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Investigating the Cognitive Readiness of Selected Kindergarten Learners with Undernutrition Status in Kalunasan Elementary School: A Descriptive Cross-Sectional Case Study

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Abstract:

This study investigated the cognitive readiness of eleven selected Kindergarten learners with undernutrition status at Kalunasan Elementary School during School Year 2026-2027 using a convergent parallel mixed-methods, descriptive cross-sectional case study design. It aimed to describe learners' nutritional status, Literacy and Numeracy (LITNUM) proficiency, and Early Childhood Care and Development (ECCD) outcomes across gross motor, fine motor, self-help, receptive language, expressive language, cognitive, and social-emotional domains, and to explore teachers' and parents' perspectives on cognitive readiness. Quantitative data consisted of secondary records including Body Mass Index (BMI) classification, pre- and post-assessments for LITNUM and ECCD, analyzed using frequencies, percentages, Exact McNemar test, and Wilcoxon Signed-Rank test with Holm adjustment. Qualitative data from semi-structured interviews with one kindergarten teacher and eleven parents were analyzed through thematic analysis following Braun and Clarke (2006) and integrated via a Joint Display Matrix. Findings revealed that 90.9% of learners were classified as wasted and 9.1% as severely wasted. Literacy improved from 100% Beginning at pre-assessment to 81.8% Developing at post-assessment, while numeracy improved from 100% Beginning to 63.6% Developing and 9.1% Consistent. McNemar tests confirmed significant improvements in both literacy (p=.0039) and numeracy (p=.0078). ECCD post-assessment showed 100% Average in five domains, but self-help and expressive language retained delays. Wilcoxon tests showed no statistically significant changes after Holm correction. Thematic analysis revealed difficulties in foundational literacy and numeracy, influences of age, language of instruction (Cebuano), concrete materials, undernutrition-related fatigue, benefits of school feeding programs, differentiated scaffolding, and challenges related to pacing, absences, socioeconomic constraints, and parental knowledge gaps. Triangulation confirmed convergence between physical status and classroom lethargy, and expansion showing that contextualized strategies enabled gains. The study proposes K-NEST: Kindergarten Nutrition, Early Development, and School-readiness Tracking, an institutionalized monitoring program integrating nutrition, ECCD, and LITNUM assessments with home-school coordination.

Keywords: cognitive readiness, undernutrition, kindergarten, LITNUM, ECCD, school readiness

Introduction:

Early Childhood Education (ECE) provides the critical foundation for cognitive, socio-emotional, and physical development necessary for lifelong learning. Investments during kindergarten significantly predict school readiness, literacy and numeracy acquisition, and long-term academic trajectories. However, undernutrition remains one of the most persistent barriers to kindergarten learning. The World Health Organization (2023) reports that undernutrition affects millions of children globally, contributing to delayed cognitive development, poor school readiness, and

reduced educational achievement, as the developing brain requires adequate nutrients to support attention, memory, and executive functioning.

In the Philippines, approximately 13.2% of assessed school-aged children are classified as stunted or wasted based on DepEd Enhanced Basic Education Information System data. Republic Act No. 11037 (Masustansyang Pagkain para sa Batang Pilipino Act) institutionalized the School-Based Feeding Program (SBFP) for Kindergarten to Grade 6. DepEd SBFP evaluations show that 120 feeding days reduced combined severe wasting and wasting from 32% to 22% nationwide, with kindergarten showing highest relative improvement (+27.2 percentage points). Local studies (Canillo & Alferez, 2025; Cubio, 2025) confirm SBFP improves nutritional status, attendance, concentration, and performance, though Macarandan & Hussien (2024) note nutrition alone does not fully explain academic variation, indicating need to explore classroom-level developmental factors.

Kalunasan Elementary School in Barangay Kalunasan, Cebu City, serves families with low incomes, agricultural livelihoods, and challenging terrain requiring hour-long walks. The school implements Gulayan sa Paaralan, BJMP Female Dormitory monthly feeding, EMCOR 100-day hot meals, Supreme Elementary Learner Government lugaw program, and DepEd SBFP. Despite these, undernutrition persists, underscoring need to understand cognitive profiles in early years.

The present study is anchored on three theories operating sequentially. Maslow's Hierarchy of Needs (1943) posits physiological needs must be satisfied before cognitive needs emerge; hungry learners prioritize survival over sustained attention and working memory. Omand et al. (2021) and Morcoso (2025) support that nutritional risk increases developmental delays. Piaget's Cognitive Development Theory (1952) situates kindergarten learners (ages 4-6) in the preoperational stage characterized by symbolic thought and intuitive problem-solving; undernutrition disrupts active engagement with manipulatives and symbolic recall, as Little (2021) and Tan & Alih (2024) confirm executive function impairments. Bronfenbrenner's Bioecological Systems Theory (1979; 2006) situates development within microsystem (home, classroom) and mesosystem (parent-teacher interaction); Ansari et al. (2022) and Reyes & De Vera (2025) emphasize synchronized home-school quality interactions predict readiness.

