



Perceived Nutritional Problems and Dimensions of Pupil Development: Evidence from Elementary Schools in Zone 2, Division of Catanduanes

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Abstract

Nutritional problems among elementary school pupils remain a significant public health and educational concern, as inadequate nutrition may adversely affect learners' cognitive, academic, and psychosocial development. This study examined the relationship between perceived manifestations of nutritional problems and pupils' cognitive function, academic performance, extracurricular engagement, and life skills competence among elementary pupils in Zone 2, Division of Catanduanes, Philippines. A quantitative descriptive-correlational research design was employed involving 114 elementary school teachers selected through stratified random sampling. Data were collected using a researcher-developed, expert-validated questionnaire to assess teachers' perceptions of pupils' nutritional conditions and developmental outcomes. The findings indicated that nutritional problems, particularly wasting and underweight, were commonly observed among pupils. Correlational analysis further revealed significant relationships between perceived nutritional problems and all examined domains of pupil development. Poorer nutritional conditions were generally associated with lower academic performance, reduced participation in extracurricular activities, diminished life skills competence, and variations in cognitive function, suggesting that nutritional status plays an important role in learners' overall development. The findings underscore the importance of strengthening school- and community-based nutrition programs to promote holistic child development and improve educational outcomes. The study recommends integrated interventions involving schools, families, health professionals, and local government agencies to address nutritional challenges and support pupils' academic success and well-being.

Keywords: nutritional status, cognitive function, academic performance, extracurricular engagement, life skills competence, elementary pupils, descriptive-correlational study, Philippines, school-based nutrition intervention



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INTRODUCTION

Nutrition is increasingly recognized as a critical determinant of children's educational success, cognitive development, and overall well-being. Beyond its role in supporting physical growth, adequate nutrition contributes significantly to learners' ability to acquire knowledge, develop essential competencies, and achieve their developmental potential. Recent scholarship has emphasized that nutrition serves as a foundational component of human capital development, influencing educational

attainment, future productivity, and socioeconomic outcomes across the life course (Black et al., 2017; Daelmans et al., 2017; Prado & Dewey, 2018). Global development initiatives similarly identify investments in child nutrition as indispensable for strengthening educational systems, improving workforce preparedness, and promoting sustainable national development (World Bank, 2020). Despite these recognized benefits, nutritional deficiencies continue to affect millions of school-aged children worldwide, posing significant challenges to educational equity and learner

achievement (Victora et al., 2021). In the Philippine context, undernutrition remains a persistent concern, with the Department of Science and Technology–Food and Nutrition Research Institute (DOST-FNRI, 2023) reporting continuing prevalence of stunting, wasting, and underweight among Filipino children. Likewise, the Department of Education has strengthened the implementation of the School-Based Feeding Program (SBFP) to improve learners' nutritional status and support better educational outcomes (Department of Education [DepEd], 2023).

Malnutrition remains a persistent concern in many developing countries and continues to manifest in various forms, including stunting, wasting, underweight conditions, and micronutrient deficiencies. These nutritional problems have been consistently linked to adverse developmental outcomes among children. Empirical evidence suggests that undernourished learners often experience deficits in attention, memory, concentration, and executive functioning, which subsequently affect their academic performance and classroom participation (Nyaradi et al., 2016; Georgieff, 2018; Prado & Dewey, 2018).

Likewise, micronutrient deficiencies have been associated with slower cognitive processing, reduced learning efficiency, and poorer educational outcomes among school-age children (Wieringa et al., 2019). Beyond cognitive and academic consequences, nutritional deprivation has also been shown to affect children's psychosocial development, physical activity levels, school attendance, and participation in extracurricular activities, limiting opportunities for holistic growth and development (Aurino et al., 2019; Bundy et al., 2018; UNESCO, 2022). The issue is particularly relevant in Catanduanes, where provincial nutrition reports have identified persistently high levels of stunting, underweight, and wasting among children, highlighting the need for sustained nutrition interventions and strengthened school–community partnerships (National Nutrition Council [NNC], 2024).

Contemporary developmental perspectives further emphasize that learner outcomes are shaped through the interaction of biological, educational, familial, and environmental factors. Educational success cannot be attributed solely to classroom instruction but must also consider the health and nutritional conditions that influence learners' readiness and capacity to engage in educational experiences (Tudge et al., 2016; Darling-Hammond et al., 2020). Recent studies highlight the importance of coordinated support from schools, families, and communities in fostering healthy developmental trajectories among children (Suwannawong et al., 2023). Consequently, understanding the relationship between nutritional conditions and multiple dimensions of learner development has become increasingly important for educators, policymakers, and health practitioners seeking to improve educational outcomes and child well-being. Within the Division of Catanduanes, the continuing implementation of the School-Based Feeding Program and related learner health initiatives reflect the Department of Education's recognition that nutrition is an essential component of learner welfare and academic success (DepEd Catanduanes, 2023).

Although substantial international literature has documented the relationship between nutrition and educational outcomes, significant gaps remain. First, previous studies have primarily concentrated on objective measures of nutritional status and traditional indicators of academic achievement. Comparatively less attention has been devoted to examining teachers' perceptions of nutritional manifestations and how these perceived conditions relate to broader developmental outcomes such as extracurricular engagement and life skills competence (Aurino et al., 2019; Wieringa et al., 2019). Teachers occupy a unique position within the educational environment, enabling them to observe learners' behaviors, performance, and developmental characteristics over extended periods. Their perceptions therefore provide valuable insights into the practical implications of nutritional problems within school settings.

