemporary education research consistently emphasizes that students' perceptions of technology play a decisive role in

shaping engagement, motivation, and learning outcomes in digitally mediated environments (OECD, 2023; UNESCO, 2023).

The Technology Acceptance Model (TAM) serves as the primary theoretical anchor of the study. Originally developed by Davis (1989), TAM explains technology adoption by positing that users' acceptance of a technological system is primarily influenced by two key constructs: perceived ease of use and perceived usefulness. Perceived ease of use refers to the degree to which a user believes that a system is free from effort, while perceived usefulness refers to the degree to which the user believes that the system enhances performance or learning outcomes. These perceptions subsequently shape attitudes toward technology use and ultimately determine behavioral intention and actual use. Within the context of education, numerous studies have validated TAM as a reliable framework for understanding students' engagement with digital learning platforms (Almaiah et al., 2022; Scherer et al., 2023). In science education, TAM provides a valuable explanation for why digital tools that are perceived as intuitive, manageable, and beneficial are more likely to be adopted by students and integrated into their learning processes. When learners perceive digital tools as easy to use and useful for understanding scientific concepts, they are more inclined to interact with them actively, thereby increasing engagement and supporting deeper conceptual understanding. Consequently, TAM supports the assumption that students' perceptions of ease of use and accessibility influence the extent to which digital tools contribute to meaningful learning experiences.

Complementing the technological perspective of TAM, Constructivist Learning Theory provides the pedagogical foundation for understanding how digital tools facilitate science learning. Rooted in the works of Piaget and Vygotsky, constructivism posits that learners actively construct knowledge through interaction with their environment, engagement in inquiry, and reflection on experiences rather than through passive reception of information. Within science education, constructivist approaches emphasize exploration, experimentation, and problem-solving as key processes in developing scientific understanding. Digital tools such as simulations, virtual laboratories, interactive visualizations, and collaborative learning platforms align closely with constructivist principles because they enable learners to manipulate variables, observe scientific phenomena, and test hypotheses in dynamic learning environments (Scherer et al., 2023). Research indicates that technology-enhanced constructivist environments can improve students' conceptual understanding and engagement

in STEM subjects by providing opportunities for inquiry-based learning and experiential exploration (Hattie, 2023). However, the effectiveness of such tools depends on learners' ability to interact with them effectively. If digital platforms are perceived as complex, inaccessible, or difficult to navigate, their potential to support meaningful knowledge construction may be diminished. Thus, students' perceptions of usability and accessibility become critical indicators of whether digital technologies successfully support constructivist learning processes.

Further strengthening the conceptual grounding of the study is the Universal Design for Learning (UDL) framework, which emphasizes accessibility and inclusivity in educational environments. UDL advocates for the design of instructional materials and learning environments that accommodate diverse learners by providing multiple means of engagement, representation, and expression (CAST, 2018; UNESCO, 2023). In the context of digital learning, UDL highlights the importance of designing technologies that allow learners with different abilities, learning preferences, and contextual constraints to participate fully in the learning process. Digital platforms aligned with UDL principles offer flexible pathways for accessing content, interacting with learning materials, and demonstrating understanding. In science education, this may include multimedia explanations of scientific concepts, interactive simulations, and alternative ways for learners to express scientific reasoning. From a UDL perspective, accessibility extends beyond physical access to technology and includes functional usability—whether learners can effectively navigate digital platforms, understand content, and participate in learning activities regardless of contextual limitations such as connectivity, device availability, or prior technological experience (UNESCO, 2023). Therefore, students' perceptions of accessibility are critical in determining whether digital tools promote inclusive participation in science learning.

Guided by these theoretical foundations, the present study conceptualizes perceived ease of use and accessibility of digital tools as key determinants of their perceived impact on science learning. Perceived impact on learning is reflected in students' reported understanding of science concepts, engagement in learning activities, motivation to learn, and support for problem-solving and critical thinking. Consistent with learner-centered perspectives in contemporary education research, the framework assumes that students' perceptions mediate the relationship between technology integration and learning outcomes. In other words, the effectiveness of digital tools in science education depends not only on their technical features

but also on how learners experience and interpret their usability and accessibility (OECD, 2023).