This study addresses a clear research gap: while quantitative SBFP evaluations show physical gains, limited qualitative inquiry exists on how undernutrition manifests in daily cognitive engagement, how teachers and parents perceive influencing factors, and what challenges occur in real-time learning environments. The study aimed to describe nutritional status, LITNUM and ECCD profiles, examine significant differences pre-post, explore teachers' and parents' descriptions of cognitive readiness, and propose an institutionalized nutritional, developmental, and learning readiness monitoring program (K-NEST).

Literature Review:

The literature review synthesizes international and local evidence on early childhood development, undernutrition biology, feeding interventions, and foundational literacy and numeracy trajectories relevant to undernourished kindergarten learners.

Early Childhood Care and Development (ECCD) and Multi-Domain Outcomes. International benchmarks by OECD (2021) demonstrate that quality early childhood programs foster cognitive and social skills, but holistic development across motor, emotional, and cognitive domains requires individualized support. In the Philippines, Cañete (2023) observed that while cognitive and language performance showed high mastery among preschoolers, self-help and expressive language consistently required scaffolding. SEAMEO CECCEP (2022) confirmed structured center-based activities accelerate cognitive readiness, yet motor regulation and social adaptability depend on individualized support. Conjares (2021) noted early exposure to integrated early childhood services buffers cognitive and socio-emotional domains, though service gaps in rural and peri-urban public schools create disparities. UNICEF, ACER, and SEAMEO-INNOTECH (2022) longitudinal research in the Philippines further highlights that developmental trajectories are non-linear and influenced by both center quality and home stimulation.

Play-Based Pedagogy and Socio-Emotional Skill Acquisition. Reyes and Bautista (2021) demonstrated structured play enhances peer interaction, social cooperation, and emotional self-regulation among kindergarten learners. Tuncdemir

(2021) established imaginative and cooperative play strengthens problem-solving, empathy, and classroom adaptability. UNESCO (2021) highlighted play-centered curricula produce higher school readiness, task engagement, and emotional regulation compared to rigid teacher-directed approaches. These findings align with DepEd Order No. 47, s. 2016, which mandates developmentally appropriate, play-based kindergarten pedagogy.

Parental Engagement and Home Learning Environments. Gudio (2022) reported home reading, storytelling, and conversational engagement significantly enhance cognitive preparedness and language reception. World Bank (2021) identified parent-child book sharing and interactive play as strong positive predictors of early cognitive and language development in low- and middle-income contexts. Conjares (2021) emphasized parental involvement as critical moderator maximizing benefits of community-based ECCD and feeding interventions. In contexts of undernutrition, home learning support becomes even more vital as compensatory mechanism for reduced school endurance.

Anthropometric Status and Biological Impact of Undernutrition. Anthropometric indicators—Weight-for-Age (WAZ), Height-for-Age (HAZ), Weight-for-Height (WHZ)—categorize stunting, wasting, and severe underweight (EDCOM II, 2023). Cañete (2023) emphasized baseline screening identifies risk for cognitive delay and poor classroom endurance. DepEd Order No. 010, s. 2024 mandates systematic nutritional tracking at school entry. Biological mechanisms are well-documented: Kirolos et al. (2022) systematic review established malnutrition leads to long-term neurodevelopmental, cognitive, and behavioral impairments affecting working memory, processing speed, and academic performance. Awaludin et al. (2020) meta-analysis showed chronic growth deficits disrupt neural connectivity leading to lower processing speed and impaired executive functioning. Locally, EDCOM II (2023) documented acute undernutrition (wasting) causes daily lethargy, short attention, and elevated absenteeism. Cañete (2023) noted undernourished preschoolers exhibit deficits in task completion due to energy depletion. de Oliveira et al. (2022) systematically reviewed food insecurity and cognitive development, confirming consistent associations. Akubuilo et al. (2020) in Nigeria with 751 primary children aged 6-12 found nutritional status significantly associated with IQ and academic performance. Recent meta-analysis by Ali et al. (2025) across low- and middle-income countries found acute undernutrition including wasting associated with lower developmental scores, varying across domains. Pizzol et al. (2021) meta-analysis similarly linked malnutrition with poorer cognitive development.

Institutionalized School-Based Feeding and Health Interventions. RA 11037 provides legal mandate for national feeding. EDCOM II (2023) demonstrated institutionalized feeding yields immediate gains in attendance, stamina, and task participation. Conjares (2021) confirmed health monitoring with micronutrient supplementation restores growth metrics. Cañete (2023) concluded sustainable academic recovery relies on localized feeding frameworks integrated with learning. Operational guidelines DepEd Order No. 036 s. 2019 (milk component), No. 031 s. 2021, and No. 038 s. 2022 strengthened implementation, LGU collaboration, and long-term tracking. Canillo and Alferez (2025) and Cubio (2025) found SBFP significantly improved nutritional status, attendance, concentration, and performance after six months.

Literacy and Numeracy (LitNum) Trajectories. Early literacy encompasses phonemic awareness, alphabet knowledge, vocabulary, and comprehension. Mulder et al. (2017) showed early executive function predicts emergent math and literacy. Villamor (2021) demonstrated targeted language interventions yield significant improvements among at-risk readers in Philippine public schools. ACTRC (2022) revealed structured phonics and print-rich environments enable rapid transition from emergent letter recognition to basic comprehension. Early numeracy involves number identification, counting, quantity comparison, and problem-solving. Clements and Sarama (2021) show concrete manipulatives drive gains in number sense and spatial reasoning. Villamor (2021) confirmed baseline vs post-instruction profiles provide diagnostic data on mastery. ACTRC (2022) established early diagnostic tracking prevents cumulative deficits, particularly for learners facing health hurdles.

