INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH AND ANALYSIS

ISSN(print): 2643-9840, ISSN(online): 2643-9875

Volume 08 Issue 04 April 2025

DOI: 10.47191/ijmra/v8-i04-39, Impact Factor: 8.266

Page No. 1833-1842

Technology Integration and Pupils' Cognitive Engagement

Wengie C. Pino[1], Crystal Jade S. Mongas[2]

[1]Southern de Oro Philippines College, Cagayan de Oro City, Philippines

[2]DepEd Division of Bukidnon, Bukidnon, Philippines

ABSTRACT: Technology integration plays a crucial role in enhancing teaching and learning process by making lessons more interactive, engaging and accessible to foster pupils' cognitive engagement. This study examined the influence of technology integration to pupils' cognitive engagement for School Year 2024-2025. Furthermore, it examined the relationship between the level of technology integration and the level of pupils' cognitive engagement as well as determining the independent variable/s that influence the level of pupil's cognitive engagement. The study used descriptive correlational design and causal research design. Simple random sampling with Slovin's Formula at five percent margin of error was used. The survey was conducted to 146 pupils from the Baungon II District, Division of Bukidnon. A researcher-made questionnaire which passed the validity and reliability tests was utilized. Statistical tools like Mean, Standard Deviation, Pearson Product Moment Correlation Coefficient, and Multiple Linear Regression were employed. Findings revealed that teachers have a strong level of technology integration in the classrooms which exhibits a very high cognitive engagement among pupils. Technology integration has a significant relationship to pupils' cognitive engagement. Learning content significantly influence pupils' cognitive engagement. Thus, school heads are encouraged to continually develop strategic plans and implement activities that further enhance technology integration, fostering greater cognitive engagement among pupils and teachers are encouraged to prioritize the development of technology-enhanced, and pupil-centered learning content.

KEYWORDS: learning, pupils' cognitive engagement, technology integration

I. INTRODUCTION

The rapid progress of technology has changed educational institutions around the world that offers new techniques to facilitate teaching and learning. Technology in schools has become essential for enhancing teaching, expanding learning materials, and fostering greater pupil engagement. However, despite widespread use, there is still a considerable study gap in understanding the specific impact of technology integration on pupils' cognitive engagement, particularly in elementary schools. While most previous research focuses on general technology use or higher education settings, little is known about how elementary school pupils engage cognitively with technology-enhanced learning environments.

Consequently, numerous researches conducted worldwide show how technology may revolutionize education. Alhumaid (2019) asserted that incorporating technology into instruction fosters problem-solving, critical thinking, and collaborative learning. Technology-supported instruction improves learning outcomes by enabling individualized and interactive learning experiences. These results demonstrate how different technology tools, such as learning management systems, instructional software, offline digital resources, and multimedia content, can encourage learners' cognitive engagement.

Additionally, DepEd Order No. 016, s. 2023, the Department of Education (DepEd) issues the Revised Guidelines on the implementation of the DepEd Computerization Program (DCP) which aims to provide public schools and DepeEd offices with appropriate, quality, and equitable technologies that would enhance the teaching, learning, governance, and operating processes, practices, programs, and policies to meet the challenges of the modern age. It geared towards excellence and the transformation of education and the delivery of public service through the DepEd Computerization Program (DCP). This revised guideline aims to provide the quality education that is globally competitive, based on a pedagogically sound curriculum that is at par with international standards.

Nevertheless, due to resource constraints, technology integration remains a challenge for many schools in rural areas but teachers have embraced innovative approaches to make use of the available resources. According to a study conducted in

Bukidnon by Lumandas (2022), simple technological tools like offline educational apps and digital storytelling have greatly increased students' cognitive and emotional involvement. In order to optimize learning results in schools with limited resources, these initiatives highlight the necessity of investigating more organized and approachable technology integration techniques.

