

Content Knowledge and Pedagogical Skills of Teachers: Its Influence on Pupils' Numeracy and Literacy Skills

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Abstract

This study examined the influence of teachers' content knowledge and pedagogical skills on pupils' numeracy and literacy skills in selected public elementary schools in Naga South District, Division of Naga City, for School Year 2024–2025. Specifically, it assessed the level of teachers' content knowledge particularly in terms of application within and across curriculum areas, research-based knowledge and principles, and Information and Communication Technology (ICT) integration. The study also determined the level of teachers' pedagogical skills focusing on strategies for promoting literacy and numeracy, strategies for developing higher-order thinking skills, and classroom communication strategies. Furthermore, the study determined the level of pupils' numeracy skills and literacy skills. It established whether there is a significant relationship between teachers' content knowledge and pupils' numeracy and literacy skills, and between teachers' pedagogical skills and pupils' numeracy and literacy skills. It also determined the extent to which teachers' content knowledge and pedagogical skills influence pupils' numeracy and literacy performance. Lastly, the study proposed a professional development program aimed at strengthening teachers' content knowledge and pedagogical skills to improve pupils' numeracy and literacy outcomes. There were 407 respondents selected through total enumeration for teacher-respondents, while random sampling technique for pupils. A descriptive-correlational research design was employed, using Mean, Weighted Mean, Pearson Product-Moment Correlation Coefficient, and Coefficient of Determination for data analysis. Major conclusions were: teachers demonstrated high to very high levels of content knowledge and pedagogical skills; pupils' numeracy skills were at an emerging or low proficient level, while their literacy skills were generally at grade level; teachers' content knowledge was significantly related to pupils' numeracy and literacy skills, while pedagogical skills showed mixed relationships; and teachers' content knowledge and pedagogical skills had a generally low to very low influence on pupils' numeracy and literacy skills.

Keywords: Content Knowledge, Pedagogical Skills, Numeracy Skills, Literacy Skills, Professional Development Program

Introduction

Effective teaching relies on content knowledge and pedagogical skill, which together form Pedagogical Content Knowledge (Shulman, 1986) the ability to transform concepts into meaningful learning. Globally, assessments (OECD, 2022; SEA-PLM, 2024) and rising learning poverty (World Bank, 2022) show many

learners lack proficiency, challenging SDG 4.6 targets. In the Philippines, policies including RA 10533 and DepEd orders emphasize quality instruction and foundational skills, yet gaps persist due to limited integration and application of knowledge. Locally, initiatives like Project 6Bs aim to improve outcomes, but disparities remain. Addressing the lack of research linking teacher competence and learner performance, this study examines how content knowledge and pedagogy influence literacy and numeracy, aiming to guide practice, supervision, and policy for better learning outcomes.

Research Objectives

This study determined the influence of teachers' content knowledge and pedagogical skills on pupils' numeracy and literacy skills in Naga City. Specifically, this attained the following objectives: To determine the level of teachers' content knowledge along with application within and across curriculum areas, research-based knowledge and principles, and Information and Communication Technology (ICT) integration. To determine the level of teachers' pedagogical skills along strategies for promoting literacy and numeracy, strategies for developing higher-order thinking skills, and classroom communication strategies. To determine the level of pupils' numeracy skills in terms of Rapid Mathematics Assessment. To determine the level of pupils' literacy skills in terms of word recognition and sentences reading, and reading fluency and comprehension. To assess the significant relationship between teachers' content knowledge and numeracy and literacy skills of pupils. To assess the significant relationship between teachers' pedagogical skills and numeracy and literacy skills of pupils. To assess the extent of influence of teachers' content knowledge on pupils' numeracy and literacy skills. To assess the extent of influence of teachers' pedagogical skills on pupils' numeracy and literacy skills. To develop a professional development program aimed at strengthening teachers' content knowledge and pedagogical skills to improve pupils' numeracy and literacy skills.