Second, much of the existing literature has investigated cognitive outcomes and academic achievement separately, resulting in a fragmented understanding of the broader developmental consequences of nutritional problems. Relatively few studies have simultaneously examined cognitive function, academic performance, extracurricular engagement, and life skills competence within a single analytical framework (Black et al., 2017; Victora et al., 2021). Given the increasing emphasis on holistic education and twenty-first-century competencies, there is a need for research that captures both academic and non-academic dimensions of learner development.

Third, a notable contextual gap exists within the Philippine educational literature, particularly in geographically isolated and rural areas such as Catanduanes. While recent local studies have explored educational effectiveness, instructional practices, leadership competence, intervention implementation, and stakeholder engagement in schools (Cordial et al., 2025a; Cordial et al., 2025b; Cordial et al., 2026), limited empirical attention has been given to the developmental implications of nutritional problems among elementary learners. Furthermore, evidence remains scarce regarding how teachers perceive manifestations of nutritional deficiencies and how these perceptions relate to learners' cognitive, academic, social, and life skills outcomes in local educational contexts.

In response to these empirical, methodological, and contextual gaps, the present study examined the relationship between teachers' perceived manifestations of nutritional problems and pupils' developmental outcomes in Zone 2, Division of Catanduanes. Specifically, the study investigated perceived indicators of stunting, wasting, underweight conditions, and micronutrient deficiencies and their association with cognitive function, academic performance, extracurricular engagement, and life skills competence. By situating the inquiry within the Philippine basic education setting and a locality that continues to face documented nutrition concerns, the study provides more contextually

grounded evidence for understanding how nutritional problems shape learner development. Its findings are intended to inform school-based and community-linked interventions that can better support pupils' nutrition, learning, and overall well-being. By providing localized evidence from a rural Philippine setting, the study contributes to the growing discourse on nutrition and education, advances understanding of the multidimensional consequences of nutritional problems, and offers an empirical basis for developing targeted interventions that support both learner development and educational success.

Statement of the Problem. This study examined the relationship between perceived manifestations of nutritional problems, as assessed by elementary school teachers, and pupils' cognitive function, academic performance, extracurricular engagement, and life skills competence in Zone 2, Division of Catanduanes. It specifically sought to identify the perceived indicators of nutritional problems among elementary pupils and determine how these perceived conditions relate to various dimensions of learner development. The findings were intended to serve as a basis for proposing an intervention plan to improve pupils' nutritional awareness and educational outcomes.

Specifically, this study sought answers to the following questions:

1. What are the perceived indicators of nutritional problems among elementary pupils, according to teachers, in Zone 2, Division of Catanduanes in terms of:
 - 1.1 stunting-related manifestations;
 - 1.2 wasting-related manifestations;
 - 1.3 underweight-related manifestations; and
 - 1.4 micronutrient deficiency-related manifestations?
2. What is the level of pupils' development, as perceived by teachers, in Zone 2, Division of Catanduanes in terms of:
 - 2.1 cognitive function;

- 2.2 academic performance;
- 2.3 extracurricular engagement; and
- 2.4 life skills competence?

3. Is there a significant relationship between teachers' perceived manifestations of nutritional problems and pupils' cognitive function?
4. Is there a significant relationship between teachers' perceived manifestations of nutritional problems and pupils' academic performance?
5. Is there a significant relationship between teachers' perceived manifestations of nutritional problems and pupils' extracurricular engagement?
6. Is there a significant relationship between teachers' perceived manifestations of nutritional problems and life skills competence?
7. What intervention plan may be proposed based on the findings to address the perceived nutritional concerns and enhance pupils' overall development?

Null Hypotheses. The following null hypotheses were tested at the 0.05 level of significance:

Ho₁. There is no significant relationship between teachers' perceived manifestations of nutritional problems and pupils' cognitive function.

Ho₂. There is no significant relationship between teachers' perceived manifestations of nutritional problems and pupils' academic performance

Ho₃. There is no significant relationship between teachers' perceived manifestations of nutritional problems and pupils' extracurricular engagement.

Ho₄. There is no significant relationship between teachers' perceived manifestations of

nutritional problems and pupils' life skills competence.

Scope of the Study. This study was conducted in Zone 2, Division of Catanduanes, Philippines, during the School Year 2025–2026. It examined the perceived manifestations of nutritional problems among elementary pupils, as assessed by teachers, in terms of stunting, wasting, underweight, and micronutrient deficiency-related manifestations, and assessed pupils' development in terms of cognitive function, academic performance, extracurricular engagement, and life skills competence. Using a descriptive-correlational design, the study determined the relationships between perceived nutritional problems and the various dimensions of pupil development. The investigation was limited to teachers' perceptions and did not involve clinical nutritional assessments or medical diagnoses. The findings served as the basis for proposing an intervention plan to address nutritional concerns and enhance pupils' overall development and educational outcomes.

Theoretical and Conceptual Framework. The theoretical and conceptual framework of this study is primarily anchored on Human Capital Theory, which posits that investments in nutrition, health, and education constitute critical forms of capital that enhance individuals' cognitive capacity, productivity, and long-term socioeconomic outcomes (Becker, 1964). Contemporary human capital discourse further reinforces the centrality of child health and nutrition in productivity formation, as evidenced by the World Bank's Human Capital Project, which frames human capital development as a multi-sectoral investment agenda. Its 2020 update further demonstrates how deficits in health and education significantly constrain future productivity and economic potential (World Bank, 2018, 2020). Empirical literature also provides robust evidence that early-life nutritional deficiencies, particularly childhood stunting, are associated with substantial long-term income losses and diminished educational attainment, thereby

weakening the overall accumulation of human capital (Galasso & Wagstaff, 2019).

