

# Sum-Vantes Poultry Farm: A Manipulative Drill Package for Addition

Andrhea Justine C. Galutan<sup>1</sup>, Jenny Lyne S. Lisayen, MAED<sup>2</sup>

Bachelor of Elementary Education. Ilocos Sur Polytechnic State College, Cervantes Campus, Cervantes, Ilocos Sur, Philippines

DOI: <https://doi.org/10.47772/IJRISS.2026.100400499>

Received: 17 April 2026; Accepted: 22 April 2026; Published: 15 May 2026

## ABSTRACT

Foundational mathematical operations like addition are crucial for early learners, but most existing interventions target middle or upper primary learners. There remains a significant research gap in the localized development of manipulative tools for Grade 1 students. This study aimed to develop and validate a Manipulative Drill Package (MDP) to enhance the addition performance of Grade 1 learners at Cervantes Central School. Using a developmental research design guided by the Successive Approximation Model (SAM), the study identified that students struggle significantly with solving problems involving sums up to 100 without regrouping, which served as the primary basis for the MDP's content. The resulting MDP features concrete, interactive, and engaging materials such as counters and visual aids designed to target identified learning gaps. Validation results from experts indicated that the MDP is a valid instructional tool, receiving high ratings for content quality, format, presentation, and organization based on the LRMDs evaluation checklist. The study concludes that the developed MDP is an innovative and valid instructional material capable of improving learner engagement and strengthening foundational arithmetic skills. It is recommended that Grade 1 mathematics teachers utilize this package to enhance student performance and engagement, while future researchers may use the study's methodologies as a reference for developing additional numeracy-focused instructional tools.

**Keywords:** Mathematics Education, Manipulative Drill Package (MDP), Grade 1 Learners, Addition Operation, Early Numeracy.

## INTRODUCTION

### Background of the Study

Mathematics plays a fundamental role in human civilization and continues to influence many aspects of modern life. From the basic arithmetic operation used in everyday transactions to the complex algorithms that drive technological innovations, mathematics serves as a critical tool for understanding and interacting with the world. It provides a structured framework that supports logical reasoning, creativity, and informed decision-making, thereby enabling individuals and societies to respond to emerging challenges and opportunities (Skovsmose, 2021). Moreover, mathematics education contributes significantly to scientific advancement, economic development, and technological progress, making it a vital component of national and global development (Ucang, 2022; Verdeflor & Pacadaljen, 2021).

In contemporary society, numeracy is no longer viewed merely as an academic requirement but as an essential life skill that supports learning, innovation, and personal development. Numeracy empowers individuals to make informed decisions, interpret data, and solve real-world problems. The promotion of numeracy is closely aligned with global educational priorities, particularly Sustainable Development Goal 4 (SDG 4), which advocates for inclusive, equitable, and quality education for all learners. Achieving this goal requires strengthening foundational skills such as literacy and numeracy, particularly during the early years of schooling when children begin to develop essential cognitive and problem-solving abilities (UNESCO, 2024; GPE Secretariat & Pinkett, 2020; Knospe et al., 2023). Developing strong mathematical foundations at an early age can improve learners' educational outcomes, support economic participation, and contribute to sustainable communities.

Globally, educational initiatives emphasize the importance of early childhood and primary education in establishing a strong foundation for learners' cognitive, social, and emotional development. Early mathematical experiences significantly influence children's later achievement in mathematics and other academic areas. Structured learning activities, regular practice, and meaningful interactions between teachers and learners have been shown to effectively improve young children's understanding of addition operation concepts (UNESCO & UNICEF, 2024; OECD, 2024). However, many countries continue to face challenges in ensuring equitable access to quality mathematics education. Learners from disadvantaged backgrounds, including those from low-income families, conflict-affected areas, and communities experiencing climate-related disruptions, often encounter barriers to quality learning opportunities. These early disadvantages tend to persist throughout schooling, resulting in substantial achievement gaps in mathematics performance (UNICEF, 2021; OECD, 2024).

Internationally, several countries have implemented strategies to strengthen mathematics education during the early years. For example, organizations such as the National Association for the Education of Young Children (NAEYC) and the National Council of Teachers of Mathematics (NCTM) advocate for developmentally appropriate mathematics instruction that incorporates play-based learning, manipulative materials, and meaningful real-world experiences to support conceptual understanding among young learners (Department of Education, 2024; NAEYC, 2024). Similarly, high-performing education systems such as Singapore and China emphasize structured curricula, highly trained teachers, and instructional approaches such as the Concrete–Pictorial–Abstract (CPA) method, which enables learners to build deep conceptual understanding before transitioning to abstract mathematical thinking (Huang & Hua, 2025).

