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Research Article

"Implementing the Revised Bloom's Taxonomy (2001) in Digital and Online Learning Environments: A Strategic Approach"

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ARTICLE INFO **ABSTRACT**

In the 21st century, the paramount importance of digital technology in education necessitates a transformative approach to pedagogy. This approach must seamlessly integrate modern digital devices and applications into the teaching and learning process. The overarching objective of improving students' learning competencies and outcomes serves as a constant guide for educational institutions and their stakeholders. Therefore, incorporating digital components into education must be aligned with these educational objectives. The foundation of effective teaching and learning lies in the clear delineation of learning objectives or outcomes. Everything else in the educational process revolves around these objectives, forming a meaningful framework for achieving them. In this context, integrating digital components into pedagogy assumes a critical role, reflecting the evolving nature of education.

This study focuses on a thorough analysis of Revised Bloom's Taxonomy (2001) to determine its seamless applicability in formulating teaching-learning objectives and learning outcomes that challenge learners' higher-order thinking skills in contemporary digitally enhanced pedagogy. This research, primarily theoretical, sheds light on how Revised Bloom's Taxonomy (2001) facilitates the categorization of learning activities based on learning objectives and underscores the crucial link between assessment and the teaching-learning process. Furthermore, this study delves into various alternative revisions of Bloom's Taxonomy, providing comprehensive insights into the 2001 version. The study underscores the imperative for educational institutions to assimilate Revised Bloom's Taxonomy (2001) principles into the evolving landscape of digital pedagogy when formulating objectives and learning outcomes. The authors recognise the challenges posed by current classroom technology limitations in a global context, which often hinder the attainment of the intended learning objectives educators envision. This research underscores the urgent need for harmonising Revised Bloom's Taxonomy (2001) and contemporary digital pedagogical approaches to ensure meaningful and effective learning outcomes.

Keywords: learning objective/outcome, learning apps, Revised Bloom's Taxonomy, digital pedagogy

Introduction

In the contemporary era, the integration of digital technology has ushered in a transformative wave, redefining how we interact with information and learning resources. The ability of cameras, desktops, laptops, and various peripheral devices to connect wirelessly using Bluetooth eliminates the need for complicated wired networks, an example of this paradigm shift. The modern smartphone, equipped with its versatile modem, offers a multifaceted utility, enabling users to access online content, engage in gaming, consume multimedia content, and even partake in audiovisual communication, all at the touch of a screen (Kroski, 2008). These devices have evolved into personal assistants, seamlessly weaving into the fabric of our personal, social, and professional lives, particularly within the educational domain (Roschelle et al., 2005).

The pervasive and user-centric adoption of digital technology stems from its ability to cater to diverse educational needs, enhance learner motivation, foster collaboration, and empower underserved students with newfound avenues for learning (Duncan-Howell & Lee, 2007). Digital learning devices have emerged as catalysts for self-directed learning, imbuing students with self-control and confidence in their educational journeys. Beyond their pedagogical value, these devices offer an engaging avenue to nurture social skills and align subject matter with real-world contexts. This alignment, often pivotal for effective learning, can be critically assessed through Bloom's Taxonomy (Anderson, 2005).

Bloom's Taxonomy provides a foundational framework in digital learning that profoundly influences pedagogical effectiveness when adapting learning materials to a digital context. Recognising the vast potential of digital learning in e-learning, Bloom's Taxonomy underscores the centrality of collaboration in the digital educational landscape. Numerous studies (Govindasamy, 2002; Tsai et al., 2015) have shown that the taxonomy's six-level structure offers a robust framework for evaluating e-learning or digital pedagogy.

This article introduces a novel approach to assist educators in creating digital learning materials: a worksheet generator grounded in Bloom's Taxonomy for Digital Learning. By employing True/False questions, this tool aids in developing practical digital learning applications. An analysis of cognitive processes and learning outcomes underscores the efficacy of this revised taxonomy in shaping the landscape of digital education. Moreover, the advantages of employing the revised Bloom's Taxonomy extend beyond content creation, encompassing syllabus analysis, learning activity classification, and the vital nexus between assessment and pedagogy. Alongside exploring the revised taxonomy, this study also delves into alternative models, evaluating their merits and limitations and concluding with recommendations for a spectrum of digital applications tailored to the diverse needs of learners.

Methodology and Approach

This article does not propose a revision of Bloom's Revised Taxonomy. However, it advocates for its adaptation to cater to the needs of a new generation of technologically proficient students, commonly called Millennials. Educators have long utilised Bloom's Revised Taxonomy to formulate objectives, design lessons, and develop assessments encompassing a broad spectrum of cognitive levels within the classroom (Anderson & Krathworthl, 2001; Joyce & Weil, 1996). However, Millennials' evolving educational and social characteristics underscore the necessity of aligning Bloom's framework with their digital-oriented learning preferences (Taylor, 2005).

