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Does Digital Proficiency Actually Improve Cognitive Achievement in Bloom's Digital Taxonomy?

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Abstract

This research explores the disparity between students' digital proficiency and their cognitive performance within the framework of Bloom's Digital Taxonomy (BDT) in secondary school mathematics education. The study investigates how digital skills impact students' ability to attain cognitive outcomes across different BDT levels. Employing a qualitative case study design, it examines 127 students from four secondary schools in three major cities in Indonesia. Data were collected through cognitive tests and digital literacy assessments, covering six dimensions: information, communication, content creation, safety, problem-solving, and competence. The results indicate that while students with strong digital skills perform well in lower-order cognitive tasks (remembering, understanding, applying), they face difficulties in achieving higher-order thinking skills (analyzing, evaluating, creating). This discrepancy highlights the necessity of aligning digital engagement with cognitive development goals, ensuring that technology fosters critical thinking and creativity rather than merely supporting superficial knowledge acquisition.

Keywords: Digital Proficiency, Cognitive Levels, Bloom's Digital Taxonomy, Technology Integration, Case Studies.

Introduction

The advancement of digital technology over the past few decades has significantly influenced various aspects of life, particularly education. Technology is no longer just a supporting tool but has become essential in enhancing students' critical thinking and problem-solving abilities. In this shift, Bloom's Taxonomy has been refined into Bloom's Digital Taxonomy (BDT) to evaluate cognitive skills within digital learning environments (Churches, 2007). This adaptation builds on Bloom's Taxonomy (Anderson & Krathwohl, 2001), incorporating technological competencies to meet the demands of the 21st century, where digital tools are deeply integrated into daily life. As education evolves alongside technology, BDT has been widely used to assess students' cognitive abilities in digital-based learning. Research by Alaghbary (2021) on Web 2.0-based learning argues that integrating technology into education plays a crucial role in developing students' critical thinking skills.

However, despite the extensive integration of technology in education, a study by Zerényi and Mátrai (2022) found that while students' technical skills have improved, not all of them successfully develop higher-order thinking skills as expected. This finding aligns with the

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current educational landscape, where students have unrestricted access to digital tools, yet often face challenges in achieving advanced cognitive levels within BDT (Ortiz et al., 2020). The main problem that arises is that the implementation of digital technology often focuses too heavily on technical aspects without considering the substance needed to foster students' critical and creative thinking skills (Starkey, 2011; Saritaş, 2022). The use of technology in learning, such as Flipbooks, Quizizz, and Videos, although beneficial for technical skills, does not always ensure students achieve higher cognitive outcomes (Zawedde, 2014; Husain, 2021). For example, Lim (2021) found that digital collaborative tasks using the dictogloss method tend to make students focus solely on completing technical tasks without deeper consideration or analysis.

In this situation, students' cognitive skills at higher-order thinking levels, such as analyzing and evaluating, become more difficult to achieve because digital activities implemented often do not promote deep understanding. Digital activities should be designed to challenge students to think more critically and reflectively (Akintolu et al., 2022). According to Goranova (2019), digital learning tools should be designed to support students in reaching higher-order thinking levels, such as analysis (C4) to creation (C6), by providing challenges that encourage them to think more critically and reflectively. Faraon et al. (2024) also support this view, noting that the use of technology like artificial intelligence can assist learning at the analysis level, but achieving higher-order thinking requires more profound interaction between students and technology.

Various studies (Alaghbary, 2021; Saritaş, 2022; Goranova, 2019) indicate that although digital technology can support learning, its effectiveness in achieving high cognitive levels often depends on instructional design, student engagement, and adequate mastery of digital tools. Kloos & Alario-Hoyos (2021) highlight that even though the use of frameworks like the DigCompEdu Framework has been adopted to support digital learning, its implementation still faces challenges in achieving higher cognitive outcomes. Research by Sayary et al. (2016) shows that the use of digital simulations is often insufficient to enhance students' critical thinking skills. While these simulations can help improve technical skills, achieving high cognitive outcomes such as analysis, evaluation, and creation remains difficult. Similarly, Ortiz et al. (2020) found that the use of open educational resources (OER) has not fully supported the achievement of high cognitive goals, which are the focus of BDT.