This study aimed to close this gap by investigating how technology integration affects cognitive engagement and provides insights into its effective use in elementary schools. In addition, the researcher aimed to investigate the relationship between pupils' cognitive engagement and technology integration. It looked at how pupils' active engagement and academic performance are impacted by digital tools, learning materials, and ICT. By tackling this issue, the study offered insightful information that would help teachers and school heads improve their methods and encourage more in-depth cognitive involvement in the classroom.

This study was anchored on several key educational theories that provide the foundation for understanding how technology integration influences pupils' cognitive engagement.

According to the Self-Regulated Cognitive Framework (SRCEF) also highlighted how technology design should be in line with self-regulation concepts. By giving them freedom and choice, features like gamified challenges, progress dashboards, and multimedia presentations meet the needs of individual pupils. In interactive materials, for instance, pupils can pause, rewind, or move to particular areas, enabling them to interact with the content at their own leisure. The ability of pupils to think critically, reflects on their knowledge, and maintains focus—all important markers of cognitive engagement—are improved by these individualized learning experiences. This approach supports the use of ICT technologies that actively engage pupils in overseeing their educational path (Garrison & Vaughan, 2023).

Recent uses of SRCEF in education have demonstrated notable advantages, especially in promoting deep learning and metacognitive abilities. Research has shown that pupils who actively control their learning in technology-rich contexts do better academically and with greater levels of cognitive engagement (Kim & Reeves, 2022). Since resource materials and interactive learning content can be created specially to encourage self-regulatory behaviors, the theory also supports the sub-variables of the study. As a result, SRCEF offers a starting point for comprehending how technology integration encourages prolonged, purposeful, and active learning engagement.

On the other hand, according to Zimmerman and Schunk (2021), to optimize cognitive engagement, the Technology-Enhanced Book-End Method divides instruction into three stages: preparation, engagement, and reflection. During the preparatory stage, pupils use videos, e-books, and other online resources to enhance their foundational knowledge. Pupils can approach learning tasks with prior context and readiness thanks to this phase, which prepares them for the forthcoming lesson.

By structuring learning into these phases, the Technology-Enhanced Book-End Method provides a clear, organized approach to technology integration that ensures pupils remain cognitively engaged throughout the learning process. This theory reinforces the idea that technology must be purposefully integrated into the curriculum to enhance active participation, critical thinking, and reflective learning. Studies like those by Garrison and Vaughan (2023) highlighted how this method creates sustained engagement, making it a valuable framework for understanding the relationship between technology and cognitive engagement.

II. METHODOLOGY

This study used a descriptive correlational to investigate on the Technology Integration and Pupil's Cognitive Engagement. The researcher used a descriptive correlational design to achieve the stated aims. Descriptive correlational design is a type of research that aims to describe the relationship between two or more variables without establishing causality. According to Siedlecki (2022), descriptive correlational design examines the relationship between variables in their natural setting without manipulation, allowing researchers to identify patterns and association.

Additionally, this study integrated the aspects of causal research design to further examine whether the independent variables/s singly or in combination influence the cognitive engagement of the pupils. Causal research design often referred to as explanatory research, seeks to determine cause-and-effect relationships by manipulating one or more independent variables and observing their effects on dependent variables (Cham et al., 2024).

The data collected for Problems 1 and 2 undergone analysis utilizing statistical techniques such as Mean and Standard Deviation. In the case of Problem 3, the analysis involved the use of Pearson Product Moment Correlation Coefficient to ascertain the presence and strength of a significant relationship between the technology Integration and pupils' cognitive engagement. Problem 4 used Multiple Linear Regression to examine which independent variable influence singly or in combination the pupils' cognitive engagement.

III. RESULTS AND DISCUSSION

Problem 1. What is the level of effectiveness and learning in terms of:

1.1 learning content;
1.2 learning resource materials: and
1.3 ICT?

Table 1 shows the overall Technology Integration of Pupils' Cognitive Engagement with the overall mean of 4.21 with SD=0.52, described as Strongly Agreed and interpreted as Very High Integration. This suggests that digital tools and interactive learning resources are effectively incorporated into the teaching and learning process. This has significant implications for pupils' cognitive engagement, as previous research suggests that incorporating technology not only increases participation but also develops higher order thinking abilities, which are essential for cognitive growth. However, technology may greatly enhance pupils learning outcomes and engagement when it is carefully included into the curriculum (Smith, 2020).