Andrew Churches (2009) is widely credited with leveraging technology to create a learning platform called Bloom's Digital Taxonomy. This framework introduces digital artefacts promoting active learning methodologies such as journaling, collaboration, role-playing, and problem-solving (Cheal, 2007). Notably, Bloom's Taxonomy categorises constructivism as the highest level of learning, wherein students critically analyse and synthesise information.

This paper derives its recommendations through a comprehensive and reflective analysis of the intricate interplay between digital technology and Bloom's Revised Taxonomy in teaching and learning. Rather than advocating for a complete overhaul, it seeks to harness the potential of digital tools to enhance the educational experience for the contemporary generation of students.

Need and Significance

Educators have long relied on Bloom's Taxonomy and its revised version as practical tools for structuring and enhancing student learning. These strategies have proven successful and continue to yield positive results. However, the educational landscape has yet to fully adapt to the needs and preferences of digital generations, such as today's students.

In the digital age, students have unprecedented access to a wealth of resources, including wikis, blogs, educational games, and many apps, often at little or no cost. Bridging the gap between traditional teaching methods and the digital resources available to students becomes essential. This gap can be significantly narrowed when teachers harness these technological tools and seamlessly integrate them into lesson planning and delivery.

For meaningful progress to occur in the 21st century, education must evolve to align with modern society's collaborative and technologically interconnected nature (Churches, 2009). This evolution necessitates adopting instructional technology and its harmonious integration into teaching and learning design and resources. The potential impact of this new teaching paradigm on students' learning experiences must be considered.

In this context, collaboration takes on a broader meaning—it implies the integration of established learning frameworks and theories with digital technology. By doing so, educators can enhance the learning process and stimulate students' curiosity, fostering a more dynamic and engaging educational environment that prepares them for the challenges and opportunities of the digital age.

The Emergence of Digital Learning

Since the 1970s, the world has witnessed a profound electronic revolution that has inundated our lives with digital devices. These electronic and digital learning tools have become accessible at any time and from any place, shaping the way we acquire knowledge. Notably,

Table-1: shows how Digital technology has evolved over the past couple of decades (from Crompton, 2014)

Year	The Evolution of mobile technologies
1970s	The Motorola DynaTAC 8000X was first released. 1st microcomputer, VHS (Video Home System) videotape recorder, floppy disc, and object-oriented programming language Smalltalk. GUI (Graphical User Interface) aided programme access and execution.
1980s	Start manufacture first videotape-sized handheld computers (laptops) including a word processor, spreadsheet, calendar, and address book. Desktop computers arrive gradually. Networking between computers was established for social sharing.
1990s	The first web browser, digital camera, graphical calculator, multimedia computers, and palm pilots were used in educational settings. A palm pilot includes a calculator, notebook, contacts, photographs, and reminders. The growth of socio-constructivist learning has enhanced scientific community interaction and mobility.
2000s	Unlike microcomputers, mobile phones were smaller and more accessible. Tablets like the Microsoft Tablet PC and Wibrian were introduced and used in schools. Virtual learning environments (VLEs) such as Blackboard and Moodle were created to help students learn online. Apple introduced iPhone with a built-in computer, accelerometer, compass, navigation, camera, and videophone system. Then came the Motorola Xoom and Apple iPad.
2010s	Machine to mobile machine connectivity (IoT) has made virtual anything more intelligent. Mobile phones were more innovative, accessible, and connected to other mobile gadgets. - Wearable devices like the iWatch and Google Glass are now being employed in schools. The semantic web allows users to find the correct information at the right time and location. Virtual reality has begun to help students learn, especially in health and marketing.
2020-2022	Artificial Intelligence and Machine Learning (A.I. and M.L) Process Robotics (RPA) Edge Computing- Enviro-Com Quantum Computing-Quasi-Com Virtual Reality and Augmented Reality(VR/AR) and Mixed Reality Blockchain IoT (IoT) and 5G

the digital learning landscape continually expands, with new iterations and versions of these devices emerging regularly (as shown in Table 1).

Concurrently, the growing ubiquity of electronic and digital devices has fueled a surge in interest in digital learning. Over the past two decades, from 2002 onward, there have been concerted global efforts to define digital learning and explore its potential future. Initiatives like LEARN, WMT, IADIS, and ALT-C have sought to harness digital technologies for education in a more structured manner. Pedagogy has gained fresh dimensions within these endeavours, emphasising "learning" and "mobility." This broadened concept of digital learning encompasses a broad spectrum of educational facets, even in the face of emerging technologies like wearable devices (Hamm et al., 2014).

The research underscores critical considerations when defining and conceptualising digital learning through electronic devices and technologies. Key issues include the mobility of learners and their learning devices, which have far-reaching implications (Traxler, 2009; Hamm et al., 2014).

However, it is essential to conceive digital learning within a broader context. The environment or ecosystem in which digital learning unfolds is pivotal. Effective digital learning hinges on communication and engagement with technology within this environment, serving as prerequisites for both the learning process and the theoretical framework underpinning it (Laouris & Eteokleous, 2005). Table 1 illustrates the evolution of online education over time, tracing its connections with human cognition and social interactions alongside the rapid advancements in technology (Hamm et al., 2014).