In this context, it is important for educators to not only focus on technological mastery but also develop students' deeper cognitive abilities (Gunarso et al., 2024). Husain (2021) emphasizes that digital assessments should be designed to encourage students to think critically and creatively, rather than merely completing technical tasks mechanically. Educators must also ensure that digital activities align with the expected cognitive levels, creating a learning environment that supports students in exploring ideas in depth (Starkey, 2011). Although digital technology is often implemented in education, many previous studies, such as those by Zawedde (2014), Sari (2014), Wedlock & Growe (2017), Sumartini (2022), and Lim (2021), have focused only on the general use of technology without thoroughly investigating whether students' digital skills truly support the achievement of higher cognitive levels, such as analysis, evaluation, and creation.

This study discusses how students' digital skills relate to achieving higher-order thinking levels (C4-C6) within BDT. It also proposes a more strategic approach to optimizing the use of digital technology, ensuring that it not only aids students in developing technical skills but also fosters the development of their critical and creative thinking skills.

This study aims to analyze the relationship between students' digital skills and cognitive achievement from the perspective of BDT. By mapping students' digital skills and cognitive levels in detail, this research is expected to provide deeper insights into how digital technology can be used not only for technical purposes but also to promote critical thinking abilities and higher cognitive development.

Method

Research Design and Subjects

This study employed a qualitative case study approach to investigate the relationship between students' digital proficiency and their cognitive achievement in mathematics. A case study was chosen because it allows for an in-depth exploration of this complex interaction, which is influenced by multiple factors. The sample consisted of 127 students from four secondary schools across three major Indonesian cities. Cognitive assessments were restricted to mathematics, establishing a clear research boundary. The sampling followed a convenient selection method, utilizing pre-existing class structures, assuming that natural variations in cognitive ability and digital proficiency existed among students within these settings.

Data Collection

Data was collected through cognitive level tests used to measure students' cognitive achievement levels based on Bloom's Digital Taxonomy. The six levels in Bloom's taxonomy were each represented by 1 question that represented each of those indicators. The cognitive indicators and digital activities in this study were adapted from Faraon et al. (2023) summary as presented in Table 1. The test was designed for mathematics with the topic of quadratic functions.

Taxonomy	Cognitive verbs (Anderson & Krathwol, 2001)	Digital verbs (Churches, 2007)	Thinking Level
Remembering	Recognizing, listing, describing, identifying, naming, locating, finding	Bullet pointing, highlighting, bookmarking, social networking, social bookmarking, searching, googling	Lowest level
Understanding	Interpreting, summarizing, inferring, paraphrasing, classifying, comparing, explaining, exemplifying	Advanced and Boolean searching, blog journaling, categorizing and tagging, commenting and annotating, subscribing	Lower level
Applying	Implementing, using, carrying out, executing	Running and operating, playing, uploading and sharing, hacking, editing	Higher level
Analyzing	Comparing, organizing, detecting, monitoring, deconstructing, attributing, outlining, finding,	Mashing, linking, reverse-engineering, cracking, mind-mapping	Higher level

	structuring, integrating		
Evaluating	Checking, hypothesizing, critiquing, experimenting, judging, testing, detecting, monitoring	Blog commenting and reflecting, posting, moderating, collaborating and networking, testing, validating	Higher level
Creating	Designing, constructing, planning, producing, inventing, devising, making	Programming, filming, animating, videocasting, podcasting, mixing and remixing, directing and producing, publishing	Highest level

Table 1 Summary Of Cognitive and Digital Verbs Adapted from As Level Indicators In This Study.

To identify the gap between students' cognitive abilities and digital proficiency, this study employed an instrument that required students to solve problems using technology. However, the use of technology was limited to specific parts of the overall cognitive process, ensuring that students still relied on fundamental reasoning skills.