Table 1: Overall Technology Integration

Variables	Mean	SD	Description	Interpretation
Learning Content	4.20	0.53	Agree	High Integration
Learning Resource Materials	4.21	0.52	Strongly Agree	Very High Integration
ICT	4.22	0.52	Strongly Agree	Very High Integration
Overall Mean	**4.21**	**0.52**	**Strongly Agree**	**Very High Integration**

Note: 4.21-5.00 Very High Integration 3.41-4.20 High Integration 2.61-3.40 Moderate Integration
1.81-2.60 Low Integration 1.00-1.80 Very Low Integration

Among the three sub-variables of technology integration, ICT received the highest rating with the Mean of 4.22, SD=0.52, defined as Strongly Agree and interpreted as Very High Integration. These results suggest that pupils receive a variety of ICT-based instructional strategies that promotes active learning and cognitive engagement. This implies that educators should strategically integrate technology to promote active participation, personalized learning, and critical thinking. However, while technology enhances motivation and comprehension, effective instructional design remains crucial to sustaining engagement. Perhaps, teachers should balance interactive digital tools with structured pedagogical approaches, ensuring that technology is not just an add-on but meaningful component of the learning process. In addition, schools should also provide continuous teacher training and access to digital resources to maximize the benefits of technology in education.

Smith and Brown (2022) emphasized that ICT integration facilitates individualized learning experiences, which are critical for cognitive development. Accordingly, pupils can advance at their own pace and get immediate performance feedback thanks to technology like multimedia, digital tools and adaptive learning software. By monitoring student progress and modifying lesson plans accordingly, these ICT technologies also help teachers create a more effective and interesting learning environment.

Moreover, Martinez et al. (2023) explored the impact of ICT tools on higher-order thinking skills. The authors found that pupils who regularly use ICT resources, such as data analysis software, online simulations, and virtual laboratories, exhibit increased problem-solving and critical thinking abilities. Martinez et al. argue that ICT provides learners with the tools to analyze information, evaluate solutions, and create innovative outcomes, thus significantly enhancing cognitive engagement.

Meanwhile, Learning Content has the lowest Mean of 4.20 with SD=0.53, described as Agree and interpreted as Very High Integration indicating that while technology is integrated into lesson content, it is perceived as slightly less effective compared to ICT tools and learning resource materials. This suggests that the way digital content is designed and delivered may not fully maximize its potential to enhance learning. The findings imply that while technology is present in the lessons, some content may lack interactivity to different leaning needs. To improve this, educators should focus on developing well-structured, engaging, and interactive digital content that aligns with learning objectives. Incorporating multimedia elements, gamified lessons, and real time assessments can help make learning content more engaging and meaningful. Additionally, teachers' training on designing and utilizing high-quality digital instructional materials will be essential to strengthening the impact of technology integration in the classroom.

This finding supported the study of Kumar et al. (2021) highlighting those institutions to work to provide the highest caliber of e-learning content in order to satisfy the pupils. It is also shown that the quality of e-learning plays a substantial mediating function between pupils' pleasure and the content. It suggests that educational institutions have a responsibility to develop and deliver e-learning content that is not only relevant and informative but also engaging and interactive.

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Problem 2. What is the level of pupils' cognitive engagement?

Tables 2 provides insights into the level of pupils' cognitive engagement in technology-integrated learning environments. The overall Mean of 4.21 with SD=0.53, described as Strongly Agree and interpreted as Very High, suggests that technology positively influence pupils' engagement, motivation and participation in learning. This indicates that technology-driven instruction enhances pupils' interest, motivation, and active participation in lessons. The high engagement levels imply that digital tools, such as interactive presentations, educational apps, and multimedia resources, effectively support learning by making content more accessible and engaging. However, the variation in Mean scores across indicators suggests that while technology fosters engagement, its effectiveness depends on how it is implemented. To sustain high engagement, educators should ensure that technology is not just used as a passive tool but as an interactive platform for critical thinking, collaboration, and problem-solving. Schools should also provide continuous teacher training and access to well-designed digital learning materials to further enhance the impact of technology on pupils' cognitive engagement.