Interdependence of Literacy and Numeracy. Literacy and numeracy share underlying mechanisms: working memory, symbolic thinking, processing speed. Villamor (2021) established strong positive correlation between language comprehension and mathematical problem-solving. SEAMEO INNOTECH (2021) demonstrated vocabulary acquisition enhances numerical reasoning and spatial understanding in kindergarten. ACTRC (2022) revealed decoding deficits correspond to arithmetic bottlenecks, emphasizing need for integrated support. Dulal et al. (2021) systematic review and meta-analysis found integrated nutrition and stimulation interventions produced greater benefits, particularly cognitive and language outcomes among undernourished children. This supports the present

study's integration of nutrition, ECCD, and LitNum.

Gaps. Despite extensive quantitative evidence, limited mixed-methods case studies explore lived classroom dynamics of undernourished kindergarten learners: how cognitive readiness manifests in real-time learning, how teachers and parents perceive multi-faceted factors, and what specific challenges occur. This study addresses that gap through triangulation of secondary records and interview data at Kalunasan Elementary School.

Methodology:

This section details the research design, environment, participants, instruments, data gathering procedure, analysis, and ethical considerations.

Research Design

This study employed a convergent parallel mixed-methods, descriptive cross-sectional case study design to evaluate nutritional status, cognitive performance, and developmental outcomes of selected Kindergarten learners with undernutrition status during SY 2026-2027. Quantitative strand addressed measurable profiles and statistical relationships using secondary records: frequencies, percentages, means, standard deviation for baseline nutritional profile, LitNum, and ECCD results across seven domains (Gross Motor, Fine Motor, Self-Help, Receptive Language, Expressive Language, Cognitive, Social-Emotional). Inferential tools included Exact McNemar test for paired categorical LitNum proficiency (Beginning, Developing, Consistent) and Wilcoxon Signed-Rank test for ECCD domain scores with Holm adjustment for multiple comparisons to control family-wise error. Qualitative strand addressed contextual understanding via semi-structured interviews, classroom observations, and document review of feeding logs. Integration occurred via Joint Display Matrix merging metrics and insights to identify convergence and expansion.

Research Environment

The study was conducted at Kalunasan Elementary School, a public elementary school under DepEd Schools Division of Cebu City, located in Barangay Kalunasan, Cebu City. The barangay has hilly terrain, narrow uphill roads, and small-scale agricultural communities, affecting travel and learners' food, rest, and well-being. The school provides Kindergarten to Grade 6 and implements SBFP, Gulayan sa Paaralan, BJMP Female Dormitory monthly feeding, EMCOR 100-day hot meals, and SELG lugaw program.

Research Participants

Participants consisted of 11 selected Kindergarten learners identified with undernutrition based on school BMI assessment, 11 parents/guardians, and 1 Kindergarten teacher, total 23 informants. Distribution: Kinder A = 5 learners (45%), Kinder B = 6 learners (55%). Purposive sampling was used per Creswell and Poth (2018) to intentionally select information-rich cases relevant to phenomenon. Inclusion criteria for learners: (1) officially enrolled Kindergarten at Kalunasan ES SY 2026-2027; (2) classified as wasted or severely wasted based on SBFP records; (3) parental informed consent and child assent; (4) regular attendance. Teacher participant must directly handle selected pupils and willing to participate. Parents/guardians must be primary caregivers knowledgeable about child's health, nutrition, routines, and voluntarily consent. Exclusion: non-consent, not meeting nutritional classification, irregular attendance.

Research Instruments

(1) Secondary Data Review: School Nutritional Assessment Records (BMI-for-age), official ECCD Checklist results (DepEd Order No. 47, s. 2016) pre/post, and LITNUM assessment scores (DepEd Order No. 14, s. 2023) pre/post. (2) Semi-Structured Interview Guides validated by adviser and panel of experts: Teacher Interview Guide focused on engagement, retention, developmental milestones, instructional challenges; Parent/Guardian Interview Guide explored home nutrition routines, health history, home learning support, socioeconomic challenges, observable behaviors. Guides based on Kvale & Brinkmann (2015). (3) Classroom observation protocol non-intrusive embedded in regular activities. Content validity reviewed by experts.

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Data Gathering Procedure

Four phases: (a) Pre-Data Gathering: secured approvals from Schools Division Superintendent Dr. Nimfa D. Bongo and School Principal Mrs. Babylin C. Palban, coordinated schedules with teacher, secured informed consent from parents/guardians and teacher, validated instruments. (b) During Data Gathering: reviewed nutritional records to identify participants, retrieved LitNum and ECCD pre/post records, conducted semi-structured interviews at participants' convenience, audio-recorded with permission. (c) Post Data Gathering: transcribed verbatim, organized notes, coded data. (d) Integration: triangulated sources.