Question number	Cognitive Indicators	Digital Proeficiency Indicators	Taxonomy Level
1	Classifying domain, codomain, and range of a function	Anotating the domain, co-domain, and range of a function	C2
2	Determining composit function of two function	Operating technology to obtain a composition of two function	C3
3	Deconstructing composit function to obtain the former function	Reversing technology to obtain former function from a composit function	C4
4	Structuring composit fuction from several function	Mind-mapping composit function using technology	C4
5	Hypothesizing composit function from contextual problem	Testing composit function into contextual problem using technology	C5
6	Constructing inverse function from a composit function	Constructing inverse function from a composit function	C6

This study also employed a technology-to-analytics conversion table, similar to the approach used in Kandaga (2022), to systematically translate digital-assisted problem-solving into non-digital analytical processes. By mapping students' use of technology to equivalent manual cognitive steps, this method allowed for a clearer identification of cognitive gaps. The table served as a framework to pinpoint where students struggled, highlighting moments when reliance on technology failed to translate into deeper cognitive engagement. This approach enabled a comparative assessment, revealing specific phases of problem-solving where students exhibited disconnects between digital proficiency and cognitive mastery in mathematics.

Data Analysis

The data analysis was conducted qualitatively to examine the gap between students' digital proficiency and cognitive indicators in Bloom's Digital Taxonomy. The study applied Miles,

Huberman, and Saldana's (2014) analytical framework, consisting of data reduction, data display, and conclusion drawing. Data reduction focused on filtering responses related to students' cognitive performance in mathematics, aligning them with Bloom's Taxonomy indicators. Each cognitive skill level was classified, and performance scores were systematically categorized. Simultaneously, students' digital literacy skills were assessed, covering six dimensions: information, communication, content creation, safety, problem-solving, and competence. Next, data display was conducted by matching students' cognitive achievement with their digital proficiency levels, structured in tables and matrices to highlight patterns. The technology-to-analytics conversion table (Kandaga, 2022) was also used to track cognitive gaps, pinpointing specific stages where students struggled to transition from digital-assisted problem-solving to analytical reasoning. This comparative analysis allowed for a detailed evaluation of the misalignment between digital reliance and cognitive mastery in mathematics.

Result and Discussion

Result

In general, this study found a significant gap between students' digital proficiency and their cognitive understanding as Bloom's Digital Taxonomy. Participants with more developed digital skills exhibited proficiency in lower-order cognitive domains such as recalling and comprehending information (Gui & Argentin, 2011). However, they often struggle with higher-order skills like analyzing, evaluating, and creating. This difficulty may be attributed to the limitations in applying digital skills in more complex contexts. While strong digital skills often indicate technical proficiency, higher-order cognitive skills require critical and creative application of knowledge, involving problem-solving and deep reflection. This suggests the need for a more strategic approach in integrating digital technology, ensuring it serves as a tool not just for basic tasks but for fostering higher-level thinking.

Profiling students' digital proficiency

This study measured students' digital proficiency by surveying 127 secondary school students in Indonesia. Before delving into the detailed categories of students' digital proficiency, it is essential to provide an overview of the overall proficiency levels measured in this study. Table 2 below summarizes the students' proficiency levels, offering a general perspective on how students perform in digital tasks before breaking down specific tools and competencies.

Proficiency Level	n	(%)
Very high	57	45%
High	29	23%
Moderate	34	27%
Low	6	5%
Very low	1	1%

Table 2 Students' Digital Proficiency based on Digital Tools Categories

Table 2 shows that 45% of students exhibited very high digital proficiency, and another 23% had high proficiency, indicating that a significant portion of students are well-equipped with digital skills. However, there is still a portion of students (5%) with low proficiency and even 1% with very low proficiency, which suggests that while the majority are capable of digital tasks,

additional support may be required for those less proficient.

