

Original Article

Assessing the Impact of TPACK-Aligned Digital Materials on Pupils' Engagement in Lutayan District II

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Abstract

This study investigated the impact of TPACK-aligned digital materials on student engagement and learning performance among Grade 5 pupils in Lutayan District II. Specifically, it determined the level of teachers' utilization of digital tools, assessed students' engagement in terms of behavioral, emotional, and cognitive dimensions, and examined the significant relationship between these variables. The study focused on the use of Microsoft PowerPoint/Google Slides, Canva for Education, and online games as instructional materials. A quantitative descriptive research design was employed, utilizing survey questionnaires administered to 114 Grade 5 pupils and their teachers. The instruments included a Teacher TPACK Integration Checklist and a Student Engagement Survey. Findings revealed that teachers demonstrated a high level of utilization of TPACK-aligned digital materials, particularly presentation and design tools, while the use of online games was observed at a moderate level, indicating an area for improvement. Moreover, students exhibited a high level of engagement across behavioral, emotional, and cognitive domains, suggesting that digital integration enhances participation, motivation, and critical thinking. Statistical analysis showed a significant positive relationship ($r = 0.72$, $p = < .001$) between teachers' use of TPACK-aligned digital materials and student engagement. The study concludes that effective integration of technology aligned with pedagogy and content knowledge significantly improves student engagement and supports better learning outcomes. It is recommended that teachers further develop their digital

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competencies and incorporate diverse interactive tools to enrich classroom instruction.

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1. Introduction

The integration of digital technology into education has increasingly changed how teachers design and deliver instruction and how learners participate in classroom activities. Digital instructional materials such as multimedia presentations, educational platforms, simulations, and interactive games provide opportunities to present content in more varied and engaging ways. However, the presence of technology alone does not necessarily result in effective teaching and learning. Its instructional value depends largely on teachers' ability to select and use technological resources in ways that are appropriate to the subject matter, learning objectives, and pedagogical approaches. This concern is addressed by the Technological Pedagogical Content Knowledge (TPACK) framework, which emphasizes the interaction among technological knowledge, pedagogical knowledge, and content knowledge in effective technology-integrated teaching.

Recent literature has emphasized that TPACK is not simply a teacher's knowledge of digital tools but involves the ability to connect technology with appropriate teaching strategies and subject content. Koehler et al. (2019) described TPACK as a framework for understanding the complex knowledge teachers need when integrating technology into instruction. Similarly, Mishra and Koehler (2019) emphasized that effective educational technology integration requires consideration of the relationships among technology, pedagogy, and content rather than treating technology as an independent component of teaching. These perspectives suggest that the effectiveness of digital instructional materials depends on how meaningfully teachers combine technological resources with pedagogical strategies and disciplinary content.

The literature also indicates that developing and measuring TPACK involves considerable complexity. Voogt et al. (2018) highlighted challenges in measuring teachers' TPACK because the framework involves interconnected forms of knowledge that may vary according to subject matter, teaching context, and technological demands. Chai et al. (2019), in their review of TPACK research, further emphasized the continuing development of the framework and the importance of examining how teachers' technological knowledge interacts with pedagogy and content in actual educational settings. Taken together, these studies indicate that TPACK should be considered in relation to teachers' instructional practices rather than merely as competence in operating digital technologies.

Empirical studies have also provided evidence that TPACK-informed technology integration can be associated with positive learner outcomes. Srisawasdi and Panjaburee (2018) found that TPACK-based simulations supported students' conceptual understanding and motivation in science learning. Huang et al. (2020) likewise examined TPACK-aligned digital learning resources and their relationship with student engagement and learning outcomes in elementary education. These findings suggest that when digital resources are purposefully connected with instructional content and pedagogy, they can provide learning experiences that support students' participation, motivation, and understanding. However, these benefits depend on the quality and purpose of technology integration rather than on the mere availability of digital resources.

More recent research has continued to highlight the importance of teachers' use of digital instructional materials in primary education. Cabero-Almenara et al. (2023) examined teachers' perceptions and uses of digital didactic materials in primary education, demonstrating the continuing relevance of teachers' practices in determining how digital resources are incorporated into instruction. This body of literature, together with research on digital technology and student engagement, indicates that technology-supported instruction can provide opportunities for greater learner involvement when digital resources are appropriately selected and integrated. Bond et al. (2020), for example, synthesized research showing that digital technologies can support student engagement when they are strategically incorporated into educational activities.