Digital learning manifests in diverse forms within the digital environment, encompassing VOIP (Voice over Internet Protocol), voice, texting, digital television, and more, as elucidated by Ozan, Yamamoto, and Demiray

(2015). This ecosystem also includes the web, search engines, and various forms of entertainment and recreation. Crompton (2014) characterizes digital learning as a holistic concept that transcends traditional boundaries, facilitating learning across numerous contexts while being contextualized, personalized, and accessible.

The Imperative of Embracing Digital Pedagogy

As we navigate the 21st century, it is evident that digital learning is still nascent, with much ground left to cover. To remain relevant in today's classrooms, where students are increasingly inclined toward using digital learning tools (Papadakis et al., 2021), researchers and educators must keep pace with the latest educational concepts and applications.

The evolving interests and technological habits of learners, coupled with the growing capacity of educational institutions to accommodate digital learning, underscore the need for a pedagogical shift suited to the demands of the 21st century. The market for digital learning equipment is reaching a saturation point.

Students now wield the power of tablets and computers to complete assignments, engage with instructors, collaborate with peers, and access course materials through various digital platforms. This transformative shift allows learners to participate in discussions with fellow students, instructors, subject matter experts, and social contexts at their own pace and convenience (Criollo et al., 2021). Platforms like Twitter and Facebook and social bookmarking tools like Diigo and Delicious have long facilitated these interactions. Additionally, integrating multimedia content from sources like YouTube, TikTok, and Vimeo adds significant value to the learning experience.

Table 2 illustrates the juxtaposition of traditional and digital learning methods, informed by various contextual variables. Embracing digital pedagogy is not merely an option but necessary to meet modern learners' evolving needs and expectations.

Promoting Meaningful and Effective Online Learning

Govindasamy (2002a) asserts the imperative of making online learning meaningful and effective. In flexible learning experiences unbound by time and space, digital learning builds upon the foundations of e-learning and distance learning. Moreover, digital learning adds significant value to the landscape of distance education (Traxler, 2009). This transformation can be characterized as a progression from e-learning to digital learning. Within the academic discourse, e-learning is typically defined as structured multimedia content characterized by interactivity. In contrast, digital learning embodies spontaneity and personalization (Laouris & Eteokleous, 2005; Friesen, 2005). When juxtaposed with traditional classroom instruction, digital learning emerges as a more adaptable and responsive approach.

Effective pedagogical methods often integrate e-learning and digital learning elements, resulting in more meaningful and efficient learning experiences. This evolution underscores the importance of aligning educational practices with the dynamic landscape of digital learning to meet modern learners' diverse needs and preferences.

Digital Learning vs. E-Learning: Navigating the Terminology

The terms "digital learning" and "e-learning" are often used interchangeably, and in some instances, they are collectively referred to as "organizational digital learning." However, it is essential to distinguish between these two concepts.

Digital learning has emerged as a prominent trend in professional courses, particularly in response to the increasing mobility of employees. Tools, platforms, Learning Management Systems (LMSs), and applications have been developed to facilitate employee learning, training, and skill development. Professional training within digital learning encompasses a spectrum of activities, including self-guided learning, meetings, immersive experiences, traditional classroom instruction, feedback collection, and progress monitoring. This approach is known for its comprehensive nature, incorporating blended learning techniques that seamlessly integrate online and offline tools. Digital learning offers a holistic approach combining various learning modes, including online, offline, and field-based experiences (R.S.S. Nehru,2014).

In contrast, e-learning predominantly refers to "fully online" components, primarily conducted through remote internet access. E-learning is characterized by its exclusive online nature, which does not facilitate face-to-face interactions. This learning mode is often self-paced and relies on digital technologies for content delivery and assessment. While e-learning is a valuable educational approach, it needs the comprehensive blending of various learning modalities seen in digital learning.

It is worth noting that digital learning can encompass a broader spectrum of interactions involving students and teachers who utilize digital technologies as part of the learning process. Therefore, while these terms are sometimes used interchangeably, understanding their distinctions can help educators and learners navigate the evolving landscape of technology-enhanced education.

Bloom's Taxonomy and Its Evolution in the Context of Education and Technology

Education has been highly valued since Aristotle, Socrates, and Plato. Concepts like the Socratic Method, Plato's Republic, and Aristotle's belief that education shapes society remain relevant even in our modern era (Johnson et al., 2013). While educational practices and learning styles have evolved significantly, until the

1950s, Bloom's Taxonomy played a pivotal role in understanding how children learn and reason in classrooms. This taxonomy aims to guide educators in setting expectations for what students should gain from their learning experiences (Krathwohl, 2002). Practitioners found it practical and valuable for structuring their teaching methods. Moreover, it incorporated educational and psychological elements, emphasizing the need to align objectives with psychological concepts and theories (Bloom et al., 1956, p. 6).

