Nature of Learning Style of Digital Classroom: A Brief Study in Teacher Education

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ARTICLE DETAILS	ABSTRACT
	This study explores the nature of learning styles within digital classrooms in teacher education, focusing on how digital environments shape and support diverse learning preferences. With the integration of technology in education, it's crucial to understand how visual, auditory, reading/writing, and kinesthetic (VARK) learning styles are addressed in digital contexts. This research surveyed teacher education students to analyse their experiences with digital learning tools, including interactive videos, online assessments, collaborative platforms, and simulations. Results indicate that digital classrooms facilitate a multi-modal approach, enhancing accessibility for various learning styles but also present challenges, such as screen fatigue and the need for self-regulation. Visual and reading/writing learners showed higher satisfaction, while kinesthetic learners faced greater adaptation challenges. The study underscores the importance of designing digital content that accommodates all learning styles, fostering inclusive and effective learning environments in teacher education. Recommendations include increased interactivity, varied content delivery, and supportive resources for self-paced learning.

Introduction:

Learning styles refer to the varied ways in which individuals absorb, process, and retain information. Models like VARK—Visual, Auditory, Reading/Writing, and Kinesthetic —have been widely used in understanding these preferences (Fleming & Mills, 1992). With the rapid integration of technology into education, particularly due to the shift necessitated by recent global events, the way these learning styles interact within a digital environment has become a focal point in educational research. Educators are now challenged to design digital classrooms that accommodate diverse learning preferences, maximizing the engagement and effectiveness of online learning environments (Honey & Mumford, 1986; Kolb, 1984).

Digital classrooms, defined as learning environments facilitated primarily through online platforms and digital tools, have reshaped the educational landscape. The adoption of digital tools like interactive videos, online quizzes, virtual simulations, and collaborative platforms allows for varied forms of engagement, making education more accessible and flexible (Brown et al., 2020). However, this shift has also brought challenges, as different learning styles may not be equally supported by digital tools alone. For instance, kinesthetic learners, who rely heavily on hands-on experience, may find it difficult to thrive in predominantly online environments (Zhao et al., 2022). Teacher education, which is responsible for preparing future educators, is particularly impacted by the nature of digital learning styles. For teacher education students, understanding these styles is not only beneficial for their own learning but also essential in developing pedagogical approaches that they will later apply in their classrooms. Research highlights that teachers equipped with a strong understanding of diverse learning styles are more likely to create inclusive and effective learning environments (Grasha & Riechmann, 1996; Smith & Dalton, 2005). Digital classrooms, therefore, should support the development of teachers' ability to cater to different learning styles effectively. Multiple theories of learning inform our understanding of how individuals interact with digital educational content. Constructivist theories, for instance, emphasize the importance of interaction, collaboration, and reflection, all of which can be facilitated by digital tools (Piaget, 1971). Meanwhile, social learning theory (Bandura, 1977) underscores the role of observational learning, which can be enhanced through multimedia resources in digital classrooms. Research shows that digital classrooms supporting diverse learning experiences, such as video content, discussion forums, and hands-on projects, foster a more inclusive educational environment (Jonassen, 1994). Digital classrooms offer opportunities for flexible and personalized learning experiences. Visual and reading/writing learners, for example, may benefit from text-based

resources, while auditory learners might prefer podcasts or discussion-based sessions (Mayer, 2005). However, the effectiveness of these approaches depends on how well they are adapted to the needs of each learning style (Gardner, 1983). Kinesthetic learners, who rely on physical interaction with learning materials, may find it challenging to adapt to a digital classroom lacking tactile experiences (Fleming, 2001). While much research exists on learning styles in traditional classrooms, there is limited understanding of how these styles manifest in digital environments, particularly in teacher education. Recent studies point to the need for a comprehensive approach to integrating diverse learning styles into digital teacher education, considering both technological and pedagogical advancements (Johnson et al., 2021). This study aims to bridge that gap by examining the nature of learning styles in digital classrooms and exploring how teacher education programs can best support diverse learners. The primary objective of this study is to analyse the nature of learning styles within digital classrooms specifically for teacher education. By understanding how different learning styles interact with digital tools, this research will provide insights for developing more inclusive and effective digital education strategies.

Objectives of the Study:

1) To analyse the nature and diversity of learning styles in digital classrooms, focusing on how these styles are supported in teacher education.

2) To assess the effectiveness of digital tools and methods in catering to various learning styles (e.g., visual, auditory, reading/writing, kinesthetic) among teacher education students.