Despite these initiatives, global assessments reveal persistent challenges in mathematics achievement. Results from the Programme for International Student Assessment (PISA) 2022 showed a significant decline in mathematics performance worldwide, partly attributed to disruptions caused by the COVID-19 pandemic. While top-performing countries such as Singapore, Macao (China), Chinese Taipei, Hong Kong, and Japan recorded high average scores ranging from 536 to 575, the Philippines scored only 355 in mathematics, which remains far below the OECD average of 472 (OECD, 2024). Similarly, the Trends in International Mathematics and Science Study (TIMSS 2019) reported that the Philippines ranked among the lowest-performing education systems in both Grade 4 and Grade 8 mathematics, highlighting persistent challenges in foundational mathematical competencies among Filipino learners (Mullis et al., 2020).

In response to these concerns, the Philippine government has introduced several initiatives to improve foundational learning outcomes. The Department of Education (DepEd) implemented the National Learning Recovery Program to address learning losses caused by the COVID-19 pandemic and to strengthen literacy and numeracy programs within the K–12 curriculum (Department of Education, 2023). Programs such as the Mathematical Teachers Association of the Philippines (MTAP) aim to enhance students' mathematical competencies by providing enrichment activities and review programs that support learners' mastery of mathematical concepts. Furthermore, collaborative initiatives between UNICEF Philippines and the University of the Philippines National Institute for Science and Mathematics Education Development (UP NISMED) have introduced digital learning tools and applications designed to improve young learners' engagement in mathematics and science (UP NISMED, 2024).

Despite these efforts, research indicates that many young learners still struggle with addition operation. Difficulties in solving arithmetic problems often stem from limited reading comprehension, weak conceptual understanding of numerical relationships, and confusion regarding operational symbols and procedures such as regrouping and borrowing (Gottfried et al., 2022; Ergiblin et al., 2022). These challenges highlight the need for instructional approaches that emphasize concrete experiences and interactive learning strategies to strengthen foundational mathematical skills.

Various instructional interventions have been explored to address these challenges. Studies have shown that strategies such as simulations, educational games, and technology-based learning tools can improve students' motivation, engagement, and academic performance in mathematics (Istiyowati et al., 2020; Almaki et al., 2023). Similarly, game-based instructional materials have been found to enhance students' enjoyment and participation in learning mathematical concepts (Jalandoni et al., 2024). Additionally, well-designed instructional materials

and learning tools have been demonstrated to improve mathematical performance by increasing learners' confidence, accuracy, and fluency in solving problems (Abanum & Akintula, 2022; Javillonar, 2024; Talan, 2021; Yulijayanti et al., 2021). The use of targeted instructional materials also promotes active participation and supports the development of deeper conceptual understanding (Buluran, 2020). Local studies further emphasize the effectiveness of material-based interventions in improving primary-level mathematics learning. Manipulative-based activities and drill packages designed to strengthen basic operation have shown positive effects on learners' mathematical proficiency and conceptual understanding (Batan, 2024; Reyes et al., 2024). Existing studies often focus on upper elementary or secondary-level learners, while limited research has examined the development and effectiveness of localized manipulative drill packages specifically designed for Grade 1 learners who are at a critical stage in developing foundational mathematical competencies (Batan, 2024; Buluran, 2020; Reyes et al., 2024). This gap shows the need for contextually relevant instructional materials that support early learners in mastering fundamental operation such as addition.

This study aimed to address this research gap by developing a Manipulative Drill Package (MDP) for Addition Operation specifically designed for Grade 1 learners at Cervantes Central School. The study seeks to determine the effectiveness of the developed instructional package in improving students' engagement, conceptual understanding, and performance in addition. By providing structured, hands-on learning experiences, the intervention was intended to support learners in building strong mathematical foundations essential to their future academic success.

## REVIEW OF RELATED LITERATURE

This section presented relevant literature that provided the foundation for this study. It was organized into two categories: Performance in Mathematics, Manipulative Materials in Teaching Mathematics.

Global assessments reveal persistent challenges in mathematics learning across many educational systems. The Programme for International Student Assessment (PISA) 2022 reported a worldwide decline in students' mathematics performance, largely attributed to disruptions caused by the COVID-19 pandemic. High-performing countries such as Singapore, Macao (China), Chinese Taipei, Hong Kong, and Japan achieved mean scores ranging from 536 to 575, demonstrating strong mathematical literacy among learners. In contrast, the Philippines recorded a score of 355, which remains significantly below the Organisation for Economic Co-operation and Development (OECD) average of 472 (OECD, 2024). Although the country showed a slight improvement from its 2018 score of 353, the results continue to indicate major gaps in mathematical proficiency among Filipino learners.

Similarly, the Trends in International Mathematics and Science Study (TIMSS 2019) revealed that the Philippines ranked among the lowest-performing countries among participating education systems in both Grade 4 and Grade 8 mathematics (Mullis et al., 2020). The most recent TIMSS cycle also introduced a fully digital assessment format that allows more complex problem-solving and inquiry-based tasks, providing deeper insights into students' mathematical thinking processes (TIMSS, 2023). These international findings highlight the need to strengthen foundational numeracy skills among learners, particularly during the early years of schooling.