Data Analysis. Quantitative

frequency counts and percentages for BMI and LitNum mastery levels; mean and standard deviation for domain scores; Exact McNemar test for literacy and numeracy proficiency change (paired nominal); Wilcoxon Signed-Rank test for ECCD domain score differences (non-parametric due to small sample, ordinal data), with Holm-adjusted p-values. Significance level .05. Qualitative: thematic analysis following Braun and Clarke (2006) six phases: familiarization, generating initial codes, searching for themes, reviewing themes, defining and naming themes, producing report. Themes included literacy/numeracy difficulties, factors influencing readiness, health/stamina, support strategies, challenges. Trustworthiness enhanced via triangulation of records, observations, interviews; member checking via debriefing; use of pseudonyms (Pupil A, Parent B). Integration via Joint Display Matrix assessing convergence, expansion, nuance.

Ethical Considerations. Strict ethical standards applied due to vulnerable minors. Principles: Beneficence—maximized benefits, minimized harm, non-intrusive observations; Respect for Human Dignity—parental informed consent in Cebuano/Visayan, verbal child assent using child-friendly language, voluntary participation with right to withdraw without penalty or loss of feeding benefits; Justice—fair selection based on objective BMI records, no discriminatory treatment; Transparency—clear communication of objectives, procedures. Confidentiality: identifiers removed, pseudonyms, locked storage, encrypted password-protected files, retention per institutional policy then destruction. No public labeling of nutritional status. Conflict of interest declared none. Study approved for oral examination September 30, 2026 with grade PASSED.

Results and Discussion:

Nutritional Status of Kindergarten Learners

Table 2 shows nutritional status based on BMI-for-age. Out of 11 learners, 10 (90.9%) were classified as wasted and 1 (9.1%) as severely wasted, indicating 100% acute undernutrition prevalence in selected sample. This prevalence warrants immediate attention as wasting reflects recent significant weight loss or failure to gain weight, associated with inadequate dietary intake or illness. According to WHO (2023) and EDCOM II (2023), wasted children exhibit compromised immune function, reduced physical stamina, and heightened vulnerability to developmental delays. Cañete (2023) emphasizes baseline anthropometric screening identifies risk for poor classroom endurance. In Kalunasan context, hilly terrain, long walks, low income, and food insecurity contribute to this profile. Qualitative triangulation confirmed convergence: teachers reported pupils resting heads on desks, rapid lethargy late morning, falling asleep; parents reported skipping breakfast, lack of appetite, complaints of exhaustion. Thus BMI metrics directly explain observed exhaustion. However, this does not establish causality between wasting and cognitive readiness deficits; it provides nutritional context for interpreting learning results. Implications align with Kirolos et al. (2022) and Pizzol et al. (2021) linking malnutrition with impaired neurodevelopment, and Ali et al. (2025) meta-analysis linking acute undernutrition with lower developmental scores.

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Nutritional Status	Frequency (f)	Percentage (%)
Wasted	10	90.9
Severely Wasted	1	9.1
Total	11	100.0

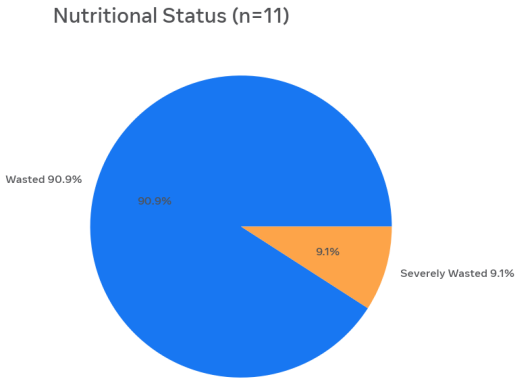


Figure 2. Nutritional Status Distribution (n=11)

Pre- and Post-Assessment LITNUM Profiles

Literacy Proficiency

Table 3 presents literacy proficiency. Pre-assessment: all 11 learners (100%) at Beginning level, indicating inability to recognize letters, letter-sound connections, and early writing. Post-assessment: 9 learners (81.8%) progressed to Developing, 2 (18.2%) remained Beginning. This represents substantial movement from non-reader to emergent reader despite undernutrition. Early literacy is core component of school readiness (UNICEF Philippines, 2023). Recent evidence indicates nutrition and developmental outcomes interconnected; Ali et al. (2025) meta-analysis found wasting associated with lower developmental scores, though varied by domain; Dulal et al. (2021) found integrated nutrition and stimulation interventions produce greater cognitive and language benefits among undernourished children. Qualitative accounts reveal mechanisms: Learner C teacher reported struggles with letter recognition and pencil grip, parent described writing/remembering letters very difficult; Learner H difficulty with letter-sound, tracing, remembering names. However, improvement noted with Cebuano instruction and visual aids. Parents utilized bedtime storybooks, line-by-line tracing with rest breaks. Teachers scheduled complex tasks early morning when energy highest, broke lessons into bite-sized modules. Results imply continued literacy support needed, particularly for 2 learners remaining at Beginning, and that literacy gains reinforce need to sustain intervention while simultaneously monitoring nutritional and developmental status, rather than treating separately.