1st Generation: Bloom's Taxonomy Classification: Among educators, Bloom's Taxonomy emerged as a seminal work (Richard, 1985). It categorized learning into three primary domains: cognitive, affective, and psychomotor (Bloom et al., 1956). The authors used both simple and complex classification systems in their analysis. Bloom's motivation for creating the taxonomy was to streamline the preparation of comprehensive exams by reducing educators' time on this task (Krathwohl, 2002). He convened an expert team in 1949, culminating in the final draft published in Psychiatry and Humanities (Bloom et al., 1956). According to Krathwohl, Bloom had several purposes in mind:

a) When discussing educational goals, we are establishing a common language for students, teachers, and administrators..
b) We are providing a method to define objectives for specific courses or curricula.
c) We ensure alignment between instructional goals, activities, and assessments within a unit or curriculum.
d) We offer a philosophical framework for objectively representing various educational purposes (Bloom et al., 1956, p. 14). This objectivity varies based on factors like educational philosophy or the relative importance of different goals (Furst, 1981).

2nd Generation: The Evolution of Bloom's Taxonomy: Forty-five years later, Anderson, Krathwohl, and Bloom revisited Bloom's Taxonomy for Biological Species, retaining its structure but introducing significant changes. The revised version included six categories (with three new names), eliminating two categories and adjusting the titles of the remaining three to reflect their goals. This updated taxonomy incorporated knowledge and cognitive processes in a two-dimensional structure (Krathwohl, 2002). As Growe (2011) noted, these changes in curriculum design significantly shift away from traditional knowledge transfer, adapting education to meet evolving skillset requirements.

Knowledge Dimension: In this revised model, knowledge categorization remained consistent with the original, aligning knowledge across subject matter lines (Krathwohl, 2002). The most notable alteration was the addition of a fourth category, Meta-cognitive knowledge, encompassing awareness of cognition and mindfulness about cognitive processes (Krathwohl, 2002).

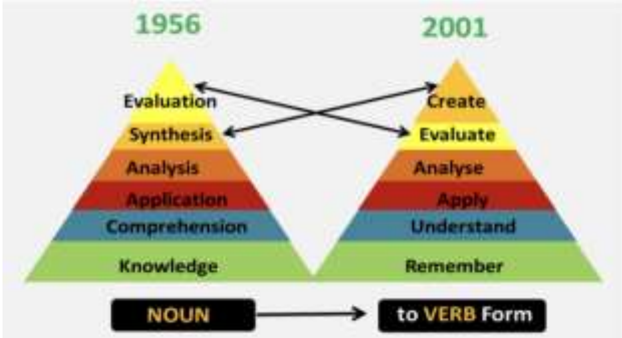
Cognitive Dimension: The cognitive dimension underwent significant revisions. The six original categories were renamed, and verbs were added to two better to articulate their intended goals (Krathwohl, 2002). The authors considered "remembering" as a synonymous concept for "understanding," thus modifying "knowledge" and "comprehension." Verb application, analysis, and evaluation forms changed, ultimately creating the "synthesis" category. These adjustments enhanced the depth and breadth of each cognitive category and corresponding learning activities (Krathwohl, 2002).

Bloom's Taxonomy of Educational Objectives has guided educational goals and standards. Its structured approach has made it easier for individuals to comprehend and align educational objectives, fostering effective teaching practices (Krathwohl, 2002).

Incorporating the Updated Bloom's Taxonomy into Digital Learning

Benjamin Bloom created the original Bloom's Taxonomy in the 1950s, categorising fundamental learning abilities. These categories encompassed cognitive, emotional, and psychomotor learning objectives. In the context of digital learning, both the cognitive and affective domains find a natural fit. The six primary cognitive domain categories are knowledge, comprehension, application, analysis, synthesis, and evaluation (Bloom, 1956; Bloom, 1976). In 2001, Anderson, Krathwohl, and Bloom introduced a significant change by transforming all categories from nouns into verbs, including the transformation of "knowledge" into "knowing" and "application" into "apply."

Furthermore, the "comprehension" category was broadened to encompass "understanding," and two new categories, "synthesis" and "evaluation," were introduced (Krathwohl & Anderson, 2010, pp. 64–65). The revised taxonomy places "create" at the pinnacle of the learning hierarchy, emphasising the importance of creativity in the learning process. Original and Revised Bloom Taxonomies (Krathwohl & Anderson, 2001)



Source: https://elearningbunch.wordpress.com/2013/02/20/revised-bloom-taxonomy/

Long-term memory involves recalling relevant information through identification and retrieval.

1) Digital Tools for Descriptive Communication: Digital tools facilitate the identification, interpretation, illustration, and categorization of descriptive messages across various communication channels, helping users understand their meanings.
2) Appropriate Method Selection: The correct method is crucial, considering the specific context in which it will be applied.
3) Decomposition and Interrelationships: The primary objective of decomposition is to comprehend the interrelationships among individual components and the overall structure, including the aims of each component.
4) Establishing Criteria and Standards: Criteria and standards serve as benchmarks to determine the quality or appropriateness of something.
5) Innovation and simplification involve the creation of new products or the development of streamlined, simpler versions of existing ones.