Methodology

The study used a descriptive–correlational design to describe current conditions and examine variable relationships without manipulation (Nugal et al., 2023; Saro et al., 2023). It assessed teachers' content knowledge and pedagogical skills, determined pupils' proficiency via RMA and CRLA results (Alimorong & Cabigon, 2020; Banal & Molina, 2022; Cabardo, 2016), and measured relationships and influence between variables (Baumert et al., 2010; Darling-Hammond, 2017; Field, 2018). Respondents included 37 teachers selected through total enumeration (Alos & Caranto, 2016; Balanquit, 2019; Ganal & Guiab, 2014) and 370 pupils chosen randomly (Buan, 2019; Cabardo, 2016; Corpuz & Salandanan, 2021; Francisco & Celon, 2020). Data were gathered using a standardized survey questionnaire (Buan, 2019; Cabardo, 2016; Corpuz & Salandanan, 2021; Francisco & Celon, 2020) and documentary analysis of official assessment records (Dela Cruz & Lapinid, 2018; Francisco & Celon, 2020; Salvan & Hambre, 2021). Ethical standards, including consent, confidentiality, and compliance with the Data Privacy Act of 2012, were strictly observed (Data Privacy Act of 2012). Descriptive statistics described levels and variability (Alos & Caranto, 2016; Buan, 2019; Cabardo, 2016; Francisco & Celon, 2020), while inferential tools tested relationships and influence (Buan, 2019; Cabardo, 2016; Corpuz & Salandanan, 2021; Francisco & Celon, 2020). Findings guided program development using a Modified ADDIE Model (Alsharif & Shukri, 2018; Branch, 2009; Molenda, 2015).

Results And Discussion

Level of Teachers’ Content Knowledge. As shown in Table 2d, Application Within and Across Curriculum Areas ranked highest (AWM = 3.49, Very Highly Skilled), followed by Research-Based Knowledge and Principles (AWM = 3.14, Highly Skilled), and ICT Integration (AWM = 3.12, Highly Skilled). Teachers showed strong proficiency in interdisciplinary instruction and research-based practice, while ICT integration, though competent, presents opportunities for further innovation. Overall, results indicate balanced, well-rounded competencies and comprehensive instructional readiness. These findings align with studies confirming high pedagogical content knowledge and self-efficacy (Anyeta & Suglo, 2024), and its critical role in effective teaching (Galimova et al., 2023). Competence is strengthened through structured planning and

Table 2d
Summary of the Level of Teachers’ Content Knowledge

Aspects	AWM	Int.	Rank
Application Within and Across Curriculum Areas	3.49	VHS	1
Research-Based Knowledge and Principles	3.14	HS	2
ICT Integration	3.12	HS	3
Overall Level	3.25	Highly Skilled	

Note. Mean scores were interpreted using the following scale: 1.00–1.75 = Fairly Skilled (FS); 1.76–2.50 = Moderately Skilled (MS); 2.51–3.25 = Highly Skilled (HS); 3.26–4.00 = Very Highly Skilled (VHS)

implementation (Aliustaoğlu & Tuna, 2022; König et al., 2020), though contextual factors also influence student outcomes (Anyeta & Suglo, 2024). Grounded in Self-Determination Theory, high content knowledge reflects professional competence and autonomy, while integration strategies foster relatedness factors that enhance motivation, instructional quality, and learner achievement.

Level of Teachers’ Pedagogical Skills. As shown in Table 3d, the overall average weighted mean was 3.35, interpreted as Very Highly Skilled. Among the dimensions, Strategies for Promoting Literacy and Numeracy ranked highest (AWM = 3.62, Very Highly Skilled), followed by Classroom Communication Strategies (AWM = 3.24, Highly Skilled), and Strategies for Higher-Order Thinking Skills, which ranked lowest yet still rated Highly Skilled (AWM = 3.20).

Table 3d
Summary of the Level of Teachers’ Pedagogical Skills

Aspects	AWM	Int.	Rank
Strategies for promoting literacy and numeracy	3.62	VHS	1
Strategies on higher order thinking skills	3.20	HS	3
Classroom communication strategies	3.24	HS	2
Overall Level	3.35	Very Highly Skilled	

Note. Mean scores were interpreted using the following scale: 1.00–1.75 = Fairly Skilled (FS); 1.76–2.50 = Moderately Skilled (MS); 2.51–3.25 = Highly Skilled (HS); 3.26–4.00 = Very Highly Skilled (VHS).

Teachers demonstrated strong proficiency in foundational skills and communication, with relatively lower but still skilled ratings in higher-order thinking strategies, indicating balanced competence. Targeted professional development in advanced instruction could further enhance quality. Findings align with research linking effective pedagogy to achievement, supported by Pedagogical Content Knowledge, Theory of Involvement, and Self-Determination Theory, confirming that integrated, competent practice fosters engagement, motivation, and learning success (Ha et al., 2021; Muijs et al., 2020).

Level of Pupils’ Numeracy Skills. Table 4 presents pupils’ numeracy proficiency based on the Rapid Mathematics Assessment (RMA), which evaluates foundational competencies including number sense, operations, geometry, measurement, and patterns. Results yielded a mean score of 10.43, corresponding to a performance level of 43.47 percent, categorized as *Emerging (Low Proficient)*. The standard deviation was 5.78, indicating notable variability in performance among learners. Collectively, the data reveals that Key Stage 1 pupils across the participating schools demonstrated less than half of the expected competencies for their grade level.