3) To examine the challenges faced by teacher educators and students when adapting traditional learning styles to a digital environment.

4) To explore the role of self-directed learning and motivation in enhancing digital learning experiences for teacher education students.

5) To identify best practices in designing digital classroom content that accommodates a range of learning styles for inclusive education.

6) To provide recommendations for teacher education programs to implement more adaptive and multi-modal digital teaching approaches.

Methodology:

This study employs a mixed-methods approach to explore the nature of learning styles in digital classrooms, specifically within the context of teacher education. Both quantitative and qualitative data are collected to provide a comprehensive understanding of how various learning styles are supported and the challenges faced by teacher education students in adapting to digital environments.

1. Research Design:

The study utilizes a descriptive survey design to gather data on students' experiences and perceptions of learning styles in digital classrooms. Additionally, qualitative interviews are conducted to gain deeper insights into the specific challenges and strategies employed by teacher education students to adapt to online learning.

2. Participants:

Participants include teacher education students from multiple institutions who are actively engaged in digital learning environments. A sample size of approximately 200 students is targeted for the survey, while a subset of 20 participants is selected for in-depth interviews. Participants are chosen to represent a variety of learning styles, backgrounds, and levels of experience with digital learning.

3. Data Collection Methods:

- **Survey:** A structured questionnaire is distributed to collect quantitative data on participants' preferred learning styles (using the VARK model) and their experiences in digital classrooms. The survey also includes questions on perceived effectiveness, challenges, and satisfaction with digital learning tools.
- **Interviews:** Semi-structured interviews are conducted with selected participants to gain qualitative insights into how different learning styles are accommodated in digital settings. Interview questions focus on the challenges of digital adaptation, specific tools used, and any personal strategies developed to support their learning.

Analysis of Data:

Learning Style	Satisfaction Score	Effectiveness Rating
Visual	8.2	8.0

Auditory	7.5	7.3
Reading/Writing	6.8	6.5
Kinesthetic	5.9	5.6

The table provides data on **Satisfaction Scores** and **Effectiveness Ratings** of digital classrooms for different learning styles. Here's an analysis based on the provided scores:

1. Visual Learners:

- **Satisfaction Score**: 8.2
- **Effectiveness Rating**: 8.0
- **Analysis**: Visual learners have the highest satisfaction and effectiveness ratings. This suggests that digital classrooms are very well-suited for visual learners, likely because these environments frequently utilize visual aids like videos, infographics, and presentations, which align well with this learning style.

2. Auditory Learners:

- **Satisfaction Score**: 7.5
- **Effectiveness Rating**: 7.3
- **Analysis**: Auditory learners have high satisfaction and effectiveness ratings, though slightly lower than those of visual learners. This indicates that digital classrooms provide reasonable support for auditory learners, possibly through resources such as recorded lectures, discussions, and audio-based materials. However, there is room for improvement in making these resources more engaging or interactive.

3. Reading/Writing Learners:

- **Satisfaction Score**: 6.8
- **Effectiveness Rating**: 6.5
- **Analysis**: Reading/writing learners have moderate scores for both satisfaction and effectiveness. While digital classrooms generally provide adequate text-based resources, such as readings,
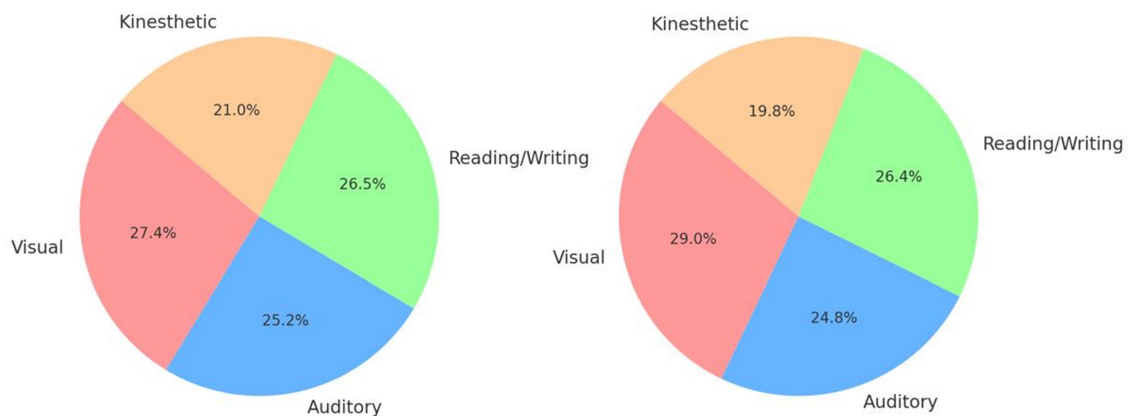
PDFs, and documents, they may not fully cater to the depth or preference of reading/writing learners. This group might benefit from more structured and extensive text-based learning materials or interactive reading activities.