Bloom's Taxonomy should encompass knowledge and cognition at a foundational level. Metacognition, for instance, is employed with factual and conceptual information to carry out tasks such as remembering, understanding, applying, evaluating, and creating (Friesen, 2005; Krathwohl & Anderson, 2010; Fisher, 2011). Educators and students can utilise the revised Bloom's Taxonomy to assess course curricula, align learning activities with specific objectives, and recognise the connections between assessment, teaching, and learning activities (Americ, 2006).

Nevertheless, viewpoints advocate for integrating the revised Bloom's Taxonomy into digital learning at higher education levels (Friesen, 2005, p. 74). Digital learning can be effectively incorporated with the revised Bloom's Taxonomy at the school level. The revised taxonomy, particularly focusing on meta-cognitive (learning to learn) knowledge, can be instrumental in designing and creating digital learning environments. Measurable learning outcomes, encompassing facts, concepts, and procedures, can be aligned with specific goals or outcomes and easily integrated into digital applications. Fisher (2011) suggests formulating distance learning objectives using the cognitive and knowledge dimensions of Bloom's Taxonomy concerning sample verbs provided in Table 3.

Table 3: Bloom's Taxonomy cognitive and knowledge dimensions (Fisher, 2011)

Bloom's Taxonomy						
Knowledge Dimension	**Cognitive Process Dimension**					
	Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge	List	Summarize	Classify	Order	Rank	Combine
Conceptual Knowledge	Describe	Interpret	Experiment	Explain	Assess	Plan
Procedural Knowledge	Tabulate	Predict	Calculate	Differentiate	Conclude	Compose
Meta- Cognitive Knowledge	Appropriate Use	Execute	Construct	Achieve	Action	Actualize

Enhancing Activity Success and Achieving Objectives: Effective Techniques

Several effective techniques can facilitate success in various activities and achieving objectives. These include repetition, testing, just-in-time learning, and leveraging background knowledge.

Alignment with Learning Frameworks: These techniques align seamlessly with various learning frameworks, such as the SOLO (Structure of Observed Learning) model by Biggs and Collis, Fink's Taxonomy for analysing cognitive processes, the Outcome Taxonomy, the PI Model, and Fink's Taxonomy (Fink, 2003).

A Closer Look at Learning Models: Biggs and Collis introduced the SOLO Taxonomy in 1982, which differs from Bloom's Taxonomy by having five levels of incompetence, progressing from pre-structural to extended abstract. It guides learners through stages, beginning with a trigger event and moving through exploration, integration, and resolution (Akyol et al., 2009).
Schrire highlights the versatility of this paradigm, capable of studying individual and group cognition (2004). In contrast, Fink (2003) presents a self-directed approach to designing course content, considering several additional factors.

Metacognitive Focus: Like the revised Bloom's Taxonomy, Fink's Taxonomy emphasises the significance of metacognitive knowledge levels. Shea et al. (2011) propose categorising student assignments related to online discussions into three tiers, drawing from the SOLO framework.
Analyzing the Cognitive Domain: The PI Model, developed by Garrison, Anderson, and Archer in 2001, is advocated by Schrire as superior to Bloom's and SOLO taxonomies for analyzing the cognitive domain in knowledge-building processes (2004).

The Digital Learning Landscape: The proliferation of apps, many of which are freely accessible, has democratised open and distance learning (Frohberg et al., 2009). Table 4 briefly introduces innovative digital learning tools and educational apps, opening new educational horizons.

Table-4:Emerging technologies and instructional software to support the revised Bloom Taxonomy

Revised Blooms Taxonomy Sub-dominies	Emerging technologies and instructional software
Create	Splice, VidTri, MindMeister, MindMaple, Podomatic, Kids Story Builder, Youtube, ZooBurst
Evaluate	Skype, Edmodo, Debate Timer, Watsapp, Picasa, Blogger, Layar, Google +
Analise	Inspiration MapsTM, Wufoo, Code Writer, Zoho Creator, Mentimeter, Wikitude
Apply	Educreations, Zoho Docs, SoloLearn, Ustrea, Adobe Connect, Google Drive, OneNote, Dropbox, Scribble
Understand	Twitter, Tumblr, Instagram, Evernote Touch, Anatomy 4D
Remember	Tureng, Google, Bing, Delicious, Diigo, WPS Office, Junaio

Revised Bloom's Taxonomy-aligned tools and applications are in development and on the horizon. Here is a breakdown of some noteworthy options:

i. Blogger, accessible at https://www.blogger.com, empowers students to critically analyse course materials, fostering interactions with their educators and peers.
ii. Edu-Creations stands out as an interactive whiteboard and screen-casting application. It harnesses open video content from YouTube within the SoloLearn educational suite to effectively teach programming, web design, and photography through user-friendly instructional video creation and distribution.
iii. Zoho Docs offers comprehensive features, including document creation, editing, seamless file and folder sharing, and the ability to work offline for convenient storage.
iv. Inspiration MapsTM is a versatile visual aid adaptable to various instructional approaches.
v. Skype, a cost-free service, facilitates audio and video calls across various devices, including smartphones, tablet PCs, television sets, and wearable gadgets.
vi. Edumodo seamlessly integrates with a school's learning management system, enabling students to transfer files and participate in discussion forums effortlessly.
vii. Splice, an iOS video editor, sets itself apart by avoiding limitations on video duration, watermarks, or intrusive advertisements.
viii. Vid Trim, tailored for Android smartphones and tablets, is an all-in-one video editor that allows users to trim, merge, compress, and convert videos to MP4, simplifying sharing them with others.
ix. Wufoo, available at http://www.wufoo.com, offers a powerful form-building platform, enabling the creation of contact forms and online surveys to collect data, manage registrations, and process payments effectively.