Table 4
Level of Pupils’ Numeracy Skills

Aspect	SD	Mean	Int.
Rapid Mathematics Assessment (RMA)	5.78	43.47	Emerging (Low Proficient)

Note. The following scale defines numeracy proficiency based on percentage ranges: < 25% *Emerging (Not Proficient)*; 25%-49% *Emerging (Low Proficient)*; 50%-74% *Developing (Nearly Proficient)*; 75%-84% *Transitioning (Proficient)*; 85%-100% *Transforming (Highly Proficient)*. SD stands for Standard Deviation, and *Int.* refers to Interpretation.

Learners demonstrated limited mastery of foundational mathematics, with inconsistent performance indicating substantial learning gaps below grade level. Results highlight the need for targeted remediation, differentiated instruction, and guided practice to support development and address disparities. Aligned with prior research (Bautista & Dones, 2025; Sa’dijah et al., 2023; Fauzi & Chano, 2025), findings confirm through Shulman’s (1986) Pedagogical Content Knowledge framework that effective integration of content and pedagogy is key to improving numeracy outcomes.

Level of Pupils’ Literacy. Based on the Comprehensive Rapid Literacy Assessment (CRLA), pupils obtained a mean of 17.19 (SD=2.00) in *Word Recognition and Sentence Reading*, interpreted as *At Grade Level*. Conversely, *Reading Fluency and Comprehension* registered a lower mean of 3.41 (SD=1.54), classified as *Developing*. The overall average of 10.30 is interpreted as *At Grade Level*, showing proficiency in basic skills but limited proficiency in higher-order literacy domains. Results reveal a marked gap between foundational and advanced reading abilities. Learners demonstrate strong decoding and word recognition skills, yet struggle significantly with fluency and meaning-making. Variability in scores indicates inconsistent

Table 5
Level of Pupils’ Literacy Skills

Aspects	SD	Mean	Int.
Word Recognition and Sentences Reading	2.00	17.19	At Grade Level

Reading Fluency and Comprehension	1.54	3.41	Developing
Overall Average Score		10.30	At Grade Level

Note. Reading profiles classify students’ reading proficiency using two assessments. Scores from Assessment I and II determine placement into four levels: Emergent (A1: 0–7; A2: 0–1), Developing (A1: 8–13; A2: 2–3), Transitioning (A1: 14–16; A2: 4–5), and At Grade Level (A1: 17–20; A2: 6–7).

development, showing that while basic mechanics are mastered, deeper text processing remains challenging. Foundational instruction is effective; however, strategies targeting fluency and comprehension require strengthening. Pupils remain in transition toward functional literacy, necessitating guided practice, scaffolding, and targeted interventions to bridge the gap between word recognition and meaningful understanding. The findings align with studies noting strong decoding but weaker comprehension skills (Casido, 2024; Santolaja, 2023; Özenç & Çarkıt, 2021). Supported by Vygotsky’s Constructivist Theory, results highlight the need for scaffolding within the Zone of Proximal Development. They also reflect Self-Determination Theory, where demonstrated competence and supportive instruction foster motivation and reading growth (Deci & Ryan, 1985).

Significant Relationship Between the Teachers’ Content Knowledge and Levels of Numeracy and Literacy Skills of Pupils. As shown in Table 6, *Application Within and Across Curriculum Areas* correlated significantly with RMA ($r = -0.504, p = 0.001$), Word Recognition ($r = -0.356, p = 0.031$), and Fluency-Comprehension ($r = -0.528, p = 0.001$). *Research-Based Knowledge* and *ICT Integration* showed significant links with RMA and Fluency-Comprehension, but none with Word Recognition ($p > 0.05$). Significant associations were consistent in numeracy and higher-order literacy skills, while basic reading mechanics were unaffected by these dimensions. Content knowledge is relevant to performance, particularly in complex competencies, though negative and moderate correlations indicate influence is not direct or absolute. Foundational reading appears shaped by other factors, suggesting content mastery alone is insufficient to fully explain learner outcomes.

