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Article

Instructional Multimedia Utilization, Learner Engagement, and Academic Performance in Science Among Grade Three Learners

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Abstract: This study examined instructional multimedia utilization, learner engagement, and academic performance in science among Grade Three learners in selected private schools in Cebu City during School Year 2024–2025. It described the learners' profile, multimedia resources available at home, teachers' use of instructional media, learners' affective, behavioral, and cognitive engagement, and science achievement. A descriptive-correlational research design was used. Respondents were selected through simple random sampling, and data were gathered using an adapted and modified questionnaire based on Heinich, Molenda, Russell, and Smaldino (2002), together with the learners' First Quarter science grades. Frequency, percentage, weighted mean, standard deviation, and Pearson product-moment correlation were employed in analyzing the data. Results showed that televisions, smartphones, and laptops were the most common multimedia resources available at home. Teachers generally utilized instructional media, particularly pictures, boards, internet resources, and real objects. Learners demonstrated favorable affective, behavioral, and cognitive engagement and achieved very satisfactory academic performance in science. Instructional media utilization had a significant positive relationship with academic performance. Affective and behavioral engagement were also significantly related to science achievement, while cognitive engagement was not significantly associated with performance. The findings suggest that purposeful multimedia integration and strategies that strengthen learners' interest, participation, attention, and persistence may improve science learning. An instructional multimedia utilization enhancement plan was therefore proposed to support more effective, accessible, and engaging science instruction across the participating private elementary school settings.

Keywords: instructional multimedia utilization, learner engagement, academic performance, science education, Grade Three learners

Introduction

Science education develops children's curiosity, reasoning, problem-solving, and ability to explain natural events using evidence. In the primary grades, these abilities are strengthened when teachers present abstract ideas through concrete, visual, and interactive experiences. Instructional multimedia combines text, images, audio, animation, video, simulations, and digital activities to represent scientific processes that may be difficult to observe directly. Recent syntheses indicate that technology-supported science instruction can improve understanding, motivation, and achievement when multimedia is aligned with learning objectives and appropriate teaching strategies (Garzón & Lampropoulos, 2024; Pang et al., 2024). Interactive learning environments also support active participation and meaningful knowledge construction, making multimedia utilization an important instructional factor in Grade Three science classrooms (Geng & Su, 2024; Zeng et al., 2024).

Despite its potential, instructional multimedia is not always used effectively in science instruction. Teachers may face limited devices, unreliable internet access, inadequate support, insufficient training, and a shortage of curriculum-aligned materials. Multimedia can also become distracting when lessons contain excessive animation, text, sound, or unrelated visual elements. Studies emphasize that technology alone does not guarantee better learning because outcomes depend on instructional design, teacher guidance, accessibility, and opportunities for learners to interact with scientific content (Akpen et al., 2024; Pang et al., 2024). Unequal access to multimedia at home may widen learning differences among pupils. These challenges can restrict teachers' use of multimedia and reduce its value for sustaining attention, participation, and understanding during science lessons (Aligo & Prudente, 2025; Soriano-Sánchez, 2025).

When problems in multimedia utilization are not addressed, learners may become passive, distracted, or less interested in science. Weak instructional design can limit affective engagement by reducing enjoyment, behavioral engagement by decreasing participation, and cognitive engagement by discouraging effortful thinking. Low engagement may eventually weaken comprehension, retention, and academic performance, particularly when scientific concepts require visualization and interaction. Systematic reviews show that technology-supported learning produces uneven effects when learner engagement and teacher support are insufficient (Akpen et al., 2024). Likewise, poorly integrated digital resources may fail to improve achievement despite their technical features. Without appropriate multimedia use, schools may miss opportunities to make science learning accessible, interactive, and responsive to young learners' needs, thereby limiting their participation and performance (Koç & Kanadlı, 2025; Cao et al., 2025).