Despite these developments, the literature also points to the need to examine technology integration within specific educational contexts. Evidence from international studies cannot automatically be assumed to represent the experiences of teachers and pupils in Philippine elementary schools, particularly in specific local school settings. Philippine education continues to expand the use of digital learning resources, but the implementation of technology-supported instruction may differ according to teachers' competencies, available resources, instructional practices, and school context. The existing literature therefore provides a strong theoretical and empirical basis for examining how TPACK-aligned digital materials are actually utilized and how their use relates to pupil engagement within a particular educational setting.

In the present study, this concern was examined among Grade 5 pupils and teachers in four public elementary schools in Lutayan District II, Sultan Kudarat, during School Year 2025–2026. The study focused on three types of digital instructional materials: Microsoft PowerPoint/Google Slides, Canva for Education, and online educational games. It examined teachers' utilization of these materials and pupils' engagement in terms of behavioral, emotional, and cognitive dimensions. These engagement dimensions were considered because classroom engagement involves not only observable participation but also learners' emotional involvement and cognitive effort during learning activities.

The study addressed a local research need by examining the relationship between teachers' utilization of TPACK-aligned digital instructional materials and pupil engagement within the participating schools. Rather than assuming that digital technology automatically improves learning, the study sought to determine the extent to which these materials were utilized and how their utilization was associated with the engagement of the Grade 5 pupils included in the study. Through this approach, the study contributed context-specific evidence on the use of TPACK-aligned digital instructional materials and provided a basis for understanding technology-integrated instruction within the participating schools in Lutayan District II.

2. Methodology

The study employed a descriptive-correlational research design to examine the relationship between teachers' utilization of TPACK-aligned digital instructional materials and pupil engagement. The study was conducted among Grade 5 pupils and teachers from four public elementary schools in Lutayan District II, Sultan Kudarat, Philippines, during School Year 2025–2026. It focused on three types of digital instructional materials, namely Microsoft PowerPoint/Google Slides, Canva for Education, and online educational games. Teachers' utilization of these materials was assessed in relation to pupils' behavioral, emotional, and cognitive engagement. The descriptive component determined the extent of utilization of digital instructional materials and the level of pupil engagement, while the correlational component examined the significant relationship between these variables.

Researcher-made survey questionnaires served as the primary instruments for data collection. Two instruments were utilized: the Teacher TPACK Integration Checklist and the Student Engagement Survey. The Teacher TPACK Integration Checklist assessed teachers' utilization of digital instructional materials, particularly Microsoft PowerPoint/Google Slides, Canva for Education, and online educational games. These tools were selected because they represented digital resources that supported the integration of technological, pedagogical, and content knowledge in classroom instruction. Meanwhile, the Student Engagement Survey measured three dimensions of pupil engagement. Behavioral engagement referred to pupils' participation and involvement in classroom activities, emotional engagement focused on their motivation, enjoyment, and interest in learning, while cognitive engagement measured their effort, critical thinking, and use of learning strategies during instructional activities.

To establish the content validity of the research instruments, the questionnaires were subjected to expert validation before their administration. The instruments were submitted to expert validators who assessed the questionnaire items based on their relevance to the research objectives, clarity of wording, appropriateness of content, and suitability for the intended respondents. The validators also examined whether the items adequately represented the indicators of teachers' utilization of TPACK-aligned digital instructional materials and pupils' behavioral, emotional, and cognitive

engagement. The comments and recommendations provided by the validators were incorporated into the revision of the instruments to improve their clarity, relevance, and overall appropriateness for the study.

Following the expert validation process, the instruments obtained an overall mean validity score of 4.95, interpreted as Very Highly Valid. This result indicated that the questionnaire items were considered appropriate and relevant to the variables being measured. Subsequently, reliability testing was conducted to assess the internal consistency of the questionnaire items. The reliability analysis yielded a Cronbach's alpha coefficient of .961, indicating excellent internal consistency. These results provided evidence of the content validity and internal consistency of the research instruments and supported their use in the actual data collection.

The data-gathering procedure followed a systematic process to ensure the proper administration of the research instruments. Before conducting the study, the researchers secured the necessary approval and permission from the concerned school administrators. Informed consent was obtained from the participating teachers and the parents or guardians of the pupil respondents, while the pupils were informed about the purpose of the study and their voluntary participation. The validated questionnaires were administered during regular class hours, with clear instructions provided to help respondents understand the items. The researchers supervised the administration of the questionnaires to ensure consistency in the data-gathering process. After the administration, the completed questionnaires were checked for completeness, organized, coded, and prepared for statistical analysis.