Utilizing Revised Bloom's Taxonomy: Digital Classroom Activities

The application of Bloom's Digital Taxonomy empowers students to engage with digital tools within the classroom. The students or teachers can choose these tools based on their needs and goals. It is important to note that the taxonomy's primary aim is not to emphasize particular tools but rather to guide students in advancing through the levels of learning, enabling them to build upon their knowledge from 'lower-order thinking skills' to 'higher-order thinking skills.

'Table 5: Activities for the Digital Classroom

Level	Description	Digital Activity
Creative	Synthesize past knowledge to create new product	Students can launch and produce their production topic in the curriculum
Evaluation	Criteria based judgments	Mandate and respond to comments made on the blog post (e.g., http://blogsopt.com)
Analysis	Determine the relationship between the parts and the whole	Use the online survey tool (e.g.survaymonkey.com/)
Application	Be able to apply later knowledge to situations	Wiki edits, such as on (e.g.www.wikipedia.org)
Understanding	Abele to construct meetings and build relationships	Create and tag bookmarks through a social bookmarking application (e.g.www.getpocket.com)
Remembering	Be able to retrieve information and resources	Identify a legitimate search engine (www.google.com) and understand how it works.

In conclusion, the synergy between the learning environment and collaboration (Cole & Stanton, 2003; Ryu & Parsons, 2009; Herrington et al., 2009b) becomes evident when essential support systems and a conducive learning flow are established (Lai et al., 2007). The evolution of digital learning has not only transformed the design of digital applications but has also given rise to the necessity for a novel pedagogical approach. The Revised Bloom's Taxonomy can be effectively implemented and realized by integrating modern digital resources. This analysis underscores the potential for redefining learning objectives and digital tools to achieve more effective outcomes. As demonstrated, digital technologies can enhance any educational lecture or learning activity.

This paper has the potential to inspire collaboration between tool designers and educators to create more adaptive and outcome-driven learning experiences in the 21st century. Digital learning applications promise to foster knowledge acquisition and mental well-being simultaneously. Furthermore, as discussed, the Revised Bloom's Taxonomy is a guiding framework for defining desired learning outcomes in this new era (Fisher, 2011; Yen et al., 2012). Mobile apps can now be integrated into diverse platforms, including bulletin boards, newspapers, and textbooks.

Additional tools such as social media, bookmarking, and RSS have expanded global accessibility (Ozan et al., 2015). Future educational policies in India and worldwide will likely offer mass online courses tailored to students' interests. Bloom's Taxonomy remains an invaluable tool for shaping learning objectives and outcomes for the future (Arshavskiy, 2016). Let us leverage the Revised Bloom's Taxonomy to develop digital learning applications that cultivate the essential skills required in the 21st century. It is worth noting that frameworks like SOLO, Fink's Taxonomy, and the PI Model also offer valuable perspectives for digital learning. Before developing digital apps and open and remote learning courses, future research endeavors can be pivotal in refining these processes. The role of technology in teacher education has long been a topic of debate. However, there is an opportunity to personalize the classroom experience and seamlessly integrate digital learning to engage millennial students. Future professional development initiatives should emphasize the crucial role of technology in education, as it can impart fundamental computer skills, boost productivity, and prepare students for the demands of the modern workplace. Technology can enrich learning environments, course structures, teaching methodologies, and learning outcomes. The integration of instructional philosophy with digital technology will profoundly influence the learning styles and achievements of both current students and future engaged citizens, creating a symbiotic relationship rather than a conflicting one.

Revised Bloom's Taxonomy Vs. Artificial Intelligence Impact on Learning Environments

Revising the taxonomy with a deeper understanding and research of the concepts beyond memorization introduces critical thinking as a more valuable component of learning and teaching. Artificial intelligence provides and enhances the educational environment (Hui, 2024).

- The educational attainment objectives designed to be implemented by Bloom's Taxonomy Spectrum can be valuable in establishing tests and providing aspirations for the best form of curriculum organization. It lists the category of cognitive skill as "remembering, understanding, applying, analyzing, and evaluating" and indicates the type of income and expenditure. At the same time, when we talk about these hierarchy levels, these stages stand for the increasing complexity of information processes that will become harder going forward. Therefore, it opens the way for HOT teaching models that educators mirror.