In this study, digital proficiency assessment divided digital tools into several categories: presentation tools, communication tools, interactive games, classroom management tools, mathematics & science tools, evaluation tools, and digital content creation tools. The survey results showed that students generally had good proficiency in using digital tools for presentation, evaluation, and communication. Table 3 below presents the data on students' digital proficiency, it shows that most students have good proficiency in using various types of digital devices.

	Inform ation	Communi cation	Interactive Gamification	Compet encies	Evaluation Tools	Cont ent	TOT AL
MIN	1	1	1	1	1	1	7
MAX	5	5	5	5	5	5	35
AVER AGE	4.42	3.92	3.31	3.09	4.85	3.09	25.7 2
STDE V	0.859	0.922	1.263	1.202	0.656	1.43 9	6.87 0

Table 3 Students' Digital Proficiency based on Digital Tools Categories

The results presented in Table 2 provide an overview of students' digital skills based on the category of digital tools. The highest average skill level is found in the Evaluation Tools category (4.85), indicating that students generally have good proficiency in using digital evaluation tools. This could suggest that students are already familiar with assessment tools such as Quizziz, WordWall, and similar applications.

On the other hand, the Competencies and Content categories have the lowest average (3.09), showing that although students generally possess basic skills in using digital tools, their proficiency in tools that support content creation or enhance their comprehension skills is still limited. This may indicate a need to emphasize improving students' skills in using these tools for more creative and complex learning purposes.

The Interactive Gamification category also shows a relatively low average (3.31), with some students demonstrating a lack of familiarity with or usage of digital gamification in learning. The high standard deviation in some categories, such as Interactive Gamification (1.263) and Content (1.439), indicates considerable variation among students in these categories. This implies significant differences between students who frequently use and those who do not use digital tools in these areas.

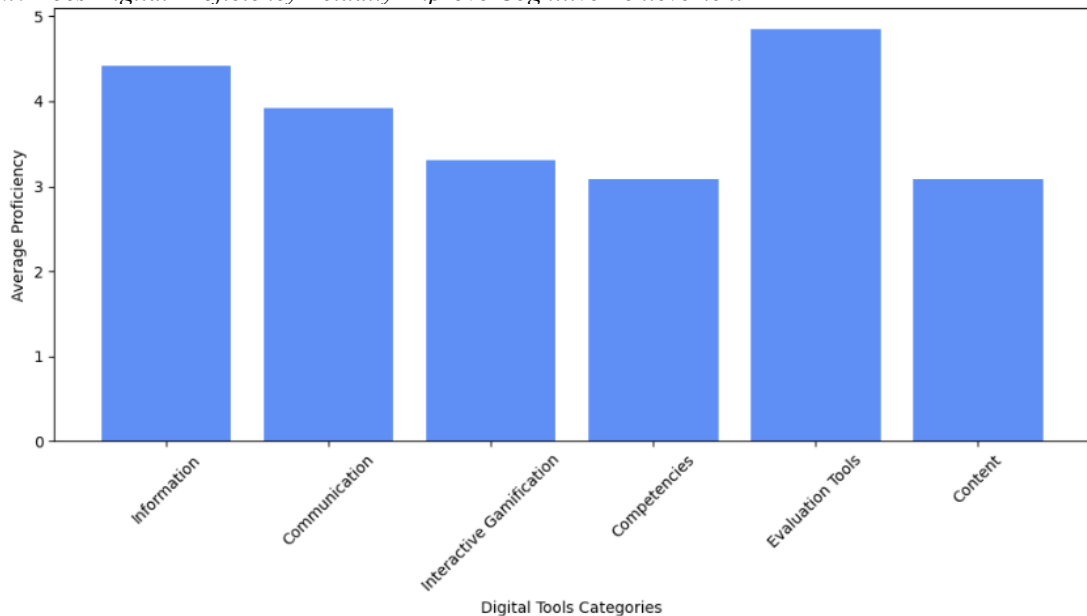


Figure 2 Average Digital Proficiency by Categories

The following section analyzes students' cognitive achievement levels based on Bloom's Taxonomy. This analysis illustrated how well students perform in different cognitive domains, from basic recall to more complex tasks such as analysis and creation, providing deeper insights into the relationship between their digital skills and cognitive development.