Complementing this, the study is also grounded in Bronfenbrenner's Ecological Systems Theory, which conceptualizes child development as a dynamic outcome of interactions between individuals and their multiple environmental systems, ranging from immediate settings such as the family and school microsystems to broader societal and policy environments (Bronfenbrenner, 1979). Recent scholarly applications further validate its relevance in understanding child development and school-based health outcomes. Tudge et al. (2016) clarified the bioecological framework as a lens for contextualizing developmental processes, while Ettekal and Mahoney (2017) demonstrated its applicability in educational and out-of-school learning contexts. In addition, Suwannawong et al. (2023) applied the theory in designing a school-family participatory nutrition intervention that improved both nutritional conditions and food environments, highlighting its practical value in intervention development. Within this study, the ecological perspective underscores the role of teachers as key microsystem actors capable of identifying nutritional manifestations and informing coordinated school-, home-, and community-based responses.

As illustrated in Figure 1, the conceptual model integrates these theoretical perspectives by depicting the relationship between teachers' perceived manifestations of nutritional problems and pupils' developmental outcomes. The independent variable includes stunting-, wasting-, underweight-, and micronutrient deficiency-related indicators, while the dependent variables encompass cognitive function, academic performance, extracurricular engagement, and life skills competence. The model posits that nutritional deficiencies may adversely influence multiple domains of learner development, with teachers positioned as primary observers within the school environment. Collectively, these relationships provide the empirical basis for the formulation of a proposed intervention plan

aimed at addressing nutritional concerns and enhancing pupils' holistic developmental outcomes through coordinated educational and community-based strategies.

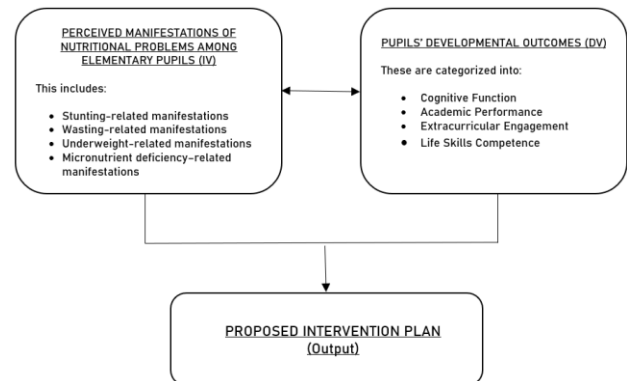


Figure 1
Conceptual Model of the Study

LITERATURE REVIEW

The relationship between nutrition and educational outcomes has attracted considerable scholarly attention because it shapes learner development, educational equity, and human capital formation. Contemporary research shows that children's cognitive, academic, social, and behavioral outcomes are influenced by nutritional, educational, environmental, and institutional factors. This review critically synthesizes literature on nutritional status and learner development to identify what is missing in studies on pupils' cognitive function, academic performance, extracurricular engagement, and life skills competence.

Nutrition, Learning Outcomes, and Learner Development. Recent scholarship recognizes nutritional status as a key determinant of children's cognitive development, educational achievement, psychosocial well-being, and lifelong human capital formation. Nutrition is not only a health concern but also an investment in learning, brain development, school readiness, and academic success (Black et al., 2017; Daelmans et al., 2017; Prado & Dewey, 2018; Victora et al., 2021). Educational outcomes, however, are also shaped by biological, environmental, instructional, and

community-level conditions (Darling-Hammond et al., 2020; UNESCO, 2022; World Health Organization [WHO], 2023). In low- and middle-income countries, malnutrition remains a major barrier to equitable learning outcomes (Victora et al., 2021; UNICEF, 2021). Yet many studies remain broad and do not examine teachers' perceptions of nutritional problems in actual school settings.

Nutrition, Cognitive Development, and Academic Performance. A growing body of evidence shows that malnutrition affects cognitive functioning, academic achievement, and school participation. Stunting, wasting, underweight, and micronutrient deficiencies are associated with weaknesses in memory, attention, language acquisition, executive functioning, and information processing (Black et al., 2017; Prado et al., 2017; Georgieff, 2018; Prado & Dewey, 2018). Children with chronic undernutrition are also more likely to have lower educational attainment and reduced school performance later in life (Victora et al., 2021).

The Lancet Early Childhood Development Series emphasized that inadequate nutrition during critical developmental periods can limit children's full potential, especially in resource-constrained settings (Black et al., 2017; Daelmans et al., 2017). UNESCO (2022) and UNICEF (2021) likewise identified nutrition as a barrier to literacy, numeracy, and learning recovery. School health and nutrition interventions are therefore considered cost-effective because they improve attendance, concentration, and academic performance (Bundy et al., 2018; Aurino et al., 2019). In the Philippine context, learner achievement also depends on health and instructional conditions. Cordial et al., (2025a) highlighted the importance of teacher competence, technological integration, and adaptive instructional practices, consistent with ecological perspectives of development (Tudge et al., 2016; Darling-Hammond et al., 2020). However, few studies have connected perceived nutritional problems with both

cognitive function and academic performance in one framework.

Nutrition, Extracurricular Engagement, and Life Skills Development. Nutrition also affects social, emotional, behavioral, and extracurricular development. Undernourished children often show lower stamina, weaker motivation, reduced participation in school activities, and poorer social engagement (Nyaradi et al., 2016; Aurino et al., 2019; Bundy et al., 2018). These limitations may reduce opportunities to build life skills such as communication, collaboration, leadership, adaptability, and problem-solving.