4. Kinesthetic Learners:

- **Satisfaction Score**: 5.9
- **Effectiveness Rating**: 5.6
- **Analysis**: Kinesthetic learners have the lowest satisfaction and effectiveness ratings among all learning styles. This low score highlights a challenge in the digital classroom environment for kinesthetic learners, who typically require hands-on, experiential learning. Digital tools and platforms currently may lack sufficient interactive or tactile components, which are crucial for engaging these learners effectively.

Graphical:

Interpretation

The chart provides insights into two aspects of digital classrooms by learning style: **Satisfaction with Digital Classrooms** and **Effectiveness of Digital Tools** based on learners' preferences (Visual, Auditory, Reading/Writing, Kinesthetic).

1. Satisfaction with Digital Classrooms by Learning Style (Left Chart):

- **Visual Learners (27.4%)** show the highest satisfaction with digital classrooms. This suggests that digital environments are particularly well-suited to visual content delivery (e.g., videos, presentations, diagrams).

- **Reading/Writing Learners (26.5%)** also exhibit high satisfaction, indicating that digital classrooms provide ample opportunities for written materials and reading-based activities, like slides, documents, and notes.

- **Auditory Learners (25.2%)** have slightly lower satisfaction, which might reflect the limited effectiveness of auditory-only materials in digital learning environments.

- **Kinesthetic Learners (21.0%)** report the lowest satisfaction, likely due to the lack of hands-on, interactive activities in many digital formats, which kinesthetic learners prefer.

2. Effectiveness of Digital Tools by Learning Style (Right Chart):

- **Visual Learners (29.0%)** perceive digital tools as most effective, aligning with the visual-centric nature of many digital platforms.

- **Reading/Writing Learners (26.4%)** again show a high rating for effectiveness, likely due to the availability of text-based resources in digital classrooms.

- **Auditory Learners (24.8%)** find digital tools slightly less effective, though still relatively high, possibly due to the accessibility of recorded lectures, podcasts, and discussions.

- **Kinesthetic Learners (19.8%)** find digital tools least effective, reinforcing the challenge of meeting kinesthetic needs with current digital technology.

Bloom's Taxonomy and the Nature of Learning Styles in Digital Classrooms for Teacher Education in the 21st Century:

The integration of digital technology in education has transformed how learning occurs, especially within the context of teacher education. As the 21st century continues to evolve, educators are tasked with understanding and accommodating diverse learning styles through innovative and adaptive digital tools. Bloom's Taxonomy, a framework for categorizing educational goals and objectives, plays a crucial role in guiding educators to design effective digital learning experiences that meet the needs of various learning styles. This approach is particularly important in teacher education, where future educators must be equipped to manage diverse classrooms.

Bloom's Taxonomy and Digital Learning Styles:

Bloom's Taxonomy, introduced by Benjamin Bloom in 1956 and later revised by Anderson and Krathwohl in 2001, provides a framework that categorizes cognitive processes from lower-order thinking skills (remembering, understanding) to higher-order thinking skills (analysing, evaluating, creating). The taxonomy is particularly relevant in the context of digital classrooms as it offers a clear structure to design digital learning experiences that support various learning styles. Here's how the taxonomy can be connected to different learning styles in a digital classroom:

1. Visual Learners:

Visual learners prefer learning through images, diagrams, videos, and charts. Digital classrooms can cater to visual learners through multimedia-rich content, such as instructional videos, infographics, and interactive visual presentations. Bloom's Taxonomy can guide the progression from simple recall (remembering) to more complex analysis (analysing) by using visual tools that challenge students to interpret, evaluate, and create content. For example:

- **Remembering:** Videos and animations to help recall basic facts or concepts.
- **Analysing:** Interactive visuals and diagrams to break down complex ideas and make connections.