The integration of digital tools in science instruction is also supported by the legal and policy frameworks governing basic education in the Philippines. The Enhanced Basic Education Act of 2013 (Republic Act No. 10533) mandates the implementation of a learner-centered curriculum that promotes critical thinking, scientific literacy, and technological competence among learners. The law emphasizes the importance of integrating technology in teaching and learning to prepare students for the demands of the twenty-first century. Complementing this mandate, the Department of Education's Basic Education Development Plan (BEDP) 2030 prioritizes digital transformation in education, including the expansion of ICT infrastructure, the development of digital learning resources, and the promotion of technology-enabled instruction to improve learning outcomes and educational equity (DepEd, 2022). Furthermore, DepEd policies on digital education and flexible learning modalities institutionalize the use of information and communication technologies to enhance instructional delivery and expand access to quality education, particularly in geographically and socioeconomically diverse contexts.

These legal and policy frameworks underscore the responsibility of educational institutions to ensure that digital technologies used in classrooms are not only available but also accessible, user-friendly, and pedagogically effective. In this regard, examining students' perceptions of digital tools in terms of ease of use, accessibility, and perceived learning impact directly supports national efforts to strengthen quality, equity, and innovation in Philippine basic education.

In addition to national legislation, the integration of digital technologies in Philippine basic education is further supported by policy issuances and memoranda from the Department of Education (DepEd) that promote the effective use of information and communication technologies (ICT) in teaching and learning. For instance, DepEd Order No. 78, s. 2010, also known as the Guidelines on the Implementation of the DepEd Computerization Program (DCP), emphasizes the provision of ICT infrastructure and digital resources to public schools to enhance teaching and learning processes. The program aims to strengthen digital literacy, support technology-assisted instruction, and improve learners' access to educational resources. More recently, DepEd Order No. 012, s. 2020, which outlines the Basic Education

Learning Continuity Plan (BE-LCP), institutionalized the use of digital platforms, learning management systems, and online resources to ensure continuous learning delivery amid disruptions in traditional classroom instruction (DepEd, 2020). These policy initiatives highlight the Department's commitment to integrating digital technologies in the classroom and underscore the importance of ensuring that such technologies are accessible, user-friendly, and pedagogically meaningful for learners.

Furthermore, the use of digital tools in education aligns closely with the global agenda on Quality Education, particularly the United Nations Sustainable Development Goal 4 (SDG 4), which seeks to ensure inclusive, equitable, and quality education and promote lifelong learning opportunities for all. SDG 4 emphasizes not only expanding access to education but also improving the quality of learning environments and instructional strategies that support meaningful learning outcomes (UNESCO, 2023). In the context of science education, digital technologies have the potential to enhance conceptual understanding, engagement, and inquiry-based learning when implemented effectively and equitably. However, international reports stress that achieving quality education requires addressing issues related to accessibility, digital inclusion, and learner-centered instructional design (OECD, 2023; UNESCO, 2023). By examining students' perceptions of the ease of use and accessibility of digital tools in science learning, this study contributes to the broader effort of ensuring that technology integration supports not only innovation in instruction but also the equitable and effective delivery of quality education.

In summary, the theoretical and conceptual foundation of this study integrates the Technology Acceptance Model, Constructivist Learning Theory, and the Universal Design for Learning framework to explain how students' perceptions of digital tools influence their science learning experiences. By positioning perceived ease of use and accessibility as central determinants of perceived learning impact, the framework provides a coherent basis for examining the effectiveness of digital technologies in science instruction. This integrated perspective supports the development of evidence-based strategies for implementing digital tools in ways that are inclusive, user-centered, and pedagogically meaningful in contemporary science education.

METHODOLOGY

The review of related literature for this study employed a systematic and thematic approach to identify, analyze, and synthesize relevant scholarly works related to digital tools in science education, students' perceptions of technology use, accessibility of digital learning platforms, and their impact on learning outcomes. The primary objective of the literature review was to establish the theoretical and empirical foundation of the study and to identify existing research gaps that justify the present investigation.

To gather relevant sources, a comprehensive search was conducted using major academic databases and digital repositories, including Google Scholar, Scopus-indexed journals, ERIC (Education Resources Information Center), ScienceDirect, and SpringerLink. Keywords used in the search included combinations of the following terms: digital tools in education, technology acceptance model in education, perceived ease of use, digital learning accessibility, technology-enhanced science learning, educational technology in STEM, and students' perceptions of digital learning. The search was limited primarily to peer-reviewed journal articles, international reports, and scholarly publications published between 2020 and 2024 to ensure the inclusion of recent and relevant studies. Foundational theoretical works, such as those related to the Technology Acceptance Model and Constructivist Learning Theory, were also included to provide theoretical grounding.