Ethical considerations were observed throughout the conduct of the study. Participation was voluntary, and the respondents were informed of their right to withdraw at any stage without penalty or unfavorable consequences. The confidentiality and privacy of the participants were protected by excluding personally identifying information from the research instruments and using appropriate codes in organizing the collected data. All information obtained from the respondents was treated confidentially and used exclusively for academic and research purposes. Furthermore, the researchers observed appropriate safeguards to minimize any potential physical, emotional, or psychological discomfort associated with participation in the study.

The collected data were analyzed using descriptive and inferential statistical methods with the aid of statistical software. Weighted mean and standard deviation were employed to determine the extent of teachers' utilization of TPACK-aligned digital instructional materials and the level of pupils' behavioral, emotional, and cognitive engagement. The Pearson product-moment correlation coefficient (Pearson r) was utilized to examine the relationship between teachers' utilization of digital instructional materials and pupil engagement. The level of significance was set at .05 to determine whether the observed relationships were statistically significant. The statistical analyses provided an empirical basis for determining the extent to which teachers' utilization of TPACK-aligned digital instructional materials was associated

with the engagement of Grade 5 pupils in the participating public elementary schools of Lutayan District II, Sultan Kudarat, Philippines.

3. Results

Table 1. Teachers' utilization of digital tools.

Variables	Mean	SD	Interpretation
Social Media Usage	3.91	1.47	Often Used
Microsoft PowerPoint / Google Slides	3.82	1.04	Often Used
Online Games	2.96	1.17	Sometimes Used
Grand Mean	3.56	1.23	Often Used

Table 1 presents the extent of teachers' utilization of digital tools in classroom instruction. The findings revealed an overall mean of 3.56 and a standard deviation of 1.23, interpreted as Often Used, indicating that teachers frequently incorporated digital tools into their instructional practices. Among the digital tools assessed, social media usage obtained the highest mean of 3.91 and a standard deviation of 1.47, followed by Microsoft PowerPoint/Google Slides with a mean of 3.82 and a standard deviation of 1.04, both interpreted as Often Used. Meanwhile, online games recorded the lowest mean of 2.96 and a standard deviation of 1.17, interpreted as Sometimes Used.

The findings indicate that teachers utilized social media and presentation-based digital tools more frequently than online educational games. This suggests that teachers tended to favor digital resources associated with communication, content presentation, and instructional delivery, while game-based learning tools were less frequently integrated into classroom activities. Overall, the results demonstrate that digital tools were regularly incorporated into teaching practices, although their frequency of utilization varied across the different types of resources.

Table 2. Students' engagement.

Engagement Dimension	Grand Mean	SD	Interpretation
Behavioral Engagement	4.04	1.06	Very High Engagement
Cognitive Engagement	3.88	1.07	High Engagement
Emotional Engagement	3.75	1.11	High Engagement
Grand Mean	3.89	1.08	High Engagement

Table 2 presents the level of pupils' engagement in terms of behavioral, cognitive, and emotional dimensions. The findings revealed an overall mean of 3.89 and a standard deviation of 1.08, interpreted as High Engagement, indicating that pupils generally demonstrated active involvement, interest, and cognitive effort during classroom learning activities. Among the three dimensions, behavioral engagement obtained the highest mean of 4.04 and a standard deviation of 1.06, interpreted as Very High Engagement. This was followed by cognitive engagement, which recorded a mean of 3.88 and a standard deviation of 1.07, interpreted as High Engagement. Meanwhile, emotional engagement obtained the lowest mean of 3.75 and a standard deviation of 1.11, also interpreted as High Engagement.

The findings indicate that pupils demonstrated greater behavioral engagement compared to cognitive and emotional engagement. This suggests that pupils were more actively involved in classroom activities and participation, while their cognitive effort, motivation, and interest in learning were also evident. Although emotional engagement recorded the lowest mean, it remained within the High Engagement category. Overall, the results demonstrate that pupils exhibited high levels of engagement across the three dimensions, with behavioral engagement emerging as the most prominent aspect of their classroom learning experiences.

Table 3. Relationship between teachers' utilization of TPACK-aligned digital materials and pupil engagement.