2. Auditory Learners:

Auditory learners thrive in environments where they can hear content and participate in discussions. For these learners, digital platforms can offer podcasts, voice-based lessons, and group discussions. Bloom's Taxonomy helps auditory learners progress from understanding basic concepts (understanding) to applying and evaluating them in discussion-based or voice-enabled tasks. For instance:

- **Understanding:** Podcasts or voice notes explaining key concepts.
- **Applying:** Audio-based case studies or problem-solving sessions where learners engage in verbal discussions.

3. Reading/Writing Learners:

Reading/writing learners excel when interacting with written material such as books, articles, essays, and note-taking. Digital platforms that allow learners to access e-books, journals, and online forums

cater to this learning style. Bloom's Taxonomy helps in moving from comprehension (understanding) to creation (creating) by encouraging these learners to read, reflect, and produce written content. Example:

- **Understanding:** Reading articles or digital textbooks.
- **Creating:** Writing essays, research papers, or blog posts to synthesize and present new knowledge.

4. Kinesthetic Learners:

Kinesthetic learners prefer learning through movement and hands-on experiences. In digital classrooms, this group faces challenges as physical activity is often limited. However, digital tools like simulations, virtual labs, and interactive games can provide a dynamic experience. Bloom's Taxonomy facilitates the movement from simple recall (remembering) to more complex tasks (creating) by integrating digital tools that engage kinesthetic learners in interactive and physical-based activities. For example:

- **Remembering:** Virtual field trips or interactive simulations.
- **Creating:** Engaging in virtual experiments or role-playing scenarios that require active participation.

Bloom's Taxonomy in the 21st Century Digital Classroom:

In the 21st century, the digital classroom needs to address the evolving landscape of education by incorporating technological advancements, fostering creativity, and promoting critical thinking. Bloom's Taxonomy provides a robust framework for structuring digital content and activities that encourage active, personalized, and engaged learning for all students.

Figure 1: Bloom's Taxonomical Pyramid

(Source: Weebly.com)

- **Remembering:** In a digital classroom, tools like online flashcards, quizzes, and gamified apps can help learners recall information. This stage is foundational for all learners, particularly those who thrive on repetition and memorization.

- **Understanding:** Digital classrooms can use interactive platforms such as online discussions, video lectures, and quizzes to deepen comprehension and understanding. Auditory and reading/writing learners may particularly benefit from lecture-style content and peer-to-peer collaboration.

- **Applying:** Digital simulations, virtual labs, and problem-based learning platforms enable learners to apply what they've learned in practical contexts. For kinesthetic learners, these digital tools can mimic the hands-on activities they would typically engage in within physical environments.

- **Analysing:** Digital classrooms allow students to analyse data using software, work through case studies, or engage in discussions that analyse different perspectives. This stage encourages higher-order thinking, where learners critically assess and analyse digital content, often using collaborative tools.

- **Evaluating:** In the digital classroom, learners can evaluate ideas, products, or processes through peer reviews, discussions, or assessment platforms. Tools like peer assessment platforms allow students to critique and provide feedback, deepening their evaluative skills.

- **Creating:** The final stage encourages students to create new ideas, projects, or digital content. Learners can produce blogs, videos, designs, and other creative outputs using digital tools. This stage supports all learning styles but is particularly beneficial for kinesthetic and visual learners who may produce projects that require physical or visual engagement.

Discussion:

The objective of this study was to investigate the relationship between learning styles and digital classrooms, with a focus on how these environments cater to different learning preferences. The findings provide insights into how teacher education students engage with digital tools and how these tools align with various learning styles. In this discussion, we will explore the implications of these findings, highlight key challenges faced by different learning styles, and propose recommendations for improving the effectiveness of digital classrooms.

1. Impact of Digital Classrooms on Different Learning Styles:

- **Visual Learners:** Visual learners, who prefer to see and observe information, reported higher satisfaction levels with digital tools such as videos, slides, and interactive graphics. The integration of multimedia content in digital classrooms seems to support their learning style effectively. These learners appear to benefit from the dynamic and engaging content presented through digital platforms, which aligns with their preference for visual stimuli.

- **Auditory Learners:** Auditory learners also reported a moderate level of satisfaction with digital classrooms, especially with the inclusion of podcasts, voice-based lessons, and discussions. However, some auditory learners faced challenges when content lacked clear verbal explanations or voice-based interactions. The effectiveness of auditory-based tools varied depending on the availability and quality of auditory resources in the digital environment.

- **Reading/Writing Learners:** This group, which prefers reading and writing-based activities, appeared to have mixed responses. While they appreciated digital tools that offered written content, such as e-books, articles, and online discussion forums, the absence of interactive or engaging textual content sometimes led to lower levels of satisfaction. Digital classrooms could further enhance this group's learning experience by providing more textual resources and written assignments that require deep analysis or reflection.