Table 2: Pupils' Cognitive Engagement

	Indicators	Mean	SD	Description	Interpretation
1.	I actively participate in lessons that use technology, such as videos or online activities.	4.03	0.55	Agree	High
2.	I enjoy interactive activities, like quizzes or games, using technology.	4.23	0.53	Strongly Agree	Very High
3.	I feel motivated to learn when technology makes lessons more engaging.	4.22	0.53	Strongly Agree	Very High
4.	I actively participate in group work that involves using technology, like research or projects.	4.31	0.52	Strongly Agree	Very High
5.	I use educational apps or online resources to help me understand lessons better.	4.37	0.51	Strongly Agree	Very High
6.	I explore additional information about our lessons using the internet or other digital tools.	4.31	0.52	Strongly Agree	Very High
7.	I enjoy using videos, animations, or simulations to understand topics better.	4.19	0.54	Agree	High
8.	I am more interested in learning when technology is integrated into the lessons.	4.08	0.55	Agree	High
9.	I use technology to collaborate with my classmates on group projects.	4.17	0.54	Agree	High
10.	I revisit digital resources, like slides or recorded videos, to review the lessons.	4.15	0.54	Agree	High
11.	I enjoy the interactive features of technology, such as answering polls or quizzes.	4.25	0.51	Strongly Agree	Very High
12.	I try to apply what I learn from technology-integrated lessons to real-life problems.	4.26	0.52	Strongly Agree	Very High
13.	I explore additional learning materials suggested by teachers through technology.	4.16	0.55	Agree	High
14.	I find it fun and engaging to use technology during individual learning tasks.	4.18	0.54	Agree	High
15.	I enjoy discovering new knowledge or skills through technology tools.	4.24	0.53	Strongly Agree	Very High
	Overall Mean	**4.21**	**0.53**	**Strongly Agree**	**Very High**

Note: 4.21-5.00 Very High 3.41-4.20 High 2.61-3.40 Moderate 1.81-2.60 Low 1.00-1.80 Very Low

According to Zhang (2023), digital tools that support critical thinking and problem-solving include instructional apps and online learning platforms. Moreover, technology aids in the development of the higher-order cognitive skills in pupils by providing chances for creative expression and collaborative learning. Zhang contends that these resources greatly improve cognitive engagement when they are chosen with care and integrated into the curriculum.

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Indicator 5, *I use educational apps or online resources to help me understand lessons better, has* the highest Mean of 4.37 with SD=0.51, described as Strongly Agree and interpreted as Very High Integration, it indicates that educational apps and online resources significantly contribute to pupils' cognitive engagement by enhancing comprehension, motivation, and independent learning. Additionally, pupils prefer educational apps and online resources because they can learn at their own pace, rewatch lessons, repeat exercises, and reinforce weak areas. Moreover, unlike traditional textbooks, online platforms offer updated content, multiple explanations, and real-world applications.

This finding is supported by Davis and Carter (2022) study which concentrated on how active involvement helps pupils become more cognitively engaged. Accordingly, pupils who actively participate conversations, problem-solving exercises, and group projects are more likely to engage cognitively. The authors stress that giving pupils the chance to be independent and make their own decisions greatly improves their motivation and cognitive engagement with learning activities.

Indicator 8*, I am more interested in learning when technology is integrated into the lessons, although* it received the lowest Mean of 4.08 with SD=0.55, described as Agree and is still interpreted as High Integration, indicates that pupils generally agree that technology integration increases their interests in their learning. However, compared to other indicators, the slightly lower rating suggests that while technology enhances engagement, other factors may influence pupils' interest in lessons. It might be that while technology provides tools for learning, engagement also depends on teaching strategies, lesson design, and pupils' motivation. If lessons are not interactive or aligned with pupils' learning needs, technology alone may not make a significant impact.