Existing research reports positive outcomes from well-designed multimedia and technology-enhanced science instruction. Garzón and Lampropoulos (2024) found that mobile learning supported K–12 science achievement, while Pang et al. (2024) reported that virtual simulations strengthen science learning by making invisible processes observable. Geng and Su (2024) found favorable effects from metaverse-supported STEM environments, and Zeng et al. (2024) showed that gamified instruction can improve academic performance. Aligo and Prudente (2025) concluded that digital learning materials enhance science achievement, whereas Soriano-Sánchez (2025) found that information and communication technologies support natural science learning in primary schools. Koç and Kanadlı (2025) further demonstrated that interactive environments improve science outcomes, while Cao et al. (2025) reported positive effects of STEM education on learning performance across educational settings.

Although many studies have examined digital learning, virtual simulations, gamification, and interactive environments, limited research has simultaneously investigated teachers' instructional multimedia utilization, learners' affective, behavioral, and cognitive engagement, and science performance among Grade Three pupils in selected private schools in Cebu City. Existing studies commonly emphasize older learners, particular technologies, or broad achievement outcomes. This leaves insufficient localized evidence on how available multimedia, classroom utilization, engagement dimensions, and science performance occur together within the experiences of young private-school learners today. This study will assess instructional multimedia utilization, learner engagement, and academic performance in science among Grade Three learners in selected private schools in Cebu City during School Year 2024–2025. It will describe learners' age, gender, and multimedia available at home; determine teachers' extent of multimedia use; measure affective, behavioral, and cognitive engagement; and identify learners' science performance. The findings will serve as the basis for an instructional multimedia utilization enhancement plan suited to learners' needs and participating schools' instructional conditions.

Literature Review

Instructional multimedia refers to the use of combined visual, auditory, textual, animated, and interactive materials to support teaching and learning. In elementary science, multimedia can help learners understand processes that are difficult to observe directly, such as changes in matter, biological functions, weather systems, and forces. Virtual simulations, videos, animations, interactive presentations, and digital learning materials allow learners to connect verbal explanations with visual representations. Pang et al. (2024) found that virtual simulation technologies can enhance science learning by supporting visualization, experimentation, and active participation. Similarly, Reyes et al. (2024) explained that virtual laboratories provide experiential opportunities while addressing limitations in equipment, time, and physical laboratory access. A meta-analysis by Aligo and Prudente (2025) reported that digital learning materials positively influence achievement in science, although outcomes depend on subject area, duration, and instructional design. Garzón and Lampropoulos (2024) also found that mobile learning can improve K–12 science achievement when applications are connected with clear instructional goals. Research on augmented and virtual reality further indicates that immersive technologies can improve understanding, motivation, and interaction by allowing learners to explore scientific concepts in simulated environments (Zhang et al., 2024; Sandoval-Henríquez et al., 2025). Artificial intelligence and intelligent tutoring systems also offer personalized feedback and adaptive learning experiences in science education (Jia et al., 2024; Ateş, 2025). However, multimedia effectiveness is influenced by teachers' technological competence, the availability of devices and connectivity, the quality of digital content, and the extent to which technology is integrated with appropriate pedagogy. Amemasor et al. (2025) emphasized that professional development is necessary for teachers to use digital instructional tools effectively, while Zou et al. (2025) identified infrastructure, digital competence, equity, and instructional alignment as continuing challenges in technology-supported education.