- **Kinesthetic Learners:** Kinesthetic learners, who learn best through physical activities and hands-on engagement, were the most dissatisfied with the digital learning environment. This learning style generally requires direct interaction, such as labs, experiments, and physical exercises. In digital classrooms, the lack of tactile experiences and physical activity-based learning was a significant challenge. Kinesthetic learners reported lower satisfaction and effectiveness ratings compared to other styles. For these learners, incorporating virtual labs, interactive simulations, or movement-based activities within the digital platform could be beneficial.

2. Challenges Identified:

- **Lack of Personalized Learning:** A common challenge across all learning styles was the lack of personalized learning experiences. While digital tools often provide some degree of customization, many students still feel that the learning environment is too generalized and not responsive enough to their individual needs. This could be particularly limiting for learners who require tailored resources to optimize their learning experience.

- **Engagement Issues:** Engagement was another challenge identified, particularly for kinesthetic and reading/writing learners. While visual and auditory learners found digital content engaging, others struggled to stay focused, especially when the content failed to align with their learning preferences. This highlights the importance of creating dynamic and multimodal learning environments that can engage all types of learners.

- **Technological Limitations:** Some students reported issues with technology, such as slow internet speeds, unreliable devices, and limited access to digital resources. These barriers often hindered the effectiveness of the digital classroom, particularly for students from low-resource backgrounds. Addressing these technological limitations is crucial to ensuring equal access to educational opportunities for all students.

3. Implications for Teaching and Learning:

The findings suggest that digital classrooms need to be more inclusive of diverse learning styles to improve student satisfaction and effectiveness. Educators should consider integrating a variety of multimedia and interactive tools to engage visual, auditory, reading/writing, and kinesthetic learners. For instance, incorporating videos, podcasts, e-books, and virtual hands-on activities can create a more comprehensive and adaptable learning environment.

Moreover, educators should emphasize active learning strategies, such as discussion forums, group projects, and problem-based learning, which can cater to a wider range of learning styles and increase student engagement. Personalized learning pathways and adaptive learning technologies that adjust content based on student responses could further enhance the digital learning experience.

4. Recommendations for Future Research:

Future research should focus on longitudinal studies that examine the long-term effects of digital classrooms on various learning styles. Additionally, exploring the impact of emerging technologies such as virtual reality (VR) and artificial intelligence (AI) on learning styles could provide new insights into how these technologies can support or hinder different types of learners.

Procedure:

The following steps outline the procedure for conducting this study on learning styles in digital classrooms within teacher education:

1. **Preparation Phase:**

- **Literature Review:** Conduct a thorough literature review on learning styles, digital education, and teacher education to frame the research questions and hypotheses.

- **Tool Development**: Develop and finalize the survey questionnaire and interview guide. The survey includes questions on learning style preferences (based on the VARK model), experiences with digital tools, and perceived effectiveness of digital learning. The interview guide includes open-ended questions to explore participants' challenges and personal strategies in digital classrooms.

- **Pilot Testing**: Pilot test the survey and interview questions with a small group of teacher education students to identify any issues with clarity or relevance. Based on feedback, refine the instruments.

2. Sampling and Participant Recruitment:

- **Participant Selection:** Identify a sample of approximately 200 teacher education students across multiple institutions. Use purposive sampling to ensure a diversity of learning styles and backgrounds.

- **Informed Consent:** Contact participants, providing them with details about the study's purpose, procedures, and ethical considerations. Obtain informed consent from all participants, ensuring they understand their rights and the confidentiality measures in place.

3. Data Collection:

- **Survey Administration:** Distribute the survey to all participants via an online platform (e.g., Google Forms or SurveyMonkey) to gather quantitative data. Give participants one week to complete the survey, with reminders sent midway to encourage participation.

- **Conducting Interviews:** From the survey respondents, select a subset of approximately 20 participants representing various learning styles for in-depth interviews. Conduct interviews either virtually (via Zoom, Teams, etc.) or in-person if feasible. Each interview lasts 30-45 minutes, focusing on participants' experiences, challenges, and adaptation strategies in digital classrooms.

4. Data Analysis:

- **Quantitative Analysis:** Analyse survey responses using statistical software (e.g., SPSS or Excel). Descriptive statistics are used to summarize preferences, perceived effectiveness, and

satisfaction with digital tools. Inferential analyses, such as t-tests or ANOVA, are conducted to explore significant differences in learning style adaptation.