Variable	Mean	r	r ²	p-value	Interpretation
Teachers' Utilization of TPACK-Aligned Digital Materials and Pupil Engagement	3.56	0.72	0.5184	< .001	Substantial Positive Correlation

Table 3 presents the relationship between teachers' utilization of TPACK-aligned digital materials and pupil engagement. The findings revealed a mean of 3.56 for teachers' utilization of digital materials and a Pearson correlation coefficient of 0.72, indicating a substantial positive correlation between the two variables. The coefficient of determination of 0.5184 indicates that approximately 51.84% of the variance in pupil engagement was statistically associated with teachers' utilization of TPACK-aligned digital materials. Furthermore, the obtained p-value of less than .001 was lower than the .05 level of significance, indicating a statistically significant relationship between teachers' utilization of digital materials and pupil engagement. Thus, the null hypothesis of no significant relationship was rejected.

The findings indicate that higher levels of teachers' utilization of TPACK-aligned digital materials were associated with higher levels of pupil engagement. This suggests that teachers who more frequently integrated digital instructional materials into their teaching practices tended to have pupils who demonstrated greater behavioral, cognitive, and emotional engagement. The substantial positive relationship highlights the relevance of technology-integrated instruction to pupils' classroom engagement.

4. Discussion

The findings of the study revealed that teachers frequently utilized digital tools in classroom instruction, with social media and Microsoft PowerPoint/Google Slides receiving higher utilization ratings than online educational games. This finding is consistent with Wohlfart and Wagner (2023), who emphasized that teachers play a central role in integrating digital technologies into classroom instruction, particularly through their technological competencies, pedagogical practices, and access to digital resources. The frequent utilization of digital tools in the present study reflects the

growing integration of technology into teaching practices. However, the differences in utilization across the three digital tools suggest that teachers may have varying preferences and levels of familiarity with available technologies. This finding can be understood through the Technological Pedagogical Content Knowledge (TPACK) framework of Mishra and Koehler (2006), which emphasizes that effective technology integration requires the appropriate combination of technological knowledge, pedagogical strategies, and subject content. The findings therefore highlight the importance of considering not only the frequency of digital tool utilization but also how these resources are incorporated into classroom instruction.

The lower utilization of online educational games is particularly relevant to the findings of Guan et al. (2024), whose systematic review of game-based learning in primary education identified generally positive learning outcomes associated with the integration of games into classroom activities. Similarly, Sun et al. (2023) found that teacher scaffolding during game-based learning contributed to pupils' learning, engagement, skills development, and enjoyment. These findings suggest that educational games have the potential to support classroom instruction when accompanied by appropriate teaching strategies and guidance. In the present study, online educational games were utilized less frequently than social media and presentation-based tools. This indicates that teachers' integration of digital resources was not equally distributed across different instructional approaches. The findings further suggest that the utilization of technology in classroom instruction may be more focused on communication and content presentation than on interactive game-based learning activities.

Regarding pupil engagement, the findings demonstrated a generally high level of engagement, with behavioral engagement obtaining the highest rating, followed by cognitive and emotional engagement. This finding is consistent with Nkomo et al. (2021), who emphasized that student engagement with digital technologies involves behavioral, cognitive, and emotional dimensions that represent different aspects of the learning experience. The higher behavioral engagement observed in the present study indicates that pupils demonstrated greater participation and involvement in classroom activities relative to the other engagement dimensions. Furthermore, Wang et al. (2023), through a systematic review and meta-analysis involving primary and secondary education, found that the use of mobile technologies produced positive effects on cognitive, affective, and behavioral learning outcomes. Although their study examined mobile technology specifically, the findings provide relevant evidence that technology-supported instruction can be associated with different aspects of pupils' learning experiences. The results of the present study similarly demonstrate that engagement is multidimensional, with varying levels across behavioral, cognitive, and emotional components.

The comparatively lower emotional engagement also deserves consideration because active participation in classroom activities does not necessarily reflect an equally high level of motivation, enjoyment, or emotional involvement. This finding is supported by Ramírez Ruiz et al. (2024), who emphasized that school engagement

should be examined from a broader perspective rather than focusing exclusively on observable participation and motivation. Their systematic review of gamification in primary and secondary education highlighted the importance of considering multiple dimensions of engagement when evaluating technology-supported instructional strategies. Likewise, Nkomo et al. (2021) explained that behavioral, emotional, and cognitive engagement are interconnected but represent distinct aspects of students' learning experiences. The findings of the present study indicate that although pupils demonstrated high engagement across all three dimensions, behavioral engagement was more prominent than emotional engagement. This suggests that pupils' observable participation may be stronger than their reported emotional involvement in learning activities, emphasizing the importance of examining engagement beyond classroom participation alone.