Level	Pre f	Pre %	Post f	Post %
Beginning	11	100.0	2	18.2
Developing	0	0.0	9	81.8

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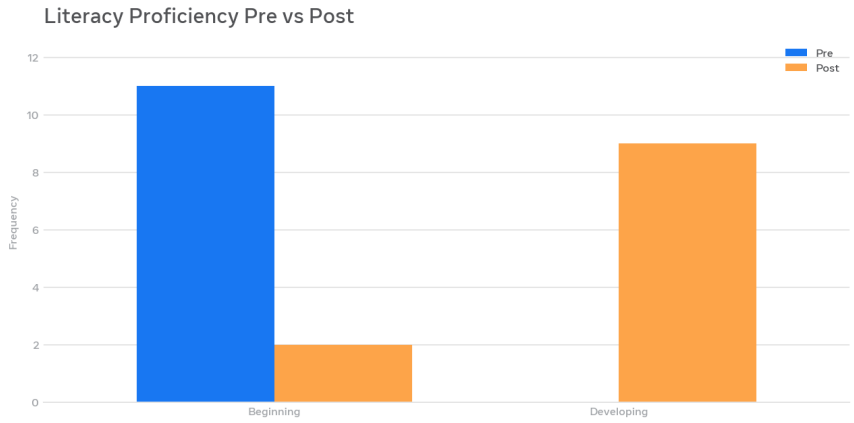


Figure 3. Literacy Proficiency Pre vs Post

Numeracy Proficiency

Table 4 shows numeracy. Pre: 100% Beginning. Post: 7 learners (63.6%) Developing, 1 learner (9.1%) Consistent, 3 learners (27.3%) Beginning. Developing indicates ability to recognize numbers, count concretely, compare quantities with support; Consistent indicates independent mastery. While improvement evident, 27.3% still at entry. Early numeracy foundation for later mathematical learning; deficits can accumulate (ACTRC, 2022; Clements & Sarama, 2021). Nutritional status may relate to outcomes via reduced stamina and executive function (Awaludin et al., 2020). Qualitative: numeracy concerns centered on recognizing printed numbers, remembering sequences, beginning concepts. Parents used familiar objects—toys, snacks, pebbles, spoons, buttons, blocks, candies—to make counting concrete. Teachers reported difficulty with digit recognition beyond 5, improved through math games and hands-on materials. This aligns with Piaget's emphasis on concrete manipulation in preoperational stage and Bronfenbrenner mesosystem where home items bridge abstract concepts. Improvement supports need to sustain learning intervention while continuing nutritional monitoring.

Level	Pre f	Pre %	Post f	Post %
Beginning	11	100.0	3	27.3
Developing	0	0.0	7	63.6
Consistent	0	0.0	1	9.1

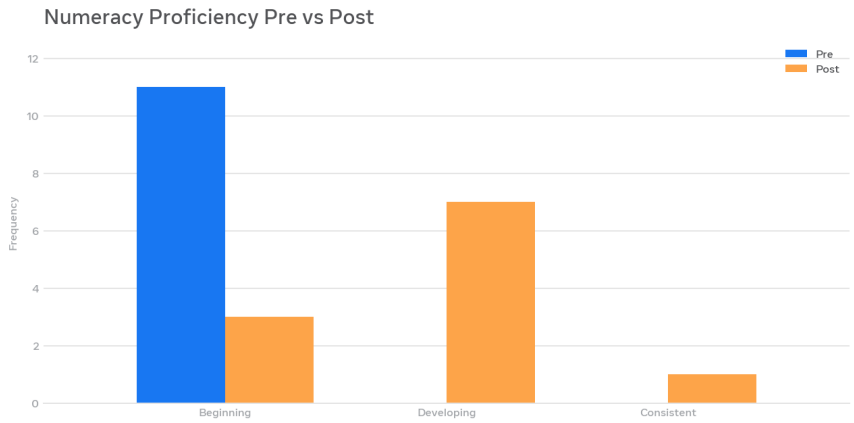


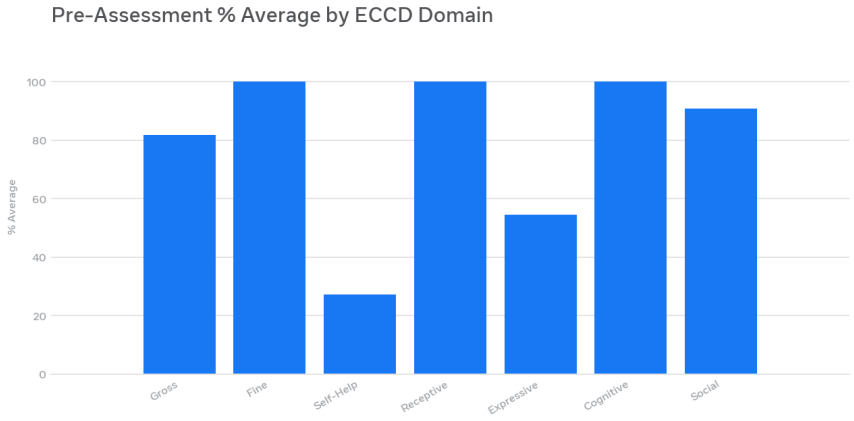
Figure 4. Numeracy Proficiency Pre vs Post