According to Pedler et al. (2022), teachers frequently have quite different idea about what constitutes pupils' engagement and use engagement tactics that run counter to these ideas. In light of this, one of the main goals of the current review is to give teaching professionals; one of the main goals of the currents review is to give teaching professionals a framework for implementing successful engagement.

The results confirm that technology integration plays a vital role in enhancing pupils' cognitive engagement (Ali et al., 2023). It is also enhanced when pupils interact with dynamic content, explore digital learning resources, and utilize ICT tools to reinforce their comprehension and retention of lessons. However, for sustained engagement, educators must use technology strategically, ensure interactively, and consider pupils' diverse leaning needs. This highlights the importance of thoughtful technology and effective learning experiences.

Problem 3. Is there a significant relationship between the level of technology integration and the level of pupils' cognitive engagement?

Table 3 shows the correlation analysis between Technology Integration and Pupils' Cognitive Engagement. The independent variable is technology integration across its three sub-variables: Learning Content, Learning Resource Materials, and ICT. Moreover, the dependent variable is pupils' cognitive engagement.

Table 3: Test of Correlation on Technology Integration and Cognitive Engagement

Variables	r-value	p-value	Level of Correlation	Decision	Interpretation
Learning Content	0.529	0.001	Moderate Positive Correlation	Reject Ho	Significant
Learning Resource Materials	0.216	0.032	Low Positive Correlation	Reject ho	Significant
ICT	0.242	0.038	Low Positive Correlation	Reject Ho	Significant

Note: 0.91 - 1.00 Very High Positive Correlation 0.71 – 0.90 High Positive Correlation
0.51 – 0.70 Moderate Positive Correlation 0.31 – 0.50 Low Positive Correlation
0.00 – 0.30 Negligible Positive Correlation *Significant when computed p-value <0.05*

Among the three sub-variables, Learning Content demonstrated the strongest correlation with pupils' cognitive engagement which registered a computed r-value of 0.529 with p-value of = 0.001, indicating a moderate positive relationship. The computed p-value is less than the p-critical value of 0.05 level of significance. This suggests that well-structured and engaging learning content presented through technology plays a crucial role in enhancing pupils' cognitive engagement. Thus, cognitive engagement involves mental effort, attention, and deep processing that pupils apply to learning materials. When content is well-structured, interactive, and meaningful, pupils are more likely to participate actively, ask questions, and make connections between concepts.

Moreover, Smith (2020) found out that integrating technology may improve individualized learning. Pupils can connect with content in ways that suit their unique needs and learning preferences by utilizing digital resources like interactive simulations and educational applications. According to Smith, incorporating technology not only increases participation but also

develops higher-order thinking abilities, which are essential for cognitive growth. According to the study, technology may greatly enhance pupils learning outcomes and engagement when it is carefully included into the curriculum.

For Learning Resource Materials, it registered as computed r-value of 0.216 with computed p-value of 0.032. The computed p-value is less than the p-critical value of o.05 level of significance. This implies the significant low positive correlation between learning resource materials and pupils' cognitive engagement. While the correlation is statistically significant, its lower value compared to Learning Content suggests that although learning resources contribute to engagement, their impact is not as strong. This indicates that simply providing access to learning resources is not enough to ensure high cognitive engagement. Thus, learning resource materials contribute to learning, their impacts depend on how they are utilized.

Providing pupils with access to materials alone does not automatically lead to engagement, what matter is how these resources are integrated into active learning processes. By ensuring that learning resources are engaging, interactive, and effectively used in instruction, teachers can maximize their impact on pupils' cognitive engagement. It also emphasizes the findings of Lee (2020) which stated that the quality and variety of learning resource materials are essential for improving pupils' engagement and cognitive development. He highlighted those pupils are better able to comprehend complex concepts and retain information when technology is used to provide diverse resource materials, such as interactive textbooks, educational videos, and simulations. The study suggests that a mix of digital resources allows for more personalized learning experiences, helping to cater to different learning styles and increasing engagement.