Furthermore, the study established a substantial positive and statistically significant relationship between teachers' utilization of TPACK-aligned digital materials and pupil engagement, with a Pearson correlation coefficient of 0.72 and a p-value of less than .001. This finding is consistent with Wang et al. (2023), whose meta-analysis demonstrated positive learning outcomes associated with technology-supported instruction in primary and secondary education. Similarly, Nkomo et al. (2021) recognized the relationship between digital technologies and student engagement while emphasizing that the educational value of technology depends on its pedagogical appropriateness and the learning context. The positive correlation observed in the present study indicates that greater utilization of digital instructional materials was associated with higher levels of pupil engagement. Moreover, the coefficient of determination of 0.5184 indicates that approximately 51.84% of the variance in pupil engagement was statistically accounted for by its linear relationship with teachers' utilization of digital materials. However, this association does not establish a direct causal effect, as other instructional, learner-related, and contextual factors may also influence pupil engagement.

The significant relationship between the two variables also aligns with the TPACK framework of Mishra and Koehler (2006), which explains that meaningful technology integration involves the interaction of technological, pedagogical, and content knowledge. This theoretical perspective is further supported by Wohlfart and Wagner (2023), whose review emphasized the importance of teachers' digital competencies and pedagogical approaches in technology integration. The findings of the present study are consistent with these perspectives, as teachers who reported greater utilization of digital instructional materials were associated with pupils who demonstrated higher engagement. Nevertheless, the results should be interpreted within the descriptive-correlational design of the study, which identifies relationships between variables without establishing cause-and-effect conclusions. The findings therefore provide empirical support for the relevance of teachers' utilization of digital instructional materials to pupil engagement rather than evidence that technology utilization independently produces improved engagement.

Overall, the findings contribute to the understanding of technology-integrated instruction among Grade 5 pupils and teachers in Lutayan District II, Sultan Kudarat, Philippines. The frequent utilization of digital tools, the high level of pupil engagement, and the substantial positive relationship between these variables are consistent with recent literature emphasizing the educational relevance of digital technologies. However, the differences in the frequency of digital tool utilization and the varying levels of engagement across behavioral, cognitive, and emotional dimensions indicate that technology integration and pupil engagement are not uniform. The findings highlight the importance of examining teachers' instructional practices alongside pupils' learning experiences when evaluating TPACK-aligned digital materials. Through this approach, the study provides context-specific evidence on the relationship between digital instructional practices and pupil engagement in public elementary schools.

5. Conclusion

The study concludes that teachers in the four participating public elementary schools in Lutayan District II frequently utilized TPACK-aligned digital instructional materials, particularly Microsoft PowerPoint/Google Slides and Canva for Education. These digital tools were commonly integrated into classroom instruction to support lesson delivery, organize instructional content, and facilitate learning activities. However, online educational games were utilized less frequently, indicating their comparatively limited integration into the instructional practices of the participating teachers. Furthermore, the findings revealed that the Grade 5 pupils demonstrated an overall high level of engagement across behavioral, cognitive, and emotional dimensions. Behavioral engagement obtained the highest mean and was interpreted as Very High Engagement, while cognitive and emotional engagement were both interpreted as High Engagement. These findings indicate that the participating pupils generally demonstrated active classroom participation, cognitive effort, interest, and motivation during learning activities. Finally, the study established a substantial positive and statistically significant relationship between teachers' utilization of TPACK-aligned digital instructional materials and pupil engagement. This indicates that higher levels of teachers' utilization of digital materials were associated with higher levels of engagement among the participating Grade 5 pupils. The findings highlight the relevance of technology-integrated instruction to pupils' behavioral, cognitive, and emotional engagement. However, given the descriptive-correlational nature of the study, the observed relationship does not establish that the utilization of digital instructional materials directly caused improvements in pupil engagement.

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Conflict of Interest Statement

The authors declare that they have no known financial, personal, or professional conflicts of interest that could have influenced the conduct, analysis, interpretation, or reporting of this study.

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