Black et al. (2017) argued that child development depends on adequate nutrition, responsive caregiving, quality education, and supportive environments. Thus, nutritional deficiencies may create disadvantages beyond academics and affect psychosocial functioning. Children's outcomes are also shaped by school and community support systems (Darling-Hammond et al., 2020; UNESCO, 2022). In the Philippine setting, Cordial et al., (2025b) found that teachers' ethical awareness, professional competence, and behavioral practices contribute to learner support, while Cordial et al., (2025b) showed that instructional leadership and administrative competence strengthen school effectiveness. Even so, extracurricular engagement and life skills remain underexamined in nutrition research, especially from the perspective of teachers.

Micronutrient Deficiencies and Learning Inefficiencies. Micronutrient deficiencies remain major nutritional concerns among school-aged children. Iron, iodine, zinc, and vitamin A deficiencies are linked to impaired cognitive performance, lower academic achievement, reduced attention span, and weaker school productivity (Abbaspour et al., 2014; Georgieff, 2018; Wieringa et al., 2019). Iron deficiency, in particular, affects neurotransmitter function, myelination, and neural metabolism, thereby weakening learning efficiency (Georgieff, 2018; Prado et al., 2017).

Recent global analyses also show that micronutrient deficiencies contribute to educational inequality because affected learners struggle to fully benefit from classroom instruction (Victora et al., 2021; WHO, 2023). Even mild deficiencies are associated with reduced concentration, slower processing, weaker working memory, and poorer educational outcomes (Georgieff, 2018; Prado & Dewey, 2018). Local evidence is consistent with these findings. Cordial et al., (2025b) showed that structured instructional interventions improve learner competencies when effectively implemented, although barriers may reduce effectiveness. Still, most studies rely on biomedical measures and give little attention to teachers' classroom observations, while integrated studies of cognitive, academic, extracurricular, and life skills outcomes remain limited in rural Philippine elementary schools.

METHODS

Research Design. This study employed a quantitative descriptive-correlational research design, which is appropriate for describing existing conditions and examining relationships among variables without manipulating the research environment (Creswell & Creswell, 2018). The descriptive component was used to assess teachers' perceptions of nutritional problems among elementary pupils, including indicators related to stunting, wasting, underweight status, and micronutrient deficiencies, as well as pupils' developmental outcomes in terms of cognitive function, academic performance, extracurricular engagement, and life skills competence. The correlational component examined the relationships between perceived nutritional manifestations and pupils' developmental outcomes without manipulating the study variables (Creswell & Creswell, 2018; Miksza & Elpus, 2018).

Population, Samples and Sampling Technique. The population of this study consisted of 159 elementary school teachers from Zone 2, Division of Catanduanes, representing the municipalities of Baras, Bato, Gigmoto, and San

Miguel during the School Year 2025–2026. Using Slovin's formula with a 5% margin of error, a sample of 114 teachers was determined to ensure a statistically adequate and representative subset of the target population. To achieve equitable representation across the participating schools and municipalities, stratified random sampling with proportional allocation was employed, wherein respondents were grouped according to school affiliation and selected proportionately based on their respective population sizes. Random selection was subsequently applied within each stratum to minimize sampling bias. Stratified random sampling is widely used to ensure proportional representation of identified subgroups in educational and social science research (Etikan & Bala, 2017; Taherdoost, 2017).

Instrumentation. The study employed a researcher-developed structured questionnaire as the principal data-gathering instrument to investigate the relationship between teachers' perceived nutritional manifestations and pupils' developmental outcomes in Zone 2, Division of Catanduanes. The instrument was organized into two sections: Part I assessed perceived nutritional indicators among elementary pupils, specifically stunting-related, wasting-related, underweight-related, and micronutrient deficiency-related manifestations; while Part II evaluated pupils' developmental outcomes in terms of cognitive function, academic performance, extracurricular engagement, and life skills competence. Responses were measured using a 4-point Likert scale, wherein higher scores reflected greater manifestation of nutritional problems or higher levels of developmental outcomes, depending on the construct being assessed.

To ensure methodological robustness, the instrument underwent face and content validation through systematic evaluation by the research committee and subject-matter experts to establish clarity, relevance, and alignment with the study objectives. A pilot testing procedure involving 30 elementary teachers from Zone 2, who were excluded from

the final sample, was conducted to determine reliability. Internal consistency was assessed using Cronbach's alpha, yielding a coefficient of 0.979, indicating excellent reliability. The instrument demonstrated excellent internal consistency (Cronbach's $\alpha = 0.979$) following expert validation and pilot testing (Creswell & Creswell, 2018; Mertens, 2022). Table 1 presents the scoring and interpretation framework.

Table 1
Evaluation and Scoring of Nutritional Indicators and Pupils' Developmental Outcomes

Assigned Points	Numerical Range	Nutritional Indicators of Pupils	Pupils' Developmental Outcomes
4	3.25–4.00	Highly Evident	Excellent
3	2.50–3.24	Evident	Very Good
2	1.75–2.49	Slightly Evident	Fair
1	1.00–1.74	Not Evident	Poor

Note: Nutritional indicators included stunting-, wasting-, underweight-, and micronutrient deficiency-related manifestations, while developmental outcomes covered cognitive function, academic performance, extracurricular engagement, and life skills competence. Higher scores reflect greater manifestation of nutritional issues or higher levels of pupil development, depending on the variable measured.