Students' Achievement on Bloom's Digital Taxonomy Indicators

The analysis of students' mathematics learning outcomes in this study was based on the indicators proposed by Churches (2007). In general, Bloom's Digital Taxonomy does not differ from Bloom's Taxonomy and its revision proposed by Anderson & Krathwohl, but Bloom's Digital Taxonomy is more specific in accommodating students' digital abilities. The student activities grouped in this study correspond to the verbs that were presented earlier in Table 1. Specifically, for each level of BDT in this study, the activities that students must perform to achieve a certain cognitive level were determined. This classification can be seen in Table 1.

Based on the analysis between the BDT activities formulated and the student's cognitive level tests, it was found that all students achieved the C1 level. Unsurprisingly, technology indeed provides great assistance in facilitating activities at this level. Cognitive abilities of remembering and understanding are facilitated by digital activities such as googling and bookmarking through the use of online search engines (Kurniasih et al., 2018; Shariman et al., 2012). Student achievement becomes worse at subsequent levels, but the fourth level (analyzing) becomes crucial because at this stage it begins to appear that activities with digital technology have no significant impact. The picture of the results of student's cognitive level tests based on the BDT level is presented in Figure 1.

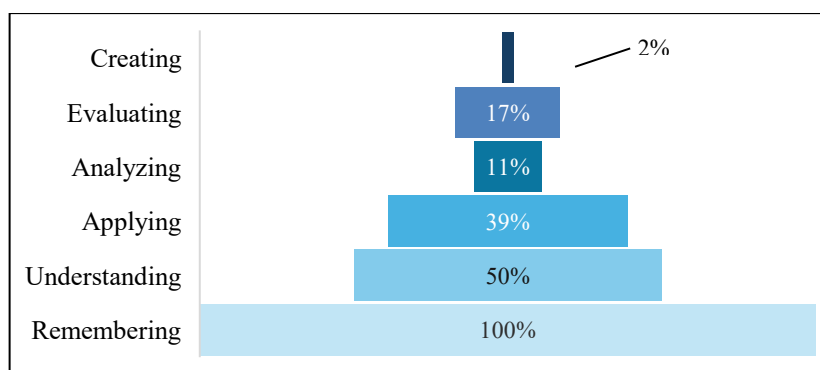


Figure 1 Student's Cognitive Level Tests Based on The BDT Level

The findings suggest that students with more developed digital skills tend to excel at the lower cognitive levels (C1 to C3) of Bloom's Digital Taxonomy. These levels involve recalling, comprehending, and applying knowledge, which is facilitated by the diverse interactive digital technologies used. As shown in Table 4, students with high and higher digital proficiency demonstrate good achievement in remembering, understanding, and applying domains. This indicates that mastery of digital technology provides an advantage in building the foundational cognitive skills that are crucial for more complex learning and problem-solving. Proficiency in leveraging digital technology appears to be a key enabler for students to effectively engage with and apply their knowledge at the basic cognitive levels.

Based on the observations conducted by the author during classroom activities, it was evident that students' performance at the C1-C3 levels was significantly aided using technology. The implementation of technology at these levels tends to be straightforward and practical, making it easier for students to benefit from it. Specifically, for the Remembering (C1) level, activities such as searching and googling information using online search engines provided strong support for students in recalling information quickly. This observation shows that technology simplifies the process of accessing and remembering information.