Table 6

Significant Relationship Between the Teachers’ Content Knowledge and Levels of Numeracy and Literacy Skills of Pupils

Indicators	Skills	r-value	p-value	Int.
Application within and across curriculum areas	Rapid Mathematics Assessment	-.504	.001	S
	Word Recognition and Sentences Reading	-.356	.031	S
	Reading Fluency and Comprehension	-.528	.001	S
Research-based knowledge and principles	Rapid Mathematics Assessment	-.468	.004	S
	Word Recognition and Sentences Reading	-.252	.133	NS

	Reading Fluency and Comprehension	-.429	.008	S
ICT Integration	Rapid Mathematics Assessment	-.387	.018	S
	Word Recognition and Sentences Reading	-.303	.069	NS
	Reading Fluency and Comprehension	-.436	.007	S

Note. Correlation measures the strength and direction of a relationship between two variables, with coefficients (r) ranging from -1.00 to +1.00. Strength categories are: ± 0.19 = Negligible Correlation (NC); $\pm 0.20\text{--}\pm 0.39$ = Low Correlation (LC); $\pm 0.40\text{--}\pm 0.69$ = Moderate Correlation (MC); $\pm 0.70\text{--}\pm 0.89$ = High Correlation (HC); $\pm 0.90\text{--}\pm 0.99$ = Very High Correlation (VHC); ± 1.00 = Perfect Correlation. S stands for Significant $\leq .05$ significant level and NS stand for Not Significant $> .05$ significant level.

Teacher expertise supports higher-level skill development, yet impact depends on effective instructional translation. Strengthening content knowledge must be paired with improved delivery strategies to bridge gaps, emphasizing pedagogy alongside mastery in professional development. Furthermore, the findings were aligned with studies affirming content knowledge’s influence on achievement (Kwateng, 2018; Peters-George, 2021), while supporting that effects are mediated by practice and context (Ampatua & Basmayor, 2025; Kaiser et al., 2022; Scherer et al., 2021). They corroborate that quality instruction is equally vital (Darling-Hammond et al., 2020), validating Shulman’s (1986) Pedagogical Content Knowledge framework.

Significant Relationship Between the Level Teacher’s Pedagogical Skills and Levels of Numeracy and Literacy Skills of Pupils. As shown in Table 7, Strategies for Promoting Literacy and Numeracy yielded significant moderate negative correlations with RMA ($r = -0.492, p = 0.002$), Word Recognition ($r = -0.345, p = 0.036$), and Fluency-Comprehension ($r = -0.481, p = 0.003$). Higher-Order Thinking Strategies showed significance only in Fluency-Comprehension ($r = -0.328, p = 0.048$), while Classroom Communication Strategies showed no significant links across all measures ($p > 0.05$).

Table 7

Significant Relationship Between the Level Teacher’s Pedagogical Skills and Levels of Numeracy and Literacy Skills of Pupils

Pedagogical Skills	Skills	r-value	p-value	Int.
Strategies for Promoting Literacy and Numeracy	Rapid Mathematics Assessment	-.492	.002	S
	Word Recognition and Sentences Reading	-.345	.036	S
	Reading Fluency and Comprehension	-.481	.003	S
Strategies on Higher Order Thinking Skills	Rapid Mathematics Assessment	-.104	.542	NS
	Word Recognition and Sentences Reading	-.240	.153	NS
	Reading Fluency and Comprehension	-.328	.048	S
	Rapid Mathematics Assessment	-.159	.346	NS
	Word Recognition and Sentences Reading	-.210	.213	NS

Classroom Communication Strategies	Reading Fluency and Comprehension	-.298	.073	NS
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Note. Correlation measures the strength and direction of a relationship between two variables, with coefficients (r) ranging from -1.00 to +1.00. Strength categories are: $\lt; \pm 0.19 = \text{Negligible Correlation (NC)}$; $\pm 0.20\text{--}\pm 0.39 = \text{Low Correlation (LC)}$; $\pm 0.40\text{--}\pm 0.69 = \text{Moderate Correlation (MC)}$; $\pm 0.70\text{--}\pm 0.89 = \text{High Correlation (HC)}$; $\pm 0.90\text{--}\pm 0.99 = \text{Very High Correlation (VHC)}$; $\pm 1.00 = \text{Perfect Correlation}$. S stands for Significant at $\leq .05$ significant level and NS stand for Not Significant at $> .05$ significant level.

Influence varies by approach: direct literacy and numeracy strategies impact outcomes consistently, while higher-order thinking has selective effect and communication strategies show none. Competence alone is insufficient; effectiveness depends on proper execution. Foundational strategies remain critical; other practices need refinement. Professional development should emphasize contextualized application to maximize impact. Results align with research confirming strong instruction enhances foundational skills (Gore et al., 2021; Strong et al., 2020), while mixed effects highlight mediation by implementation and context (Scherer & Teo, 2021; Voogt et al., 2021; Major et al., 2021). Supported by Self-Determination Theory, findings show how different pedagogies foster competence, autonomy, and relatedness to support learning.