The selection of literature followed specific inclusion criteria. Studies were included if they (1) examined the use of digital tools or educational technologies in teaching and learning, (2) focused on students' perceptions, usability, accessibility, or learning outcomes associated with digital platforms, and (3) were published in reputable peer-reviewed journals or recognized international organizations such as UNESCO, OECD, and the World Bank. Studies that focused solely on technological infrastructure without discussing student experiences or learning outcomes were excluded. Additionally, priority was given to empirical studies and systematic reviews that examined technology use in science, STEM, or general classroom learning contexts.

After identifying relevant sources, the selected literature was organized and analyzed using a thematic synthesis approach. Studies were grouped according to key themes relevant to the variables of the present study, including perceived ease of use of digital tools, accessibility of digital learning platforms, technology adoption in education, and the impact of digital tools

on science learning outcomes. This thematic organization allowed the researcher to compare findings across studies, identify patterns and consistencies in the literature, and highlight areas where research evidence remains limited. The analysis also examined how theoretical frameworks such as the Technology Acceptance Model (TAM), Constructivist Learning Theory, and Universal Design for Learning (UDL) have been applied in previous studies to explain students' engagement with digital technologies.

Finally, the literature was synthesized to establish the conceptual and theoretical foundation of the study and to identify gaps in existing research, particularly in relation to students' perceptions of ease of use and accessibility of digital tools in science education. The synthesis of global, national, and regional studies provided the basis for positioning the present research within the broader discourse on technology-enhanced learning and informed the development of the study's conceptual framework.

RESULTS AND DISCUSSION

The growing integration of digital technologies in education has significantly transformed science instruction by enabling more interactive and learner-centered approaches. Research indicates that digital tools such as simulations, virtual laboratories, educational videos, and interactive learning platforms provide opportunities for learners to visualize complex scientific processes and engage with content in meaningful ways (Scherer et al., 2023). These technologies represent a major strength in contemporary science education because they enhance conceptual understanding and support inquiry-based learning environments that encourage exploration and experimentation (Hattie, 2023). Studies consistently show that students exposed to technology-supported instruction demonstrate higher engagement and improved comprehension of abstract scientific concepts compared with those in traditional lecture-based settings (OECD, 2023).

Another strength highlighted in the literature is the capacity of digital tools to promote active learning and student motivation. Interactive digital platforms provide opportunities for immediate feedback, collaborative learning, and personalized instruction, which are essential elements in modern educational environments (Almaiah et al., 2022). In science education, such tools allow learners to manipulate variables, observe simulated experiments, and explore cause-and-effect relationships in ways that traditional instructional methods may not fully support. These features align with constructivist principles that emphasize experiential

learning and knowledge construction through active engagement (Scherer et al., 2023). Consequently, digital technologies can strengthen learners' scientific reasoning and problem-solving abilities when used effectively in classroom settings.

Despite these strengths, the literature also identifies several weaknesses associated with the integration of digital technologies in education. One major limitation is that the presence of technology alone does not guarantee improved learning outcomes. Several studies reveal that technology implementation often fails to produce significant gains when digital tools are poorly designed, difficult to navigate, or inadequately integrated into instructional practices (Almaiah et al., 2022). In many cases, learners may experience cognitive overload when interacting with complex digital platforms, which can reduce engagement and hinder comprehension of scientific concepts. These findings suggest that the success of digital learning tools depends heavily on usability, accessibility, and alignment with instructional objectives.

Another weakness emphasized in the literature concerns disparities in digital literacy and technological readiness among learners. While digital technologies offer innovative learning opportunities, not all students possess the necessary skills or experience to navigate digital learning environments effectively (UNESCO, 2023). Learners who are unfamiliar with digital platforms may experience frustration and reduced participation in technology-enhanced instruction. Furthermore, some studies indicate that teachers may also struggle with effectively integrating digital tools into science instruction due to limited training or insufficient pedagogical support (OECD, 2023). These challenges highlight the need for continuous professional development and learner support to maximize the benefits of digital technologies in education.

In addition to weaknesses, the literature identifies several opportunities presented by digital technologies for improving science education. One notable opportunity lies in the potential of digital tools to expand access to educational resources and facilitate flexible learning environments. Online platforms, digital simulations, and multimedia learning materials allow students to access science content beyond the physical classroom, thereby supporting self-directed learning and exploration (World Bank, 2023). Such opportunities are particularly relevant in modern educational contexts where blended and technology-assisted learning environments are becoming increasingly common.