Digital Proficiency	Bloom's Digital Taxonomy					
	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating
Very low	1%	0%	0%	0%	1%	0%
Low	4%	4%	2%	0%	3%	0%
Moderate	27%	13%	9%	3%	4%	0%
High	23%	13%	11%	4%	5%	0%
Very high	45%	20%	17%	4%	4%	2%
TOTAL	100%	50%	39%	11%	17%	2%

Table 4 Students' Cognitive Achievements Based on Their Digital Proficiency

At the Understanding (C2) level, applications like GeoGebra and Maple offered effective support by allowing students to visualize and better comprehend mathematical concepts. These tools provided interactive simulations that helped bridge the gap between abstract concepts and practical understanding. For the Applying (C3) level, tools such as Photo math, Maple, POM-QM, and ChatGPT facilitated students in applying mathematical and problem-solving skills in

an accessible manner. The instructions or commands required to use these tools at this level were relatively simple, without involving complex or nested commands. Students could complete tasks without needing to integrate multiple applications or engage in complex ways of thinking. As a result, technology at these levels significantly contributed to their achievement.

Discussion

The results of this study were consistent with findings from earlier research, reinforcing the notion that digital technology is instrumental in enhancing student learning. Wedlock and Grove (2017) highlighted the pivotal role that digital tools play in helping students cultivate essential cognitive skills. In particular, they pointed out that these technologies significantly aid in the processes of remembering and understanding information, especially for students at the C1 and C2 levels of cognitive development. Furthermore, Lin (2021) explored the impact of specific simulation technologies, including GeoGebra and Maple, on student learning outcomes. His research demonstrated that these tools were particularly effective in enhancing students' comprehension at the C2 level. However, Lin argued that advancing to the Applying (C3) level and beyond requires a more profound integration of technology alongside a critical and reflective learning approach. This deeper engagement is essential for students to develop the necessary competencies to navigate more complex problems effectively. Moreover, Sumartini (2022) emphasized that while applications such as Photomath and Maple have the potential to bolster basic cognitive skills at the Applying (C3) level, they do not inherently ensure that students can transfer their knowledge to more intricate and varied contexts. This observation underscores a crucial gap in the educational process and highlights the necessity for implementing targeted learning strategies. Such strategies should focus on fostering critical thinking skills, thereby enabling students to ascend to higher levels of understanding and application as defined by Bloom's Digital Taxonomy. By prioritizing these efforts, educators can better prepare students to tackle complex tasks and challenges in their academic and real-world endeavors.

The condition was different from that faced by students with low and very low digital proficiency. These students did not show good cognitive achievement at the cognitive levels C1 to C3, with only 5% of students accomplishing the remembering and understanding indicators, and just 2% reaching the applying level. This indicates that at the lower and middle-order thinking levels (C1-C3), insufficient digital skills become an obstacle in supporting students' cognitive development. The detailed overview of students' cognitive achievements based on their digital proficiency is presented by a crosstab in Table 4.

While the previous analysis highlights several advantages, it was also identified that students with moderate to very high digital skills still do not benefit from their digital proficiency to support their ability to apply, analyze, and evaluate information at higher cognitive levels. Based on the data, at the C4, C5, and C6 levels in Digital Bloom's Taxonomy, students' digital proficiency does not significantly affect the achievement of these higher cognitive indicators. This is reflected in the low percentage of student achievement at these levels, even though students have high levels of digital proficiency. For example, students with very high digital proficiency only achieved 4% at the Analyzing and Evaluating levels, and only 2% at the Creating level. Even students with high digital proficiency only achieved 4% at the Evaluating level and showed no achievement at all at the Creating level. Students with medium digital proficiency also show a similar trend, with very low achievement at the Analyzing and Evaluating levels, and zero at the Creating level. This data indicates that although students have good digital proficiency, this does not automatically help them achieve indicators at higher

cognitive levels, such as analyzing, evaluating, and creating.

Digital proficiency serves as a valuable asset in the pursuit of higher-order cognitive skills, but it is essential to recognize that it is just one element of a broader educational strategy. Current digital tools have limitations, often concentrating on procedural and technical tasks that are suitable for lower-order cognitive activities. By enhancing these tools to encourage deeper, reflective thinking, we can create more meaningful learning experiences that enable students to engage in complex tasks such as analysis and evaluation (Gardenia et al., 2021; Haleva et al., 2020; Herrmann, 1996). To foster higher-order thinking, such as analysis and evaluation, it is crucial to implement effective instructional design (Kandaga et al., 2023a). While tools like GeoGebra and Photomath can provide answers, it is essential to integrate these resources with teaching methods that promote critical thinking and understanding of core concepts. This approach will better equip students with the analytical skills necessary for comprehensive learning. When it comes to the Creating (C6) level, which involves generating innovative ideas or products, it is important to acknowledge that digital tools alone may not be sufficient. Fostering creativity requires students to synthesize information from varied sources and engage in open-ended exploration. Encouraging independent exploration and reflection can heighten the effectiveness of these tools, enabling students to innovate.