Information and Communication Technology (ICT) registered as computed r-value of 0.242 with computed p-value of 0.038. The computed p-value is less than the p-critical value of o.05 level of significance. This implies the significant low positive correlation between ICT and pupils' cognitive engagement. While the correlation is statistically significant, its lower value suggests that ICT alone does not strongly predict cognitive engagement. This means that while integrating technology into education can enhance learning experiences, its effectiveness in engaging pupils depends on how it is implemented.

In addition, ICT alone does not guarantee engagement, what matters is how teachers design learning experiences that actively involve pupils. By focusing on interactive, student-centered, and well-integrated ICT practices, educators can maximize its impact on cognitive engagement and improve overall learning outcomes. Johnson (2021), claimed that the integration of ICT in classrooms has changed the way pupils learn by improving interactivity and collaboration. The study also emphasized how ICT promotes cognitive engagement by facilitating real-time access to information and offering opportunities for peer-to-peer learning, which promotes deeper understanding and critical thinking.

Problem 4. Which of the independent variables singly or in combination influence pupils' cognitive engagement?

Table 4: Regression Analysis on Technology Integration and Cognitive Engagement

	UC		SC				
Variables	**B**	**SE**	**B**	**t-value**	**Sig. (P-value)**	**Decision**	**Interpretation**
Constant	0.5968	0.5768	0.5773	6.4869	0.001		
Learning Content	0.6597	0.6984	0.6789	6.9685	0.001	Reject Ho	Significant
Learning Resource Materials	0.2335	0.1241	0.0332	1.1265	0.890	Accept Ho	Not Significant
ICT	0.1133	0.0258	0.0468	1.1272	0.770	Accept Ho	Not Significant

Note: UC = Unstandardized Coefficients SC = Standardized Coefficients
Dependent Variable = Cognitive Engagement *Significant when computed p-value <0.05.*

Table 4 presents Multiple Regression Analysis with independent variables that singly or in combination affect pupils' level of learning engagement. It is proved that only one (1) out of the three (3) independent variables has positively influenced with the pupils' cognitive engagement where $\beta = 0$ as null and the alternative of $\beta \neq 0$. Moreover, Learning Content ($\beta = 0.6789$, t-value = 6.9685, p-value = 0.001) has a positively influence on the pupils' level of cognitive engagement.

This implies that the learning content significantly influences pupils' cognitive engagement emphasizing the need for well-structured, interactive, and meaningful instructional materials. Effective learning content enhances engagement by incorporating multimedia elements such as visuals, animations, and audio, which cater to different learning styles and improve information retention. Additionally, integrating gamification strategies, such as quizzes and interactive activities, fosters motivation and sustained attention. When content is clear, well-organized, and connected to real-life experiences, pupils are more likely to engage in critical thinking and problem-solving, leading to deeper cognitive involvement. Furthermore, adaptive and inquiry-based approaches encourage active participation, making learning more personalized and relevant. These findings suggest that educators should prioritize the development of interactive, technology-enhanced, and student-centered learning content to maximize pupils' cognitive engagement in the classroom.

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Moreover, this finding supports the study of Lee (2020) which stated that the quality and variety of learning content are essential for improving pupils' engagement and cognitive development. He also highlights those pupils are better able to comprehend complex concepts and retain information when technology is used to provide diverse resource materials, such as interactive textbooks, educational videos, and simulations. The study suggests that a mix of digital resources allows for more personalized learning experiences, helping to cater to different learning styles and increasing engagement.

In the same table, the analysis of the independent variable level as holding the dependent variable constant at a time. It can be seen from the statistical results: Learning Resource Materials (β = 0.0332, t-value = 1.1265, p-value = 0.890, indicate that learning resource materials does not have a significant impact on pupils' cognitive engagement. This suggests that while learning resource materials, such as textbooks, worksheets, and supplementary reading materials, are essential for instruction, they may not directly influence how actively pupils engage in learning. One possible explanation is that traditional learning resources are often passive in nature, requiring only reading or reference rather than active participation. Unlike interactive learning content that incorporates multimedia and hands-on engagement, printed or static materials may not sufficiently stimulate cognitive processes such as critical thinking, problem-solving, and sustained attention.