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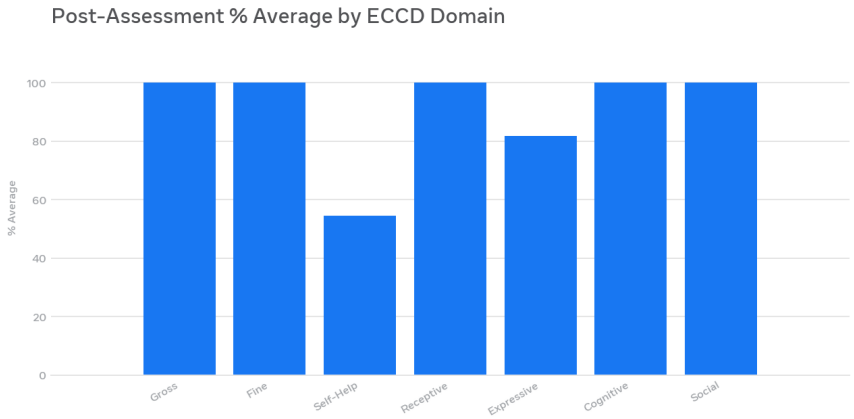
ECCD Developmental Profiles

ECCD Checklist measures seven domains. Pre-assessment (Table 5) showed majority Average in gross motor 81.8% (9), fine motor 100% (11), receptive language 100% (11), cognitive 100% (11), social-emotional 90.9% (10). However delays concentrated in self-help: 27.3% Significant Delay (3), 45.5% Slight Delay (5), only 27.3% Average; expressive language: 45.5% Slight Delay (5), 54.5% Average; gross motor 18.2% Slight Delay (2); social-emotional 9.1% Significant Delay (1). Self-help includes feeding, dressing, toileting independence; expressive language includes articulation, vocabulary use. Delays align with literature: Cañete (2023) noted self-help and expressive language require targeted scaffolding; SEAMEO CECCEP (2022) confirmed motor regulation and adaptability depend on individualized support. Undernutrition-related fatigue may hinder self-care practice and verbal participation. Ali et al. (2025) found acute undernutrition associated with lower developmental scores. Post-assessment (Table 6) showed improvement: 100% Average in gross motor, fine motor, receptive language, cognitive, social-emotional. Self-help improved to 54.5% Average (6), but 9.1% Significant Delay (1) and 36.4% Slight Delay (4) remained. Expressive language improved to 81.8% Average (9) with 18.2% Slight Delay (2). This suggests descriptive stabilization but persistent adaptive delays requiring extended support, as fine-motor fatigue during writing drills and speech hesitation persisted per teacher observations. Dulal et al. (2021) indicates combining nutrition with developmental stimulation benefits outcomes, particularly among undernourished. Results support need for continuous monitoring beyond single assessment.

Domain	Significant Delay	Slight Delay	Average	Slightly Advanced
Gross Motor	-	2 (18.2%)	9 (81.8%)	-
Fine Motor	-	-	11 (100%)	-
Self-Help	3 (27.3%)	5 (45.5%)	3 (27.3%)	-
Receptive	-	-	11 (100%)	-
Expressive	-	5 (45.5%)	6 (54.5%)	-
Cognitive	-	-	11 (100%)	-
Social-Emotional	1 (9.1%)	-	10 (90.9%)	-



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Significant Difference in LITNUM Proficiency

Table 7 presents Exact McNemar test for paired nominal data appropriate for small sample (n=11) with dichotomous improvement. Literacy: 9 improved, 0 declined, p=.0039 < .05, significant, reject null. Numeracy: 8 improved, 0 declined, p=.0078 < .05, significant, reject null. Findings indicate statistically significant positive changes in proficiency after assessment period, suggesting learners demonstrated meaningful learning gains despite undernutrition status. This aligns with Villamor (2021) that targeted language and math interventions yield significant improvements among at-risk learners, and with Canillo & Alferez (2025) that SBFP improves concentration. Qualitative expansion explains mechanisms: Mother Tongue (Cebuano) instruction made instructions accessible, reducing hesitation; visual aids, music, storytelling, peer-assisted learning scaffolded instruction; household manipulatives (spoons, coins, slippers) concretized abstract concepts. Theoretical integration: Maslow physiological support via feeding replenished energy, enabling Piagetian active engagement, facilitated by Bronfenbrenner microsystem synergy. Limitations: no control group, small sample, cannot attribute improvement solely to specific intervention; concurrent feeding and instructional adaptations confound. Nevertheless, significance indicates intervention period associated with progress.

LITNUM	Improved	Declined	p-value	Decision
Literacy	9	0	.0039*	Reject H0 Significant
Numeracy	8	0	.0078*	Reject H0 Significant