Data Analysis. The data collected were encoded, organized, and analyzed with the assistance of a statistician using appropriate descriptive and inferential statistical tools. Weighted mean was employed to determine the level of perceived nutritional indicators among elementary pupils, including stunting-, wasting-, underweight-, and micronutrient deficiency-related manifestations, as well as their developmental outcomes in terms of cognitive function, academic performance, extracurricular engagement, and life skills competence. Ranking based on weighted mean values was also applied to identify the relative standing of each indicator. Furthermore, Pearson's product-moment correlation coefficient (Pearson's r) was used to examine the relationships between perceived nutritional manifestations and pupils' developmental outcomes (Creswell & Creswell, 2018; Field, 2020).

Limitations of the Study. This study relied on teachers' perceived manifestations of pupils' nutritional problems rather than clinical or anthropometric assessments. Although teachers are well positioned to observe learners' daily behaviors, attentiveness,

participation, and classroom functioning, their perceptions should not be interpreted as medical diagnoses. Nevertheless, these observations provide valuable educational insights into how nutritional manifestations relate to learner development within the school context. Future studies should triangulate teachers' perceptions with anthropometric measurements or clinical nutritional assessments to strengthen the validity and comprehensiveness of the findings.

Ethical Considerations. Ethical principles were strictly observed throughout the study. Prior to data collection, permission was obtained from the appropriate authorities, and informed consent was secured from all teacher-participants after they were adequately informed about the study's purpose, procedures, and their rights, including voluntary participation and the option to withdraw at any time without penalty. Since the study relied solely on teachers' perceptions of pupils' nutritional manifestations and developmental outcomes, no direct data were collected from pupils. Confidentiality and anonymity were maintained by excluding identifying information from the data collection process and research reports, while all responses were used exclusively for academic and research purposes. The researcher adhered to the principles of honesty, objectivity, and transparency throughout data collection, analysis, and reporting (Mertens, 2022; Israel & Hay, 2021).

RESULTS

This section presents the findings of the study on the perceived nutritional problems among elementary pupils and their relationship with pupils' developmental outcomes in Zone 2, Division of Catanduanes. It includes the level of perceived nutritional manifestations, the level of pupils' development in terms of cognitive function, academic performance, extracurricular engagement, and life skills competence, the significant relationships between nutritional problems and each developmental domain, and the proposed

intervention plan formulated based on the results of the study.

Perceived Nutritional Problems Among Elementary Pupils. As presented in Table 2, nutritional problems among elementary pupils in Zone 2, Division of Catanduanes were generally perceived as evident, as reflected by the overall weighted mean of 2.70 (SD = 0.84). Among the indicators, wasting (M = 2.76, SD = 0.82), underweight (M = 2.76, SD = 0.83), and stunting (M = 2.74, SD = 0.89) emerged as the most commonly observed nutritional concerns, suggesting the presence of both acute and chronic forms of undernutrition among learners. Micronutrient deficiencies obtained the lowest mean (M = 2.54, SD = 0.79), although they remained evident, indicating that deficiencies in essential nutrients continue to be a concern despite being less visibly manifested. The relatively comparable mean scores across indicators suggest that nutritional challenges are multifaceted and pervasive rather than confined to a single condition. Overall, the findings imply that nutritional problems remain a notable concern among elementary pupils and may have important implications for their physical development, learning capacity, and educational outcomes.

Table 2

Composite Table on the Nutritional Status of Elementary Pupils in Zone 2, Division of Catanduanes (n = 114)

Variable	Weighted Mean	Standard Deviation (SD)	Verbal Interpretation	Rank
Wasting	2.76	0.82	Evident	1
Underweight	2.76	0.83	Evident	2
Stunting	2.74	0.89	Evident	3
Micronutrient Deficiencies	2.54	0.79	Evident	4
Overall Weighted Mean	2.70	0.84	Evident	

Level of Pupils' Development. As presented in Table 3, the level of pupils' development in Zone 2, Division of Catanduanes was generally rated as Very Good, with an overall weighted mean of 3.12 (SD = 0.66), indicating that learners demonstrate a generally strong but not yet optimal level of development across key domains. Among the indicators, academic performance obtained the highest mean (M = 3.17, SD = 0.64), followed closely by life skills competence (M = 3.15, SD = 0.68) and

extracurricular engagement (M = 3.12, SD = 0.66), all suggesting that pupils are performing satisfactorily in both academic and non-academic domains. Cognitive function recorded the lowest mean (M = 3.05, SD = 0.64), though still interpreted as very good, indicating that while learners demonstrate adequate cognitive functioning, it remains the most relatively constrained area compared with other developmental dimensions. The close clustering of mean scores further suggests a generally consistent level of development across domains, with only minimal variation. Overall, these results imply that pupils exhibit a positive developmental profile, although continued enhancement is needed to achieve higher levels of proficiency, particularly in cognitive development.

Table 3

Composite Table on the Level of Development of Pupils in Zone 2, Division of Catanduanes (n = 114)

Variable	Weighted Mean	Standard Deviation (SD)	Verbal Interpretation	Rank
Academic Performance	3.17	0.64	Very Good	1
Life Skills Competence	3.15	0.68	Very Good	2
Extracurricular Engagement	3.12	0.66	Very Good	3
Cognitive Function	3.05	0.64	Very Good	4
Overall Weighted Mean	3.12	0.66	Very Good	

Relationship Between Perceived Nutritional. As shown in Table 4, pupils' nutritional status was significantly associated with cognitive function, indicating that nutrition is an important correlate of learners' cognitive development in Zone 2, Division of Catanduanes. Stunting demonstrated a very strong positive relationship ($r = 0.871$, $p < 0.001$), whereas micronutrient deficiencies showed a moderate negative relationship ($r = -0.519$, $p < 0.001$). Wasting ($r = 0.368$, $p < 0.001$) and underweight ($r = -0.201$, $p = 0.032$) exhibited weaker but significant relationships. Collectively, these findings indicate that nutritional conditions influence pupils' cognitive functioning.