Extent of Influence of Teachers’ Content Knowledge on the Levels of Numeracy and Literacy Skills of Pupils. As shown in Table 8, Application Within and Across Curriculum Areas had the highest influence: 25% on numeracy ($r^2=0.25$) and 28% on comprehension ($r^2=0.28$), both low influence. Research-Based Knowledge and ICT Integration showed lower to very low influence (15–22%). Influence on word recognition was consistently minimal (6–13%). Overall, predictive strength was limited, slightly higher in numeracy and comprehension but generally weak.

Table 8
Extent of Influence of Teachers’ Content Knowledge on the Levels of Numeracy and Literacy Skills of Pupils

Skills		r ² -value	Int.
Application within and across curriculum areas	Rapid Mathematics Assessment	0.25	LI
	Word Recognition and Sentences Reading	0.13	VLI
	Reading Fluency and Comprehension	0.28	LI
Research-based knowledge and principles	Rapid Mathematics Assessment	0.22	LI
	Reading Fluency and Comprehension	0.18	VLI
ICT Integration	Rapid Mathematics Assessment	0.15	VLI
	Reading Fluency and Comprehension	0.19	VLI

Note. The categorization of influence follows a standardized legend: a score of 0.00 indicates no influence (NI); 0.00 to 0.19 represents very low influence (VLI); 0.20 to 0.39 indicates low influence (LI); 0.40 to 0.69 is considered moderate influence (MI); 0.70 to 0.89 corresponds to high influence (HI); and 0.90 to 1.00 denotes very high influence (VHI).

Content knowledge contributes but is not decisive; impact depends on application, not mastery alone. Basic literacy is shaped by other factors, and subject knowledge requires effective instruction and environment to work. Improving outcomes means integrating content and pedagogy, with professional development focusing on curriculum integration and research-based practice. Aligned with research (Suglo et al., 2023; Tuya et al., 2025; Aderinoye-Rabiu et al., 2025; Moshi, 2024) and the Theory of Involvement, findings confirm Pedagogical Content Knowledge and meaningful instruction are key to engagement and learning.

Extent of Influence of Teachers’ Pedagogical Skills on the Levels of Numeracy and Literacy Skills of Pupils. As shown in Table 9, Strategies for Promoting Literacy and Numeracy exerted low influence on RMA ($r^2=0.24$) and Fluency-Comprehension ($r^2=0.23$), and very low influence on Word Recognition ($r^2=0.12$). Higher-Order Thinking Strategies showed very low influence on Fluency-Comprehension ($r^2=0.11$). Overall, influence ranged from low to very low, with slightly greater effects on foundational skills.

Table 9

Extent of Influence of Teachers’ Pedagogical Skills on the Levels of Numeracy and Literacy Skills of Pupils

Pedagogical Skills	Skills	r ² -value	Int.
Strategies for Promoting Literacy and Numeracy	Rapid Mathematics Assessment	0.24	LI
	Word Recognition and Sentences Reading	0.12	VLI
	Reading Fluency and Comprehension	0.23	LI
Strategies on Higher Order Thinking Skills	Reading Fluency and Comprehension	0.11	VLI

Note. The categorization of influence follows a standardized legend: a score of 0.00 indicates no influence (NI); 0.00 to 0.19 represents very low influence (VLI); 0.20 to 0.39 indicates low influence (LI); 0.40 to 0.69 is considered moderate influence (MI); 0.70 to 0.89 corresponds to high influence (HI); and 0.90 to 1.00 denotes very high influence (VHI).

Pedagogical practices contribute but explain limited performance variance; direct strategies have greater impact, yet skills alone are insufficient, with higher-order approaches yielding minimal gains. Improving outcomes requires integrating pedagogy, content mastery, and supportive environments, with development focused on learner alignment and contextualization. Aligned with research (Olandoi & Mwangi, 2021; Arthur & Imoro, 2025; Ampatua & Basmayor, 2025; Moshi, 2024) and Astin’s (1984) Theory of Involvement, findings confirm meaningful, structured instruction fosters engagement and achievement.

Professional Development Program to Enhance the Level of Teachers' Content Knowledge and Pedagogical Skills and to Improve the Numeracy and Literacy

Skills of the Pupils. Developed using the modified ADDIE model, this program strengthens teachers' content knowledge and pedagogy to address pupils' gaps in numeracy (*Emerging*) and literacy (*Developing*). Based on identified needs and aligned with standards, it features workshops, mentoring, and collaborative activities. Grounded in research (Kais et al., 2022; Exconde & Escabel, 2021; Quilapio et al., 2022; FITED, 2020) and learning theories, it aims to enhance instruction, engagement, and achievement.

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