- AI adds life to the classrooms and takes them away from the prioritization of the content taught in these classes. The teaching process remains the same, but AI makes education live through teachers, not the content they teach. Learners are likely to fully take advantage of an artificially powered, adaptable, individual development-oriented educational system since these make them attain self-actualization. In material terms, these devices become the primary sources of substantial data, continuously streamed to the seniors, who are their bosses but not their rivals. Thus, the delivery of feedback from the seniors becomes less troublesome for the individual carer in the coming late years of the generation.
- AI integration in education majors in the cognitive aspects ensures that students are given an intellectually friendly environment to feel free and learn without stressing their minds. AI and the other factors today that can extend our minds and let us have new experiences through VR and other interfaces are one of a kind. These new strategies, like adaptive testing and problem-solving assignments that require you to think critically and assess related skills, are the methods that need to be used for testing purposes. Additionally, AI allows students to interact, receive feedback, and revise their creations. This way, inter-synaptic communication will be stronger, and in the end, the child will remember more content and understand better.

On the one hand, AI helps the learning process; on the other, it is a factor in students' learning process. Anonymity, biased prejudice against algorithms, and digital addictions are the ethical issues modern society has to deal with now. The strategic goal of using critical thinking, creativity, and social and emotional skills in combination with technological abilities is the objective for the teachers. Areas that teachers must cover to ensure AI is mixed up with humanized education should be outlined.

In conclusion

The last point is that digital, artificial intelligence, and web-based learning systems using Revised Bloom's Taxonomy and 21st-century skills should be introduced to fulfill the desire to get maximum results out of education. Hence, as a result, we arrive at appropriate models and create learning opportunities in which the cognitive dimension of our learners and Bloom's three cognitive levels can be well developed, and, above all, we will obtain a more profound and longer-lasting learning experience. The power to find a solution to any digital or online problem is that of the specific genre, which provides the learner with skills such as critical thinking, creativity, and problem-solving essential for success in the digital age.

References

1. Akyol, Z. Et al. (2009). A response to the review of the community of inquiry framework. International Journal of E-Learning & Distance Education, 23(2), p.123-136
2. Amer, A. (2006). Reflections on Bloom's revised taxonomy, Electronic Journal of Research in Educational Psychology, 4(1),p. 213-230
3. Anderson, L. W. (2005). Objectives, evaluation, and the improvement of education. *Studies in Educational Evaluation*, *31*(2-3), pp. 102–113. https://doi.org/10.1016/j.stueduc.2005.05.004
4. Anderson, L. W. et al. (2001). A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives. Allyn & Bacon
5. Bloom, B. (1956). *Taxonomy of educational objectives The Classification of Educational Goals*. https://www.uky.edu/~rsand1/china2018/texts/Bloom%20et%20al%20-Taxonomy%20of%20Educational%20Objectives.pdf
6. Bloom, B. S. (1976). Human characteristics and school learning. McGraw-Hill
7. Brabrand, C., & Dahl, B. (2009). Using the SOLO taxonomy to analyze competence progression of university science curricula. Higher Education, 58(4), p.531-549
8. Criollo-C, S., Guerrero-Arias, A., Jaramillo-Alcázar, Á., & Luján-Mora, S. (2021). Mobile learning technologies for education: Benefits and pending issues. Applied Sciences, 11(9), p.4111
9. Duncan-Howell, J. A., & Lee, K. T. (2007). M Learning Innovations and Initiatives: Finding a place for mobile technologies within tertiary educational settings. Proceedings ascilite Singapore, 2007
10. Fink, L. D. (2003). A self-directed guide to designing courses for significant learning. University of Oklahoma, 27, p.11
11. Frohberg, D., Goth, C., & Schwabe, G. (2009). Mobile Learning Projects Critical Analysis of the State of the Art. *Journal of Computer Assisted Learning*, *25*(4), 307–331. http://www.learntechlib.org/p/103930/
12. IOWA State University. (n.d.). *Revised Bloom's Taxonomy, Center for Excellence in Learning and Teaching, Iowa State University*. Www.celt.iastate.edu. https://www.celt.iastate.edu/teaching/effective-teaching-practices/revised-blooms-taxonomy/
13. Herrington, Jan, et al.(2009). Using mobile technologies to develop new ways of teaching and learning. Faculty of Education – Papers