Consistent with Human Capital Theory, adequate nutrition supports the development of cognitive abilities essential for learning and future productivity. Likewise, Ecological Systems Theory suggests that nutritional

conditions within pupils' immediate environments shape their learning readiness and cognitive development. These findings highlight the need for integrated school-based nutrition and health programs, particularly in nutritionally vulnerable rural communities.

Table 4
Pearson Correlation Between Nutritional Status of Pupils and Cognitive Function (n = 114)

Variables	Statistical Test	Computed Value (r)	df	p-value	Decision	Interpretation
Stunting and Cognitive Function	Pearson r	0.871	112	<0.001	Reject H_0	Significant, very strong positive relationship
Wasting and Cognitive Function		0.368	112	<0.001	Reject H_0	Significant, weak positive relationship
Underweight and Cognitive Function		-0.201	112	0.032	Reject H_0	Significant, weak negative relationship
Micronutrient Deficiencies and Cognitive Function		-0.519	112	<0.001	Reject H_0	Significant, moderate negative relationship

Relationship Between Perceived Nutritional Problems and Academic Performance. As shown in Table 4, pupils' nutritional status was significantly associated with cognitive function, indicating that nutrition is an important correlate of cognitive development among learners in Zone 2, Division of Catanduanes. Stunting exhibited a very strong positive relationship with cognitive function ($r = 0.871$, $p < 0.001$), while micronutrient deficiencies showed a moderate negative relationship ($r = -0.519$, $p < 0.001$). In comparison, wasting ($r = 0.368$, $p < 0.001$) and underweight ($r = -0.201$, $p = 0.032$) demonstrated relatively weaker but statistically significant relationships. Overall, the findings suggest that nutritional problems are systematically associated with variations in pupils' cognitive functioning, with micronutrient deficiencies showing the most adverse association among the negative indicators.

Viewed through Human Capital Theory, these findings emphasize that adequate nutrition supports the development of cognitive capacities essential for future educational attainment and productivity. Likewise, Ecological Systems Theory explains that pupils' nutritional conditions within their immediate home and school environments directly influence their readiness to learn and participate in classroom activities. The results therefore reinforce the need for integrated school-based nutrition interventions, regular

health monitoring, and strengthened collaboration among schools, families, and health agencies to enhance learners' cognitive development, particularly in nutritionally vulnerable rural communities.

Table 5
Pearson Correlation Between Perceived Nutritional Problems and Academic Performance (n = 114)

Variables	Statistical Test	Computed Value (r)	df	p-value	Decision	Interpretation
Wasting and Academic Performance	Pearson r	-0.412	112	<0.001	Reject H_0	Significant, moderate negative relationship
Underweight and Academic Performance		-0.398	112	<0.001	Reject H_0	Significant, moderate negative relationship
Stunting and Academic Performance		-0.523	112	<0.001	Reject H_0	Significant, weak negative relationship
Micronutrient Deficiencies and Academic Performance		-0.367	112	<0.001	Reject H_0	Significant, weak negative relationship

Relationship Between Perceived Nutritional Problems and Extracurricular Engagement. As shown in Table 6, pupils' nutritional problems were significantly associated with extracurricular engagement, indicating that nutrition influences participation beyond classroom learning. Stunting had the strongest inverse relationship with extracurricular engagement ($r = -0.476$, $p < 0.001$), while wasting ($r = -0.351$, $p < 0.001$), underweight ($r = -0.327$, $p < 0.001$), and micronutrient deficiencies ($r = -0.289$, $p < 0.001$) showed consistent moderate to weak negative associations. These results suggest that poorer nutritional status corresponds to reduced involvement in school activities, limiting learners' opportunities for holistic development.

Table 6
Pearson Correlation Between Perceived Nutritional Problems and Extracurricular Engagement (n = 114)

Variables	Statistical Test	Computed Value (r)	df	p-value	Decision	Interpretation
Wasting and Extracurricular Engagement	Pearson r	-0.351	112	<0.001	Reject H_0	Significant, moderate negative relationship
Underweight and Extracurricular Engagement		-0.327	112	<0.001	Reject H_0	Significant, weak negative relationship
Stunting and Extracurricular Engagement		-0.476	112	<0.001	Reject H_0	Significant, weak negative relationship
Micronutrient Deficiencies and Extracurricular Engagement		-0.289	112	<0.001	Reject H_0	Significant, weak negative relationship

From the perspective of Human Capital Theory, extracurricular participation helps build competencies that support future productivity, making nutrition an important foundation for learner growth. Ecological Systems Theory

further explains that pupils' nutrition within their home and school environments affects their participation in school life. In the rural Philippine context, these findings support integrated school- and community-based nutrition programs that promote both health and active engagement.