Learner engagement is commonly understood through affective, behavioral, and cognitive dimensions. Affective engagement includes interest, enjoyment, belonging, and positive attitudes toward learning; behavioral engagement refers to attention, participation, effort, and completion of activities; and cognitive engagement involves strategic thinking, persistence, reflection, and willingness to understand complex concepts. Instructional multimedia may promote these dimensions by presenting science content in varied and interactive forms. Errabo and Ongoco (2024) found that interactive mobile learning modules supported engagement and understanding by allowing learners to interact directly with instructional content. Belessova et al. (2024) likewise reported that technology-supported activities in primary schools can increase participation and academic performance when learners actively create, explore, and solve problems. Akpen et al. (2024) concluded that digital learning environments can support engagement and performance, but their effectiveness depends on interaction, instructional support, and access to appropriate resources. Gamified instruction may also improve motivation and achievement through feedback, goals, rewards, and active participation, although excessive competition or poorly designed elements may distract learners from lesson objectives (Zeng et al., 2024). Soriano-Sánchez (2025) found that information and communication technologies can support primary learners' natural science achievement, motivation, and inclusion when materials address diverse learning needs. Interactive learning environments have also been associated with stronger science outcomes because they encourage inquiry, feedback, collaboration, and active knowledge construction (Koç & Kanadlı, 2025). Furthermore, Kassa et al. (2024) reported improved biology achievement when multimedia was combined with dynamic classroom instruction, demonstrating that technology is most effective when accompanied by purposeful teaching. Collectively, the literature suggests that multimedia utilization can improve science engagement and academic performance, but positive outcomes depend on how frequently, appropriately, and meaningfully teachers use multimedia during instruction.

Methodology

The study employed a descriptive-correlational research design to examine the relationships among instructional multimedia utilization, learner engagement, and academic performance in science. This design was appropriate because it described existing conditions and determined associations among variables without manipulating them. The respondents were Grade Three learners from Colegio Del Santo Niño, St.

Mary's Academy, Younghomes Learning Center, and Gentle Childcare Learning Center in Cebu City during School Year 2024–2025. Simple random sampling was used to select the respondents.

Data were collected through an adapted and modified survey questionnaire based on Heinich, Molenda, Russell, and Smaldino (2002). The instrument contained items on the learners' profile, available multimedia devices at home, teachers' utilization of instructional multimedia, and learner engagement. Multimedia utilization was assessed using a five-point Likert scale ranging from highly utilized to not utilized. Learner engagement was examined in terms of affective, behavioral, and cognitive engagement. The learners' First Quarter grades in science were used to determine academic performance. Before administration, the questionnaire underwent pilot testing to establish the internal consistency of its items. After securing permission from the principals of the participating schools, the researcher coordinated the schedule for orientation and questionnaire administration. Informed consent was obtained before participation. The learners received instructions and assistance from their subject teachers while answering the questionnaire. Completed questionnaires were retrieved, checked, and treated confidentially. Informal interviews were also conducted with selected respondents to validate their responses. Frequency counts and percentages were used to describe the respondents' profiles. Weighted means were utilized to determine the extent of instructional multimedia utilization and the levels of learner engagement. Academic performance was interpreted using the prescribed grading categories. Pearson product-moment correlation was applied to determine the direction, strength, and statistical significance of the relationships among instructional multimedia utilization, learner engagement, and science performance at the selected private educational institutions.

Results

Table 1. Multimedia Available at Home

Multimedia Available	Frequency	Rank
Laptop	67	3
Game Consoles	29	9
Smart TV/TV	82	1
Books/Comic Books	64	4
Smartphones/Cell Phones	81	2
Video Camera	31	8
Magazines	27	10
Radio	33	7
Digital Gadgets	38	6
Desktop Computer	44	5
Dictionary	13	11

The findings show that Smart TV or television was the most commonly available multimedia resource at home, followed closely by smartphones or cell phones and laptops. Books or comic books and desktop computers were also available to many learners. In contrast, dictionaries were the least available resource, followed by magazines and game consoles. The results indicate that most learners had access to visual and digital devices that could support multimedia-based learning. However, differences in resource availability suggest that instructional activities should remain accessible to learners with fewer devices at home.