Significant Difference in ECCD Domain Scores

Table 8 presents Wilcoxon Signed-Rank test comparing pre-post median scores. Gross Motor pre median 13.00 (IQR 1.00) post 13.00 (0.00), W=0.00, p=.25 unadjusted, Holm-adjusted .75, not significant. Fine Motor 11.00 to 11.00, p=.25, adjusted .75, NS. Self-Help 21.00 (2.00) to 24.00 (3.50), W=4.00, p=.0273 unadjusted, adjusted .1641, NS after correction. Receptive Language 4.00 (0.50) to 5.00 (0.50), p=.0625, adjusted .3125, NS. Expressive Language 7.00 (1.00) to 8.00 (0.50), p=.1875, adjusted .75, NS. Cognitive 17.00 (1.00) to 21.00 (3.50), W=1.00, p=.0578, adjusted .0547, approaching but not significant. Social-Emotional 22.00 (2.00) to 22.00 (2.00), p=.4609, adjusted .75, NS. None reached significance after Holm adjustment controlling family-wise error for seven comparisons, as recommended by Wasserstein & Lazar (2016) and Fethney (2010) regarding p-value interpretation. Small sample (n=11) limits statistical power, increasing Type II error risk. Descriptive improvements in Self-Help, Receptive, Expressive, Cognitive suggest clinical relevance despite non-significance. Triangulation with qualitative data confirms steady behavioral stability when rest breaks and feeding support provided. Teachers observed fine-motor fatigue during writing, speech hesitation; parents noted shyness, frustration when tired, challenges with self-feeding. This expansion highlights that statistical non-significance does not imply no progress, but need for larger sample, longer follow-up, and targeted intervention for self-help and expressive language.

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Domain	Pre Median (IQR)	Post Median (IQR)	Holm-adjusted p
Gross Motor	13.00 (1.00)	13.00 (0.00)	.7500 NS
Fine Motor	11.00 (1.00)	11.00 (0.00)	.7500 NS
Self-Help	21.00 (2.00)	24.00 (3.50)	.1641 NS
Receptive	4.00 (0.50)	5.00 (0.50)	.3125 NS
Expressive	7.00 (1.00)	8.00 (0.50)	.7500 NS
Cognitive	17.00 (1.00)	21.00 (3.50)	.0547 NS
Social-Emotional	22.00 (2.00)	22.00 (2.00)	.7500 NS

Teachers' and Parents' Descriptions of Cognitive Readiness

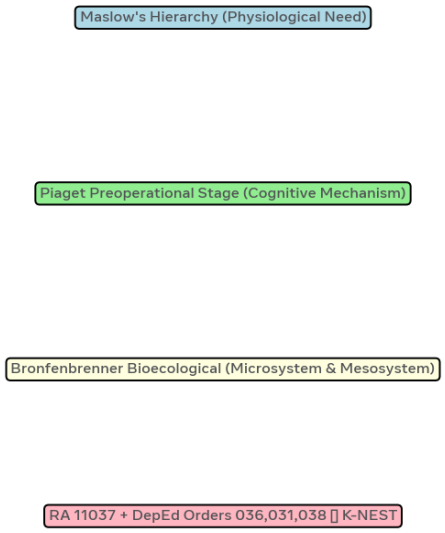
Qualitative analysis yielded themes across five areas: literacy and numeracy readiness, perceived factors, health/nutrition/stamina, learning support, and challenges. Literacy and Numeracy Readiness and Difficulties: Theme 1 Difficulties in Foundational Literacy Skills—teachers and parents repeatedly described challenges in letter recognition, remembering names/sounds, phonological awareness, tracing, writing, blending. Learner C: teacher struggles with letter recognition and pencil control, parent very difficult. Learner H: difficulty letter-sound, tracing. Theme 2 Difficulties in Foundational Numeracy—recognizing printed numbers, sequence, beginning concepts. Parents used toys, snacks, pebbles, spoons, buttons, blocks, candies to concretize. Theme 3 Emerging Improvement—teachers described improvement from Beginning to Developing, greater participation, confidence, while some required structured support. Factors Perceived to Influence Cognitive Readiness: Theme 1 Age, Development, Absorption Capacity—younger children short attention, slow processing, immature fine-motor, pencil grip, need frequent rest. Theme 2 Language of Instruction and Concrete Materials—Cebuano/Sinugbuanong Binisaya made instructions accessible, reduced hesitation; hands-on items like toys, bottle caps, stones, picture cards bridged abstract to concrete, aligning with Piaget concrete operational support and SEAMEO INNOTECH (2021) vocabulary-numerical link. Health, Nutrition, Stamina, Learning Engagement: Theme 1 Undernutrition, Fatigue, Reduced Concentration—chronic undernutrition compromised endurance, lethargy, extreme fatigue, drowsiness shortly into sessions, shortened attention, hampered retention. Supports Kirolos et al. (2022), EDCOM II (2023). Theme 2 Role of Feeding Programs—targeted snack feeding replenished energy, allowed focus, stabilized attendance, improved stamina, consistent with EDCOM II (2023), Canillo & Alferez (2025). Learning Support at School and Home: Theme 1 Differentiated Classroom Strategies, Scaffolding, Multisensory—teachers broke lessons into short bite-sized modules, complex tasks early morning when energy highest, utilized music, storytelling, visual aids, peer-assisted learning to scaffold without overwhelming. Theme 2 Home-Based Guidance, Manipulatives, Routines—parents established short regular routines, guided step-by-step, incorporated everyday items (spoons, slippers, plates, coins) to practice counting, provided encouragement, frequent rest breaks. Challenges: Theme 1 Teacher Challenges Pacing and Managing Absences—balancing individualized attention with class needs, managing health-related absences, fatigue-driven attention loss, continuous readjustment, struggling to maintain progress while accommodating frailty. Theme 2 Socioeconomic Constraints, Household Demands, Knowledge Gaps—parents limited financial resources, time constraints, lack familiarity with modern kindergarten curricula, preparing budget-friendly nutrient-rich meals while juggling chores restricted tutoring time, scarcity of materials, difficulties teaching unfamiliar concepts adding stress. These align with Conjares (2021) and World Bank (2021) on home learning environment importance.