- **Qualitative Analysis:** Transcribe interviews and analyse the data thematically. Code the data to identify patterns and themes related to adaptability, preferred digital tools, and self-directed learning strategies. Cross-reference these themes with survey data to validate findings.

5. Integration of Findings:

- **Data Triangulation:** Integrate quantitative and qualitative data to provide a comprehensive view of the role of learning styles in digital classrooms within teacher education. Examine how survey trends align with interview insights to identify areas where digital classrooms meet or fail to meet diverse learning style needs.

- **Formulate Conclusions:** Draw conclusions on how digital classrooms impact different learning styles, particularly in the context of teacher education. Identify key challenges and best practices that emerged from both datasets.

6. Reporting and Dissemination:

- **Compile Findings:** Write a comprehensive report detailing the study's methodology, findings, discussion, and recommendations for enhancing digital classrooms in teacher education.

- **Share Results:** Present findings to relevant stakeholders, including teacher education programs, academic institutions, and education policymakers. Consider publishing in educational journals or presenting at conferences to contribute to ongoing discussions on digital learning and learning styles.

This structured procedure ensures that the study is systematic, reliable, and provides actionable insights on supporting diverse learning styles within digital classroom

Conclusion:

The study sought to explore the impact of digital classrooms on various learning styles among higher secondary and teacher education students, using Bloom's Taxonomy as a guiding framework. The findings indicate that digital classrooms offer substantial benefits, especially for visual and auditory learners, by providing diverse multimedia tools and interactive platforms that cater to their strengths. However, challenges remain in fully supporting kinesthetic and reading/writing learners, who often face limitations in engagement and learning effectiveness within predominantly digital settings.

Key Insights:

- **Digital Classroom Advantages:** Digital platforms provide accessibility, flexibility, and a range of multimedia resources that support visual and auditory learners. These platforms help students progress through Bloom's cognitive levels, from basic recall to more complex analytical and creative skills, through interactive materials and resources.

- **Learning Style Gaps:** Kinesthetic learners often encounter engagement challenges due to a lack of hands-on, interactive components in digital classrooms. Similarly, reading/writing learners sometimes struggle with less emphasis on text-based materials, especially when assignments and resources are heavily multimedia-oriented.

- **Bloom's Taxonomy in Digital Contexts:** Bloom's Taxonomy remains a valuable framework for structuring digital learning experiences. By offering structured, tiered approaches to cognitive engagement—such as memory aids, comprehension activities, application exercises, and creative projects—educators can help students move through cognitive stages in ways that fit their learning styles.

- **Technology Barriers and Accessibility:** Technological limitations, such as inconsistent internet access and lack of suitable devices, highlight ongoing accessibility issues. Addressing these barriers is essential to ensure equitable educational experiences for all students, especially in digital settings.

Recommendations for Educators and Institutions

- **Enhance Multimedia Diversity:** Incorporating a broader range of resources, such as audio content, virtual simulations, and interactive applications, could better support auditory and kinesthetic learners. A mix of instructional formats can help bridge the engagement gaps across different learning styles.

- **Develop Hands-On Digital Experiences:** Digital tools that include simulations, virtual labs, and problem-based learning activities can help kinesthetic learners engage more deeply. Providing platforms that allow for "learning by doing" would enable these students to better participate in digital classrooms.

- **Promote Flexible Learning Options:** Allowing students to select from multiple content formats—visual, auditory, and text-based—can empower them to learn in ways that best match their styles. Flexible tools that encourage personalization would likely improve learning outcomes and engagement.

- **Invest in Technological Infrastructure:** For digital classrooms to be effective, institutions must invest in accessible technology and internet infrastructure, especially for students in underserved communities. Providing resources for device access and high-speed connectivity is critical to equitable learning.

Final Thoughts:

The digital classroom has transformed education, offering new possibilities for personalized, flexible learning experiences. However, maximizing the benefits of digital learning requires ongoing adjustments to meet the diverse needs of students, particularly when considering different learning styles. By leveraging frameworks like Bloom's Taxonomy, educators can design digital curricula that support holistic cognitive development and create inclusive, adaptive learning environments that cater to all students.

Through continued innovation and commitment to equity, digital classrooms can become powerful, inclusive spaces where all learning styles are valued and supported, preparing students more effectively for the demands of the 21st century.

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