Relationship Between Teachers' Perceived Manifestations of Nutritional Problems and Life Skills Competence. As shown in Table 7, pupils' nutritional problems were significantly associated with life skills competence, underscoring the broader developmental consequences of malnutrition beyond cognitive and academic domains. Wasting demonstrated a moderate inverse relationship with life skills ($r = -0.389$, $p < 0.001$), while underweight ($r = -0.344$, $p < 0.001$), stunting ($r = -0.497$, $p < 0.001$), and micronutrient deficiencies ($r = -0.311$, $p < 0.001$) revealed consistent but weaker negative associations. These results indicate that poorer nutritional status systematically corresponds to diminished capacity in communication, collaboration, adaptability, and problem-solving—skills essential for holistic learner development.

Table 7
Pearson Correlation Between Teachers' Perceived Manifestations of Nutritional Problems and Life Skills Competence ($n = 114$)

Variables	Statistical Test	Computed Value (r)	df	p-value	Decision	Interpretation
Wasting and Life Skills Competence	Pearson r	-0.389	112	<0.001	Reject H_0	Significant, moderate negative relationship
Underweight and Life Skills Competence		-0.344	112	<0.001	Reject H_0	Significant, weak negative relationship
Stunting and Life Skills Competence		-0.497	112	<0.001	Reject H_0	Significant, weak negative relationship
Micronutrient Deficiencies and Life Skills Competence		-0.311	112	<0.001	Reject H_0	Significant, weak negative relationship

Interpreted through Human Capital Theory, the findings suggest that nutritional deprivation constrains the formation of competencies critical for future productivity and social participation. From an ecological systems perspective, teachers' observations highlight how health conditions within the microsystem directly shape pupils' readiness to engage in broader school and community contexts. In the Philippine rural setting, where nutritional vulnerabilities remain prevalent, these results

reinforce the need for integrated school-based and community-supported nutrition programs that not only address physical health but also safeguard learners' capacity to acquire essential life skills.

Proposed Intervention Plan for Enhancing Nutritional Status and Pupils' Development

Rationale. The intervention framework in Table 8 was developed based on empirical evidence revealing that pupils in Zone 2 exhibit evident nutritional problems ($WM = 2.70$), including stunting, wasting, underweight conditions, and micronutrient deficiencies. Correlation analyses further established that these nutritional concerns are significantly associated with cognitive function, academic performance, extracurricular engagement, and life skills competence, with mostly moderate to strong negative relationships. These findings indicate that nutritional deprivation is a critical determinant of holistic learner development. Hence, an integrated, school-based and community-supported intervention is necessary to address both biological needs and educational outcomes simultaneously.

DISCUSSION

The findings indicate that nutritional problems remain an important determinant of holistic learner development among elementary pupils in Zone 2, Division of Catanduanes. As shown in Table 2, teachers perceived nutritional problems as evident ($WM = 2.70$), with wasting, underweight, and stunting as the most commonly observed manifestations. These findings suggest that both acute and chronic malnutrition continue to constrain learner development.

The results support Black et al. (2017), Prado and Dewey (2018), and Vitoria et al. (2021), who identified undernutrition as a persistent barrier to children's physical growth, cognitive development, and educational attainment. Similarly, UNICEF (2021) and WHO (2023) reported that nutritional vulnerabilities continue to undermine children's

developmental potential and learning opportunities. Viewed through Human Capital Theory, these nutritional conditions may limit competencies essential for future productivity, while Ecological Systems Theory highlights the influence of school and family environments on learner development.

The findings therefore support strengthening DepEd school feeding programs and school-community partnerships.

extracurricular engagement, and cognitive function. These findings support the ecological perspective of Tudge et al. (2016) and Darling-Hammond et al. (2020), which emphasizes that learner outcomes are shaped by interacting school, family, and community factors. The findings also align with Cordial et al., (2025a), who highlighted the contribution of teacher competence and adaptive instructional practices to learner achievement. Collectively, these results suggest that supportive

Table 8
Integrated School-Based Nutrition and Health Intervention Framework

Key Area of Concern	Objective	Evidence-Based Intervention Strategies	Key Activities	Responsible Persons	Timeline	Expected Outcomes	Monitoring & Evaluation Indicators
Stunting (Growth Deficit)	To reduce stunting and improve long-term physical development of pupils	Nutrition-sensitive growth monitoring and dietary enhancement program	- Quarterly height-for-age monitoring - Protein-rich school feeding - Parental nutrition education sessions - Daily energy-dense feeding	School Head, School Nurse, Teachers, Barangay Health Workers	Year-round (Quarterly evaluation)	Improved height-for-age status; reduced stunting prevalence	Anthropometric records; feeding attendance reports
Wasting (Acute Malnutrition)	To address acute malnutrition affecting cognitive and academic functioning	Intensive school feeding and health surveillance program	- Deworming and health screening - Medical referral system for at-risk pupils - Fortified meal distribution	School Nurse, LGU Health Office, Teachers	Monthly	Improved BMI-for-age; reduced wasting incidence	BMI tracking; health referral logs
Underweight Conditions	To improve nutritional intake affecting academic and life skills performance	Balanced diet supplementation and household nutrition support program	- Parent nutrition coaching - Home-based dietary planning guides	Teachers, Parents, Nutritionists	Quarterly	Increased weight-for-age; improved classroom engagement	Weight monitoring records; parent participation logs
Micronutrient Deficiencies	To reduce anemia and nutrient-related cognitive impairment	Micronutrient supplementation and school gardening initiative	- Iron and vitamin A supplementation - Nutrition seminars - School vegetable gardening "Brain-boost" school feeding	School Health Personnel, LGU, PTA	Semi-annual	Reduced anemia prevalence; improved energy and focus	Hemoglobin tests; participation rate in gardening
Low Cognitive Function (r = up to -0.519)	To enhance attention, memory, and problem-solving linked to nutrition status	Nutrition-cognition integration program	- Attention-enhancement classroom activities - Sleep and hygiene education	Teachers, School Nurse	Continuous	Improved cognitive test performance and attentiveness	Cognitive assessment tools; teacher observation scales
Low Academic Performance (r = -0.523)	To improve academic outcomes affected by nutritional deficits	Nutrition-supported academic enhancement program	- Breakfast-before-class feeding - Remedial instruction for undernourished learners - Nutrition-sensitive lesson integration	Teachers, School Head	Continuous	Improved test scores and classroom participation	Academic records; formative test results
Low Extracurricular Engagement (r = -0.476)	To increase participation in school activities and social development	Energy-support and inclusion-based participation program	- Pre-activity feeding support - Sports and club participation encouragement - Talent development activities	Teachers, Coaches, PTA	Whole school year	Increased participation in sports, clubs, and school events	Attendance in extracurricular activities
Low Life Skills Competence (r = -0.497)	To enhance communication, independence, and problem-solving skills	Integrated life skills and nutrition-responsive pedagogy program	- Group-based learning tasks - Communication and leadership exercises - Practical classroom responsibilities	Teachers	Continuous	Improved life skills performance and independence	Performance-based assessments; teacher rating scales