Furthermore, pupils' cognitive engagement levels depend more on how these materials are used rather than their mere availability—for example, a textbook alone may not engage students unless it is integrated into an interactive or collaborative learning activity. Additionally, modern learners, particularly in technology-enhanced environments, may be more drawn to digital and interactive resources rather than conventional print materials, reducing their direct impact on cognitive engagement. This finding suggests that while learning resource materials support instruction, they should be supplemented with interactive strategies and technology-based tools to enhance pupils' active cognitive involvement.

Likewise, it can be seen from the statistical results: Information and Communication Technology (ICT) (β = 0.0468, t-value = 1.1272, p-value = 0.770, indicate that ICT does not have a significant impact on pupils' cognitive engagement. This suggests that while ICT tools such as computers, projectors, and educational software are widely used in classrooms, their mere presence or use does not automatically lead to higher cognitive engagement among pupils. One possible explanation is that ICT alone does not guarantee meaningful learning—it depends on how it is implemented in instruction. If ICT tools are used passively, such as merely displaying slides or videos without interactive elements, pupils may remain disengaged. Additionally, young learners or pupils may view ICT tools as entertainment rather than learning aids, which could lead to surface-level engagement rather than deep cognitive involvement. Another factor could be the digital literacy of both teachers and pupils—if they are not adequately trained to use ICT effectively for interactive and problem-solving activities, its potential to enhance engagement may be limited. This finding suggests that for ICT to significantly impact pupils' cognitive engagement, it must be integrated with interactive teaching strategies, student-centered activities, and well-designed digital content that actively involves pupils in learning tasks rather than serving as a mere instructional supplement.

This conclusion has been studied by Anyanwu and Ossai-Onah (2021) in which their research highlighted the positive correlation between ICT knowledge and cognitive development in primary school pupils. The results indicated a moderate positive correlation between ICT knowledge and intellectual abilities, such as critical thinking, reasoning, and analytical skills. It means that ICT integration merely depend on how it is integrated and used by teachers in the classrooms. Furthermore, a strong positive correlation was found between ICT knowledge and perceptual abilities, suggesting that early exposure to digital tools enhances visual processing, spatial awareness, and pattern recognition. These findings highlight the importance of integrating ICT-based instructional strategies to support cognitive development in young learners.

IV. CONCLUSIONS

Based on the findings given above, the following conclusions can be drawn:

1) Teachers demonstrate a strong commitment in enhancing the learning experience.
2) Technology integration influences pupils' cognitive engagement by making content more accessible, interactive, and engaging.
3) Effective use of technology can greatly enhance pupils' involvement in learning thus, integrating technology in the classroom foster a higher level of pupils' cognitive engagement.
4) Effective learning content enhances cognitive engagement by incorporating multimedia elements, integrating gamification, and implementing adaptive and interactive approaches with pupils' needs and interests.

V. RECOMMENDATIONS

To enhance pupils' cognitive engagement through technology, the following recommendations are proposed for teachers and administrators. These suggestions aimed to optimize the use of technology in the classroom, ensuring that it actively contributes to meaningful learning experiences.

1) Teachers are encouraged to continue to explore and implement innovative tools to further enhance cognitive engagement in pupils. Professional development opportunities may be provided to ensure that teachers remain updated with evolving technologies and integration strategies.
2) Teachers are encouraged to strategically use the technology as an interactive platform for critical thinking, collaboration, and problem-solving of students. Schools are also encouraged to develop different technological resources to ensure all pupils benefit from enhanced learning opportunities.
3) School heads are encouraged to continually develop strategic plans and implement activities that further enhance technology integration, fostering greater cognitive engagement among pupils.
4) Teachers are encouraged to prioritize the development of interactive, technology-enhanced, teaching strategies, lesson design and pupil-centered learning content to maximize pupils' cognitive engagement in the classroom. Continuous evaluation of the content's effectiveness should be conducted to ensure that it consistently engage pupils.

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