Data Triangulation and Integration

Table 9 Joint Display Matrix merges quantitative metrics and qualitative insights to assess convergence, expansion, nuance. Nutritional Status: quantitative 90.9% wasted, 9.1% severely wasted; qualitative teachers report resting heads, rapid lethargy, fatigue; parents report skipping meals, low appetite, exhaustion; triangulation outcome Convergence—BMI metrics directly align with observed exhaustion, reduced attention, low study endurance. Literacy: pre 100% Beginning post 81.8% Developing McNemar significant; teachers note initial struggles with letter-sound, pencil grip mitigated by Cebuano and visual aids, parents bedtime storybooks, tracing; Convergence & Expansion—gains match reported progress, qualitative shows Cebuano scaffolding and short tasks enabled gains despite low energy. Numeracy: pre 100% Beginning post 63.6% Developing 9.1% Consistent significant; teachers difficulty digit >5 improved via games, parents count real-life items; Convergence & Expansion—test gains reflect progress, tactile objects bridged abstract. ECCD: pre high delays Self-Help 72.7% and Expressive 45.5%, post 100% Average in 5 domains, Wilcoxon non-significant; teachers fine-motor fatigue, speech hesitation; parents shyness, frustration, self-feeding challenges;

Expansion & Nuance—while statistical tests non-significant due to small sample, qualitative confirms steady stability when rest and feeding provided. Overall triangulation demonstrates academic instruction alone insufficient; persistent delays in self-help and expressive language plus socioeconomic constraints justify K-NEST program combining screening, feeding, developmental intervention, home-school coordination.

Figure 1. Theoretical Framework Schematic



Conclusion:

The study investigated cognitive readiness of eleven kindergarten learners with undernutrition status at Kalunasan Elementary School SY 2026-2027 using mixed-methods case study. Baseline physical assessment revealed widespread acute undernutrition: 90.9% wasted, 9.1% severely wasted, converging with teacher and parent reports of lethargy, short attention, rapid exhaustion, skipped meals. This confirms Maslow's premise that unmet physiological needs override cognitive engagement and supports WHO (2023) and Kirolos et al. (2022) linking malnutrition with neurodevelopmental and academic risks.

Despite this, learners demonstrated meaningful and statistically verified progress in foundational literacy and numeracy. Literacy moved from 100% Beginning to 81.8% Developing; numeracy from 100% Beginning to 63.6% Developing and 9.1% Consistent, with McNemar tests significant at p=.0039 and p=.0078 respectively. Qualitative expansion revealed mechanisms: Mother Tongue Cebuano instruction, bite-sized modules, early morning scheduling of complex tasks, visual aids, music, storytelling, peer-assisted learning, and parental use of household manipulatives (spoons, coins, slippers, bottle caps, stones) enabling concrete understanding. These findings align with Piaget's preoperational need for concrete manipulation and Bronfenbrenner's mesosystem synergy, and support Dulal et al. (2021) that integrated nutrition and stimulation yields greater cognitive-language benefits.

ECCD developmental tracking showed generally Average performance post-intervention in gross motor, fine motor, receptive language, cognitive, social-emotional (100%), but persistent delays in self-help (9.1% significant, 36.4% slight) and expressive language (18.2% slight). Wilcoxon Signed-Rank tests showed no statistically significant changes after Holm correction, with cognitive domain approaching significance (adjusted p=.0547). Small sample limits power, but descriptive stabilization suggests clinical relevance. Qualitative data contextualized persistent challenges: fine-motor fatigue during writing, speech hesitation, shyness, frustration when fatigued, and parental time constraints impacting self-care mastery.

Triangulation highlights two critical insights: first, convergence between BMI metrics and classroom lethargy

confirms physical status directly explains exhaustion; second, expansion shows academic gains possible despite frailty when instruction contextualized and supported by feeding. School feeding programs emerged as essential boosters replenishing energy, stabilizing attendance, and enhancing alertness, consistent with RA 11037 mandate and DepEd Orders.

Thus, while acute undernutrition severely compromises stamina, attention, and baseline performance, it does not permanently impede academic growth when properly supported. Sustaining outcomes requires holistic framework unifying continuous health tracking, nutritional intervention, developmental screening, literacy/numeracy support, and structured home-school collaboration. The study proposes K-NEST: Kindergarten Nutrition, Early Development, and School-readiness Tracking—institutionalized program with Screen, Assess, Identify, Intervene, Monitor, Refer, Reassess cycle, integrated into existing SBFP and ECCD activities, emphasizing early identification, early intervention, shared responsibility among school head, teachers, health personnel, parents, and stakeholders. Recommendations include developing specialized modules for expressive language and self-help, supporting parents with time-efficient micro-routines, strengthening quarterly monitoring and reassessment, and conducting larger-sample longitudinal replication to evaluate long-term sustainability.

Hence, findings underscore that addressing undernutrition in kindergarten is not merely health issue but educational equity imperative; holistic, localized, preventive monitoring ensures undernourished learners are not left behind in foundational learning.

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