Despite these nutritional concerns, pupils were generally rated as having very good developmental outcomes (WM = 3.12), with academic performance obtaining the highest mean, followed by life skills competence,

educational environments may partly offset the effects of nutritional challenges, reinforcing the need for coordinated nutrition and educational interventions.

The correlation analysis confirms the significant influence of nutrition on cognitive development. As shown in Table 4, micronutrient deficiencies exhibited a moderate negative relationship with cognitive function ($r = -0.519$), while underweight showed a weak negative association ($r = -0.201$). These findings support evidence that inadequate nutrient intake impairs neurological development, memory, attention, and executive functioning (Georgieff, 2018; Prado et al., 2017; Wieringa et al., 2019). From the perspective of Human Capital Theory, poor nutrition limits cognitive capacities essential for future productivity, while Ecological Systems Theory highlights the role of health within learners' immediate environments. Although the positive association between stunting and cognitive function differs from previous evidence, the overall findings reaffirm the importance of school-based nutrition interventions to strengthen cognitive development.

The findings further demonstrate that nutritional problems were significantly associated with academic performance. Stunting showed the strongest inverse relationship ($r = -0.523$), followed by wasting ($r = -0.412$), underweight ($r = -0.398$), and micronutrient deficiencies ($r = -0.367$). These findings support evidence that malnourished children often experience lower academic achievement, poorer attendance, reduced classroom participation, and diminished educational attainment (Black et al., 2017; Bundy et al., 2018; Aurino et al., 2019; UNESCO, 2022). Victora et al. (2021) further argued that chronic nutritional deprivation limits educational success across the life course. Viewed through Human Capital Theory, poor nutrition constrains the development of knowledge and skills essential for lifelong productivity, while Ecological Systems Theory highlights the complementary role of schools and families in supporting academic success. These findings reinforce the importance of strengthening DepEd school-based nutrition programs and school-community partnerships to improve learner achievement.

Beyond cognitive and academic outcomes, the findings demonstrate that nutritional problems significantly influence extracurricular engagement and life skills competence. Table 6 showed significant negative relationships with extracurricular engagement, with stunting exhibiting the strongest association ($r = -0.476$), while Table 7 likewise identified stunting ($r = -0.497$) and wasting ($r = -0.389$) as the strongest correlates of reduced life skills competence. These findings support Nyaradi et al. (2016), Bundy et al. (2018), Aurino et al. (2019), and Black et al. (2017), who reported that undernutrition limits physical stamina, motivation, social participation, and broader developmental outcomes. Viewed through Human Capital Theory, reduced extracurricular participation and life skills development may constrain future productivity and social participation, while Ecological Systems Theory highlights the role of schools and families in fostering these competencies. These findings reinforce the need for DepEd and community-based nutrition initiatives that promote both learner health and holistic development.

The findings reinforce that learner development is multidimensional, with nutrition influencing biological, cognitive, academic, and socio-emotional outcomes. Viewed through Human Capital Theory, adequate nutrition supports the development of competencies essential for lifelong learning and productivity, while Ecological Systems Theory highlights the interconnected roles of schools, families, and communities in shaping learner development. Consistent with Cordial et al., (2025a) and Cordial et al., (2025b), the findings underscore the need to integrate nutrition with instructional, psychosocial, and community-based interventions to promote holistic learner development.

To address the identified nutritional concerns and their effects on learner development, the study proposes an integrated intervention plan that combines nutrition and education strategies. Rather than isolated interventions, the findings support strengthening DepEd's School-Based Feeding Program through

coordinated partnerships among schools, the Department of Health (DOH), local government units (LGUs), families, and community stakeholders. Such collaboration can enhance nutritional status, holistic learner development, and overall educational outcomes through sustained school–community support.

In conclusion, this study contributes localized evidence that nutritional problems remain significant determinants of elementary pupils' cognitive, academic, and holistic development in Catanduanes. Viewed through Human Capital Theory, the findings underscore the importance of adequate nutrition in developing competencies essential for lifelong productivity, while Ecological Systems Theory highlights the shared responsibility of schools, families, health agencies, and communities in supporting learner development. These findings reinforce the need to strengthen DepEd-led nutrition programs through sustained interagency and community partnerships. Future research may incorporate objective nutritional assessments and longitudinal designs to further examine the long-term effects of nutrition on learner development.

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