Table 2. Extent to Which the Teachers Utilize Instructional Media During Instruction

Indicators	WM	SD	Verbal Description
My teacher explains our lesson through pictures.	4.42	0.81	Highly Utilized
My teacher uses charts in presenting a lesson.	3.28	1.42	Moderately Utilized
My teacher uses projector in showing something for the class.	2.55	1.73	Less Utilized
My teacher uses PowerPoint in presenting a lesson.	3.38	1.74	Moderately Utilized
My teacher uses real objects in presenting a new lesson.	3.59	1.41	Utilized
My teacher uses the board in emphasizing important points.	4.25	1.10	Highly Utilized
My teacher asks me to bring materials for my science class.	3.82	1.18	Utilized
My teacher gives me chance to watch movies related to the lesson.	3.04	1.48	Moderately Utilized
During experiments, my teacher shows real objects.	3.65	1.39	Utilized
My teacher makes use of television for some lessons.	2.93	1.58	Moderately Utilized
My teacher uses pictures and flashcards in presenting a lesson.	3.45	1.37	Utilized
My teacher uses internet through laptop in showing interesting topics in science.	4.10	1.24	Utilized
Aggregate Weighted Mean	3.53		Utilized
Aggregate Standard Deviation		1.37	

The findings indicate that teachers generally utilized instructional media during classroom instruction, as reflected by the aggregate weighted mean of 3.53. Pictures were the most frequently used medium, with a weighted mean of 4.42 and a standard deviation of 0.81, followed by the board with a weighted mean of 4.25 and a standard deviation of 1.10. Projectors were the least utilized, with a weighted mean of 2.55 and a

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standard deviation of 1.73. The aggregate standard deviation of 1.37 suggests noticeable variation in how often instructional media were used across teachers and classrooms.

Table 3. Level of the Learners' Engagement in School in Terms of Affective Engagement

Indicators	WM	SD	Verbal Description
I am very interested in learning.	4.18	1.07	Utilized
I think what we are learning in school is interesting.	4.05	1.14	Utilized
I like what I am learning in school.	4.07	1.16	Utilized
I enjoy learning new things in class.	4.27	1.13	Highly Utilized
I think learning is boring.	4.04	1.38	Utilized
I like my school.	4.46	1.01	Highly Utilized
I am proud to be at this school.	4.44	0.88	Highly Utilized
I look forward to going to school.	4.05	1.14	Utilized
I am happy to be at this school.	4.42	1.01	Highly Utilized
Aggregate Weighted Mean	4.22		Highly Utilized
Aggregate Standard Deviation		1.10	

The results indicate that the learners demonstrated a high level of affective engagement, as reflected by the aggregate weighted mean of 4.22. Liking the school received the highest rating, with a weighted mean of 4.46 and a standard deviation of 1.01, followed by being proud of the school, with a weighted mean of 4.44 and a standard deviation of 0.88. Enjoying new classroom learning also received a highly utilized rating. The aggregate standard deviation of 1.10 indicates some variation in learners' feelings, interests, and attitudes toward school and learning,

Table 3. Level of the Learners' Engagement in School in Terms of Behavioral Engagement

Indicators	WM	SD	VD
I try hard to do well in school.	4.30	1.17	Highly Utilized
In class, I work as hard as I can.	4.14	1.10	Utilized
When I'm in class, I participate in class activities.	4.17	1.07	Utilized
I pay attention in class.	4.01	1.16	Utilized
When I'm in class, I just act like I'm working.	3.18	1.63	Moderately Utilized
In school, I do just enough to get by.	3.00	1.42	Moderately Utilized
When I'm in class, my mind wanders.	2.86	1.55	Moderately Utilized
If I have trouble understanding a problem, I go over it again until I understand it.	4.31	0.97	Highly Utilized
When I run into a difficult homework problem, I keep working at it until I think I've solved it.	4.04	1.13	Utilized

I volunteer to help with school activities such as sports day and parent day.	3.93	1.21	Utilized
I take an active role in extracurricular activities in my school.	3.76	1.32	Utilized
Aggregate Weighted Mean	3.79		Utilized
Aggregate Standard Deviation		1.25	

The findings indicate that the learners demonstrated a utilized level of behavioral engagement, as reflected by the aggregate weighted mean of 3.79. Repeating a difficult problem until it was understood received the highest rating, with a weighted mean of 4.31 and a standard deviation of 0.97, followed by trying hard to perform well in school, with a weighted mean of 4.30 and a standard deviation of 1.17. Mind wandering received the lowest rating, with a weighted mean of 2.86 and a standard deviation of 1.55. The aggregate standard deviation of 1.25 indicates noticeable variation in learners' effort, participation, attention, persistence, and involvement in school activities.