Finally, achieving higher-order cognitive outcomes relies on several non-digital factors that enhance the learning experience. A strong conceptual understanding, the ability to identify relationships among different concepts, and engaging activities that inspire reflective thought are all vital (Kandaga et al., 2023a). While digital proficiency is important, it is most effective when paired with foundational skills, critical thinking, and a supportive learning environment. By focusing on these interconnected elements, educators can empower students to reach a deeper understanding and develop the critical and creative thinking skills essential for success.

Gap Between Digital Activities and Cognitive Indicators in the BDT

The research findings indicate that merely possessing digital skills is insufficient for students to successfully achieve more advanced cognitive outcomes. As we progress to the higher levels of Bloom's Digital Taxonomy (C4 to C6), the impact is no longer solely dependent on students' digital proficiency, but also on the way technology is utilized. While interactive digital technology can be an effective tool, cognitive abilities at higher levels require a more holistic approach (Kandaga et al., 2023b). As Kandaga et al. (2023a) suggests, although interactive digital technology can provide visualization and simulation that facilitates conceptual understanding, it will be less effective if not supported by appropriate learning strategies and techniques. Achieving cognitive indicators at the Analyzing, Evaluating, and Creating levels should emphasize the development of appropriate modes of thinking, rather than simply relying on the features available in the technology (McDougall, 2005; Chinien & Boutin, 2004; Serafin et al., 2014).

For example, the use of simulation software that enables students to explore and manipulate variables can indeed support analysis and evaluation (Smetana & Bell, 2012; Price et al., 2019). However, this is effective only when students are guided to critically and reflectively examine the results they obtain (Price et al., 2019). Without clear direction or prompting questions that encourage further exploration, the technology will be utilized merely as a passive tool, failing to stimulate the higher-order thinking skills required at these cognitive levels (Pineteh, 2014).

At the Creating level, where students are tasked with generating novel ideas or products, relying

solely on technology for presentation or modeling is grossly inadequate in facilitating intended innovation. To truly empower students to create something innovative, technology must be integrated with learning strategies that encourage active knowledge construction and deep conceptual understanding, such as inquiry-based or project-based approaches. Fostering the appropriate modes of thinking must be the foundation when incorporating technology into learning (Onyango & Gitonga, 2017). Failing to utilize appropriate technology results in learning that is dull and ineffective, unable to help students achieve the expected cognitive indicators at the higher levels of C4 through C6.

The findings of this study challenge the prevailing assumption that digital activities directly correlate with students' cognitive achievements in Bloom's Digital Taxonomy. This study contrasts with previous research by Zawedde (2014) and Lin (2021), which presented digital practices as an effective means to support higher-order thinking skills. While those studies highlighted the successful achievement of high order thinking indicators through digital activities, the current analysis casts doubt on this direct connection. The crux of the matter lies in the need to look beyond the mere execution of digital tasks and instead evaluate the substantive content and cognitive processes they reflect. For instance, creating a podcast may ostensibly align with the Creating level of BDT, but the assessment should focus on the critical thinking, depth of understanding, and originality of ideas expressed, rather than just the technical aspects of production. This distinction becomes particularly crucial in contexts where technical proficiency, rather than cognitive development, is the primary learning objective, such as in broadcasting courses. This study suggests that the relationship between digital activities and cognitive achievement is more nuanced than previously portrayed, necessitating a more holistic and discerning approach to evaluating the cognitive impact of technology-mediated learning.