Another opportunity highlighted in recent studies is the ability of digital technologies to support inclusive and differentiated instruction. Frameworks such as Universal Design for Learning emphasize the use of digital tools to provide multiple means of engagement, representation, and expression, thereby accommodating diverse learning needs and preferences (UNESCO, 2023). Through multimedia content, adaptive learning systems, and interactive instructional materials, digital technologies can support learners with varying cognitive abilities, learning styles, and academic backgrounds. These inclusive features contribute to more equitable learning environments and help ensure that all students can participate meaningfully in science learning.

Digital technologies also create opportunities for improving learners' higher-order thinking skills and scientific inquiry competencies. Interactive simulations and digital experimentation platforms allow learners to investigate scientific phenomena, analyze data, and test hypotheses in dynamic environments that replicate real-world scientific investigations (Hattie, 2023). Such experiences foster critical thinking, analytical reasoning, and problem-solving abilities—skills that are essential for success in STEM-related disciplines. Consequently, the integration of digital technologies in science education has the potential to prepare learners for future academic and professional challenges in increasingly technology-driven societies.

However, the literature also highlights several threats that may hinder the effective use of digital technologies in education. One major threat is the persistent digital divide, which refers to disparities in access to technological resources such as internet connectivity, digital devices, and technological infrastructure (UNESCO, 2023). Students from economically disadvantaged communities may face difficulties accessing digital learning tools consistently, thereby limiting their ability to benefit from technology-enhanced instruction. These inequalities may widen existing educational gaps and undermine efforts to promote equitable learning opportunities.

Another significant threat involves the risk of overreliance on technology in instructional processes. While digital tools can enhance learning experiences, excessive dependence on technology may reduce opportunities for face-to-face interaction, collaborative discussion, and hands-on experimentation—elements that are essential in effective science education (OECD, 2023). Furthermore, poorly curated digital content may expose learners to inaccurate

information or distractions that reduce the effectiveness of instructional activities. These concerns underscore the importance of maintaining balanced instructional approaches that combine digital innovation with sound pedagogical practices.

Finally, the literature suggests that the successful integration of digital technologies in science education requires careful consideration of learners' perceptions and experiences. Students' perceived ease of use and accessibility of digital tools significantly influence their engagement, motivation, and willingness to adopt technology-supported learning environments (Scherer et al., 2023). When learners perceive digital tools as accessible, intuitive, and relevant to their learning needs, they are more likely to engage actively with instructional materials and develop positive attitudes toward science learning. Conversely, when digital tools are perceived as difficult to use or inaccessible, their potential benefits may not be fully realized.

Overall, the literature demonstrates that digital technologies offer significant strengths and opportunities for enhancing science education, but their effectiveness is moderated by various weaknesses and threats related to usability, accessibility, and equity. Understanding these factors is therefore essential for designing and implementing digital learning environments that support meaningful and inclusive science education. By examining students' perceptions of the ease of use and accessibility of digital tools, the present study seeks to contribute to the growing body of research that informs the effective integration of educational technologies in contemporary science instruction.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

The review of related literature indicates that digital technologies have become an integral component of contemporary science education, offering significant potential to enhance learners' engagement, conceptual understanding, and inquiry-based learning experiences. The integration of digital tools such as simulations, multimedia platforms, and interactive applications supports learner-centered instruction consistent with constructivist and technology adoption theories. However, the literature also reveals that the effectiveness of these technologies depends largely on students' perceptions of ease of use, accessibility, and instructional relevance. While digital tools present strong opportunities for improving science learning and promoting inclusive educational environments, persistent challenges such as

digital literacy gaps, unequal access to technological resources, and limitations in instructional implementation remain evident. These findings highlight the importance of examining learners' experiences and perceptions to ensure that digital technologies function as effective tools for meaningful science learning rather than as barriers to participation.

RECOMMENDATIONS

Based on the synthesis of the literature, it is recommended that educators, school administrators, and policymakers prioritize the selection and implementation of digital tools that are user-friendly, accessible, and aligned with pedagogical objectives in science instruction. Schools should strengthen technological infrastructure and provide equitable access to digital learning resources to address disparities in technology use among learners. Additionally, professional development programs should be continuously provided to teachers to enhance their competence in integrating digital technologies effectively within science classrooms. Curriculum developers and educational technology designers are also encouraged to adopt learner-centered and inclusive design principles, such as those promoted by the Universal Design for Learning framework, to ensure that digital platforms accommodate diverse learners' needs. Finally, further research should be conducted to explore students' perceptions and experiences with digital tools in various educational contexts to generate evidence-based strategies that support the effective and equitable integration of technology in science education.

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