Table 4. Level of the Learners' Engagement in School in Terms of Cognitive Engagement

Indicators	WM	SD	Verbal Description
When I study, I try to understand the material better by relating it to things I already know.	4.27	0.97	Highly Utilized
When I study, I figure out how the information might be useful in the real world.	4.10	1.05	Utilized
When learning new information, I try to put the ideas in my own words.	4.00	1.13	Utilized
When I study, I try to connect what I am learning with my own experiences.	4.05	1.13	Utilized
I make up my own examples to help me understand the important concepts I learn from school.	3.93	1.17	Utilized
When learning things for school, I try to see how they fit together with other things I already know.	3.89	1.16	Utilized
When learning things for school, I often try to associate them with what I learned in other classes about the same or similar things.	4.08	0.98	Utilized
I try to see the similarities and differences between things I am learning for school and things I already know.	4.05	1.05	Utilized
I try to understand how the things I learn in school fit together with each other.	4.05	1.15	Utilized
I try to match what I already know with things I am trying to learn for school.	4.08	1.07	Utilized

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Indicators	WM	SD	Verbal Description
I try to think through topics and decide what I am supposed to learn from them, rather than studying topics by just reading them over.	3.74	1.30	Utilized
When studying, I try to combine different pieces of information from course material in new ways.	3.90	1.24	Utilized
Aggregate Weighted Mean	4.01		Utilized
Aggregate Standard Deviation		1.12	

The data indicate that the learners demonstrated a utilized level of cognitive engagement, as reflected by the aggregate weighted mean of 4.01. Relating new material to prior knowledge received the highest rating, with a weighted mean of 4.27 and a standard deviation of 0.97. In contrast, thinking through topics to identify what should be learned received the lowest rating, with a weighted mean of 3.74 and a standard deviation of 1.30. The aggregate standard deviation of 1.12 indicates some variation in how consistently learners connected ideas, applied information, generated examples, and used deeper learning strategies.

Table 5. Level of Academic Performance of the Learners in Science

Level	Numerical Range	f	%
Outstanding	90–100	39	46.43
Very Satisfactory	85–89	23	27.38
Satisfactory	80–84	15	17.86
Fairly Satisfactory	75–79	7	8.33
Did Not Meet the Expectations	Below 75	0	0.00
Total		84	100.00
Mean		88.04	
Standard Deviation		5.55	

The findings indicate that the learners generally demonstrated strong academic performance in science, with an overall mean of 88.04, interpreted as very satisfactory. Most learners were classified as outstanding, representing 46.43 percent, followed by 27.38 percent who attained a very satisfactory rating. Meanwhile, 17.86 percent achieved a satisfactory rating, while 8.33 percent were fairly satisfactory. No learner failed to meet expectations. The standard deviation of 5.55 shows a moderate variation in the learners' science grades, suggesting that although performance was generally favorable, some differences in achievement were observed among the respondents.

Variables	r-value	Strength of Correlation	p-value	Decision	Remarks
Instructional Media Utilization and	0.249	Negligible	0.022	Reject	Significant

Variables	r-value	Strength of Correlation	p-value	Decision	Remarks
Academic Performance in Science		Positive		H_0	

Table 6. Test of Relationship Between Instructional Media Utilization and Academic Performance in Science

The findings indicate that instructional media utilization had a negligible positive relationship with the learners' academic performance in science, as shown by an r-value of 0.249. This means that greater use of instructional media was associated with a slight increase in science performance. The p-value of 0.022 was lower than the 0.05 level of significance; therefore, the null hypothesis was rejected. The relationship was statistically significant, suggesting that instructional media utilization contributed meaningfully to learners' science achievement. Visual materials, real objects, internet resources, and other multimedia tools may have helped clarify scientific concepts, sustain attention, and improve understanding. However, because the correlation was negligible, other factors such as teaching strategies, learner motivation, study habits, and classroom environment may also have influenced performance.