This research presents a compelling counterargument to the notion that students' engagement in digital activities directly corresponds to their achievement of higher-order thinking skills within Bloom's Digital Taxonomy. The findings reveal that even when students undertake digital activities that ostensibly align with advanced BDT levels, such as creating a podcast at the C6 level, this does not automatically guarantee their achievement of the associated cognitive indicators. Contrary to findings from other studies, this study suggests a skeptical perspective that a student's involvement in interactive digital experiences does not necessarily translate to their cognitive indicator achievements matching those digital endeavors.

However, it must be acknowledged that in certain contexts, digital activities can closely align with Bloom's Digital Taxonomy. For example, Kandaga's research shows how using GeoGebra in Transformation Geometry supports cognitive achievement at the C6 level (Kandaga et al., 2023a). Creating a GeoGebra applet to simulate geometric transformations represents the cognitive indicators at C6. Students who can create such an applet demonstrate not just the ability to apply, analyze, or evaluate, but also the skills to create based on deep knowledge. This suggests students who successfully create the GeoGebra applet have reached a high cognitive level, capable of not only applying, analyzing, or evaluating but also creating something based on their understanding.

Faraon et al. (2024) research is another example that provides a compelling case for the alignment between digital activities and the cognitive levels of Bloom's Digital Taxonomy. In their study, they implemented the Analyzing level (C4) through the task of "Handling errors in web development code." This activity challenged students to deeply engage with error codes, requiring them to sort, organize, and comprehend the emerging patterns. Notably, the students

then leveraged artificial intelligence to devise effective resolution strategies, demonstrating not merely the ability to identify problems, but also to develop appropriate solutions. This digital experience, therefore, powerfully reflects the complex problem-solving process associated with the Analyzing level, where students exhibit high cognitive capabilities supported by technological tools.

The research by Zawedde (2014), Lin (2021), Kandaga et al. (2023a), and Faraon et al. (2024) suggests that the disconnect between digital activities and cognitive achievement levels in Bloom's Digital Taxonomy may stem from the inappropriate selection of concepts and technologies. Specifically, choosing digital activities that are irrelevant or misaligned with the targeted cognitive objectives can be a crucial factor in creating the gap between students' cognitive achievements and their use of digital technology.

This study's findings highlight a persistent disconnect between students' engagement in digital activities and their corresponding cognitive achievements within Bloom's Digital Taxonomy framework. It is crucial to recognize that the digital activities outlined in BDT are not inherently tied to specific cognitive levels. Rather, they serve as illustrative examples of strategies that can be employed to promote the meaningful integration of technology into the learning process. Fundamentally, the realization of desired cognitive outcomes depends not solely on the implementation of these digital activities, but also on the purposeful and thoughtful integration of technology within the relevant learning context, ensuring its alignment with the targeted cognitive objectives.

Conclusion

This study presents a compelling counterargument to the widely held assumption that students' engagement in digital activities directly correlates with their attainment of higher-order cognitive skills within Bloom's Digital Taxonomy. The findings challenge this prevailing notion, revealing a disconcerting gap between students' mastery of digital proficiencies and their substantive cognitive understanding. While digital tools and resources can indeed serve as powerful enablers of advanced cognition, their mere implementation does not automatically guarantee the desired cognitive outcomes. Specifically, the research suggests that even when students undertake tasks that ostensibly align with the higher levels of BDT, such as creating a podcast, this does not necessarily translate to their achievement of the associated cognitive indicators. The crux of the issue lies in the need to move beyond simply evaluating the execution of digital tasks and instead focus on assessing the substantive content and cognitive processes they reflect. Ultimately, this study emphasizes the urgent need for a more thoughtful and intentional approach to integrating technology in the learning process, one that prioritizes the alignment between digital activities and the targeted cognitive objectives, rather than solely focusing on the execution of digital tasks. Educators must carefully select digital activities that are closely matched to the desired cognitive outcomes, ensuring a meaningful integration of technology that supports the development of students' substantive understanding and advanced thinking skills.

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