14. Hui, E. (2024). Promoting cognitive skills in AI-supported learning environments: the integration of Bloom's taxonomy. *Education 3-13*, 1–11. https://doi.org/10.1080/03004279.2024.2332469
15. Kesim, E., & Altınpulluk, H. (2014). Perceptions of distance education professionals regarding the use of MOOCs. *Turkish Online Journal of Qualitative Inquiry*, *5*(4). https://doi.org/10.17569/tojqi.83986
16. Krathwohl, D. R. (2002). A Revision of Bloom's Taxonomy: An Overview. *Theory into Practice*, *41*(4), 212–218. https://doi.org/10.1207/s15430421tip4104_2
17. KRATHWOHL, D. R., & ANDERSON, L. W. (2010). Merlin C. Wittrock and the Revision of Bloom's Taxonomy. *Educational Psychologist*, *45*(1), 64–65. https://doi.org/10.1080/00461520903433562
18. Kroski, E. (2008). On the Move with the Mobile Web: Libraries and Mobile Technologies. Library Technology Reports. http://eprints.rclis.org/12463/
19. Kuo, R., Chang, M., Ying, K., & Heh, J. (2011). Design Electronic Botany Worksheet Generation Based on Bloom's Taxonomy for Mobile Learning. *2011 IEEE 11th International Conference on Advanced Learning Technologies*, 192-194
20. Lucander, Henriette et al. (2010). The structure of observed learning outcome (SOLO) taxonomy: A model to promote dental students' learning. European journal of dental education: official journal of the Association for Dental Education in Europe. 14. 145-50. 10.1111/j.1600-0579.2009.00607.x
21. Lai, C.-H., Yang, J.-C., Chen, F.-C. ., Ho, C.-W. ., & Chan, T.-W. . (2007). Affordances of Mobile Technologies for Experiential Learning: The Interplay of Technology and Pedagogical Practices. *Journal of Computer Assisted Learning*, *23*(4), 326–337. https://www.learntechlib.org/p/99827/
22. *Oregon State University*. (n.d.). Oregon State University. Retrieved December 19, 2021, from https://oregonstate.edu/#table
23. Papadakis, S., Kalogiannakis, M., & Zaranis, N. (2021). Teaching mathematics with mobile devices and the Realistic Mathematical Education (RME) approach in kindergarten. Advances in Mobile Learning Educational Research, 1(1), p.5-18.
24. Peterson, P. L. (1977). Book Reviews: Bloom, B. S. Human Characteristics and School Learning. New York: McGraw-Hill, 1976. 284 + xxi pp. $10.95. American Educational Research Journal, 14(1), 73–75. https://doi.org/10.3102/00028312014001073
25. *Revised Bloom Taxonomy*. (2013, February 20) Learning Mama. https://elearningbunch.wordpress.com/2013/02/20/revised-bloom-taxonomy/
26. R.S.S.Nehru(2013). E-Learning-Theory and Practice, APH Publishing Co. New Delhi, ISBN- 978-93-313-1956-0
27. R.S.S.Nehru(2013). Essentials of E-Learning APH Publishing Co. New Delhi, ISBN- 978-93-313-1954-8
28. R.S.S.Nehru(2013).Blended Learning, APH Publishing Co. New Delhi, ISBN-978-93-313-2111-4
29. R.S.S.Nehru(2014). ICT in Education, APH Publishing Co. New Delhi, ISBN-978-93-313-2226-5
30. R.S.S. Nehru (2014). Principals of Curriculum, APH Publishing Co. New Delhi, ISBN- 978-93-313- 2226-5
31. R.S.S.,Nehru and Chakraborty S. (2020). The Education of Things (IoT) for Smart Learning Through IoT Intervention: A Case Study Based Analysis. In: Gunjan V., Garcia Diaz V., Cardona M., Solanki V., Sunitha K. (eds) ICICCT 2019 – System Reliability, Quality Control, Safety, Maintenance and Management. ICICCT 2019. Springer, Singapore. https://doi.org/10.1007/978-981-13-8461-5_60ISBN:978-981-13-8460-8
32. S Pal, S., Cuong, TQ, & Nehru, R.S.S. (Eds.). (2020). Digital Education Pedagogy: Principles and Paradigms (1st ed.). Apple Academic Press. https://doi.org/10.1201/9781003009214, ISBN:9781771888875
33. Souvik Pal, Quang Cuong Ton, & R S S Nehru. (2022). Digital education for the 21st century: technologies and protocols. Apple Academic Press; Boca Raton, Fl, USA; Abingdon, Oxon, UK.Hard ISBN: 9781774630075
34. Stenbom, S., Jansson, M., & Hulkko, A. (2016). Revising the Community of Inquiry Framework for Analyzing One-To-One Online Learning Relationships. *The International Review of Research in Open and Distributed Learning*, *17*(3). https://www.learntechlib.org/p/173725/
35. Shea, P., Gozza-Cohen, M., Uzuner, S., Mehta, R., Valtcheva, A. V., Hayes, S., & Vickers, J. (2011). The Community of Inquiry framework meets the SOLO taxonomy: a process-product online learning model. *Educational Media International*, *48*(2), 101–113. https://doi.org/10.1080/09523987.2011.576514
36. Technologies (ICALT), 2011. 11th IEEE International Conference on (pp. 192-194) IEEE.*Using Bloom's Taxonomy to Write Learning Objectives*. (n.d.). eLearning Learning. Retrieved December 19, 2021, from https://www.elearninglearning.com/bloom/?open-article-id=5315409&articletitle=using-bloom-s-taxonomy-to-write-learning-objectives&blogdomain=coursearc.com&blog-title=coursearch
37. Yen, J.C., Lee, C.Y. & Chen, I. (2012). The effects of image(cid:0)based concept mapping on mobile learners' learning outcomes and cognitive processes. British Journal of Educational Technology, 43(2), p.307-320. DOI> 10.1111/J.14678535.2011.01189.x