Table 7. Test of relationship between the learners' school engagement and their academic performance in science

Variables	r-value	Strength of Correlation	p - value	Decision	Remarks
Affective Engagement and Academic Performance In Science	0.315*	Weak Positive	0.004	Reject Ho	Significant
Behavioral Engagement and Academic Performance In Science	0.373*	Weak Positive	0.000	Reject Ho	Significant
Cognitive Engagement and Academic Performance in Science	0.183	Negligible Positive	0.095	Do not reject Ho	Not Significant

*Significant at p<0.05 (two-tailed)

The findings indicate that affective and behavioral engagement were significantly related to the learners' academic performance in science. Affective engagement showed a weak positive correlation, with an r-value of 0.315 and a p-value of 0.004. Behavioral engagement also showed a weak positive correlation, with an r-value of 0.373 and a p-value of less than 0.001. Since both p-values were lower than the 0.05 level of significance, the null hypotheses were rejected. This suggests that learners who showed greater interest, enjoyment, participation, attention, effort, and persistence tended to obtain higher science grades.

Cognitive engagement showed a negligible positive correlation with academic performance, with an r-value of 0.183 and a p-value of 0.095. Since the p-value exceeded the 0.05 level of significance, the null hypothesis was not rejected. This means that the learners' reported use of deeper learning strategies was not significantly associated with their science performance. The result may indicate that affective and behavioral participation had more immediate connections with achievement than cognitive strategies in this group. Other factors, including teaching methods, prior knowledge, assessment practices, and learning support, may also have influenced science performance.

Discussion

The findings show that learners had access to various multimedia resources at home, particularly televisions, smartphones, laptops, books, and desktop computers. These resources may support learning beyond the classroom, although fewer learners had access to dictionaries, magazines, video cameras, and game consoles. Teachers generally used instructional media during science lessons, relying mostly on pictures, boards, internet resources, real objects, and learner-provided materials. Projectors, television, movies, charts, and PowerPoint presentations were used less consistently. This suggests that teachers favored readily available visual and concrete materials, while more equipment-dependent technologies were limited by access, availability, or classroom conditions.

The learners demonstrated strong affective engagement, showing interest in learning, enjoyment of classroom activities, pride in their school, and happiness in attending. Their behavioral engagement was also favorable, particularly in effort, participation, persistence, and willingness to solve difficult tasks, although some reported mind wandering or doing only enough to complete requirements. Cognitive engagement was evident through connecting new lessons with prior knowledge, personal experiences, and real-life situations. The learners generally achieved favorable science performance, with most attaining outstanding or very satisfactory ratings. Instructional media utilization was significantly related to science achievement, while affective and behavioral engagement also showed significant positive relationships with performance. Cognitive engagement, however, was not significantly related to science grades, suggesting that emotional interest and active participation had more immediate influence on achievement than self-reported learning strategies.

Conclusion

The findings showed that Grade Three learners had access to various multimedia resources at home, while teachers generally utilized visual, concrete, and internet-based materials during science instruction. Learners demonstrated favorable affective, behavioral, and cognitive engagement and achieved strong academic performance in science. Instructional media utilization was significantly related to academic performance, indicating that appropriate multimedia use may support better understanding and achievement. Affective and behavioral engagement were also significantly associated with science performance, showing that interest, enjoyment, participation, attention, effort, and persistence contribute to learning outcomes. Cognitive engagement was not significantly related to performance. Therefore, schools should strengthen multimedia integration, provide suitable instructional resources, and develop classroom strategies that promote learners' emotional involvement, active participation, persistence, and guided higher-order thinking.

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