### Performance in Mathematics

Mathematics is widely recognized as a core subject across all levels of education because it develops critical thinking, problem-solving skills, and logical reasoning. However, many learners continue to experience difficulties in mastering mathematical concepts. The disruptions caused by the COVID-19 pandemic have further widened existing learning gaps, particularly among young learners who require consistent and guided instruction in foundational skills (Sooknanan & Seemugal, 2023). According to the SEAMEO INNOTECH (2023) analysis of PISA data, only 16% of Filipino learners reached at least Level 2 proficiency in mathematics, indicating that the majority of students struggle with addition operation tasks such as interpreting simple data and solving routine problems.

Several studies have examined the factors influencing students' mathematics performance. Saha et al. (2024) emphasized that both academic preparedness and emotional readiness play crucial roles in learners'

mathematical achievement. Their findings shows that differences in learning behaviors and motivation can significantly affect students' performance in mathematics. For instance, inconsistent study habits and limited motivation may hinder learning among some students, while others struggle with abstract mathematical concepts and balancing academic demands.

Motivational and psychological factors also contribute to mathematics performance. Bengmark et al. (2017) proposed a conceptual framework highlighting the importance of self-efficacy, motivation, study habits, and students' overall perceptions of mathematics. Their findings shows that learners who develop positive attitudes toward mathematics and effective learning habits are more likely to succeed in mathematical tasks. Similarly, Román-Mata et al. (2020) and Muhtadi et al. (2022) reported that emotional intelligence plays an important role in students' academic success by helping them manage academic stress and maintain motivation during challenging learning situations.

Cognitive strategies also influence mathematical learning. Memnun and Hart (2020) demonstrated that metacognitive training significantly improved students' problem-solving abilities in mathematics. Students who were taught to reflect on their thinking processes were able to analyze mathematical problems more effectively and select appropriate solution strategies. These findings were further supported by Aini and Khuzaini (2024), who reported that metacognitive awareness enhances students' understanding of mathematical concepts across diverse learning contexts. Despite these findings, difficulties in mastering addition operation concepts remain evident among elementary learners. Erbilgin et al. (2022) found that many primary students struggle with understanding fundamental terms such as "sum" and "difference" due to weak conceptual foundations and the absence of effective instructional support. Likewise, Murillo and Tan (2022) identified several least-mastered competencies in elementary mathematics, including number line representation and set operation.

Local studies further confirm the persistence of these challenges. Batan (2024) reported that nearly half of Grade 2 learners in Pasig City struggled with both routine and non-routine mathematical problems. Other studies also revealed deficiencies in learners' understanding of number comparison, place value, and basic problem-solving skills (Gill, 2024; Magtolis, 2023; Pellissier, 2023). These findings shows that many learners do not acquire the necessary foundational competencies during the early stages of schooling. Consequently, researchers emphasize the importance of implementing structured and developmentally appropriate numeracy interventions to address these learning gaps.

The literature indicated that mathematics performance was influenced by a combination of cognitive, motivational, and instructional factors. Addressing these challenges requires effective teaching strategies and supportive learning environments that enhance learners' confidence, engagement, and conceptual understanding in mathematics.

### **Manipulative Materials in Teaching Mathematics**

One instructional strategy widely recognized for improving mathematics learning is the use of manipulative materials. Manipulatives are concrete objects that allow learners to physically explore mathematical concepts, making abstract ideas more understandable and meaningful.

Numerous studies highlight the effectiveness of manipulative-based instruction in enhancing students' engagement, conceptual understanding, and problem-solving skills.

Tandika et al. (2022) emphasized that well-designed instructional materials help develop learners' critical thinking, creativity, and problem-solving abilities, particularly in mathematics education. Their qualitative study revealed that teachers who utilized diverse learning materials were able to provide more effective and differentiated instruction suited to learners' developmental needs. Similarly, Songkram (2020) found that structured instructional packages increase student engagement and promote active learning by connecting mathematical concepts with real-life applications.

Research also indicates that instructional materials improved learners' accessibility to mathematical content. Portana et al. (2021) observed that well-organized and contextually relevant materials help learners understand

mathematical ideas more effectively because students can directly experience and interact with the concepts being taught. Likewise, Dharmas (2023) reported that manipulative instructional materials significantly improved classroom participation and conceptual understanding among learners with diverse needs, although challenges such as cost and teacher training remain barriers to wider implementation.

Technology-supported manipulatives and simulations also contribute to improved mathematics learning. Studies by Talan (2021) and Alenezi (2020) demonstrated that simulations and interactive models help learners visualize abstract mathematical concepts, making them easier to understand. These tools also increase students' motivation and participation in mathematics learning.

Similarly, Abanum and Akintula (2022) found that game-based learning and simulation activities improve learners' engagement and retention of mathematical concepts. These approaches create interactive learning environments where students actively participate in problem-solving activities. Laidin et al. (2021) also reported that simplified instructional methods, such as the Butterfly Method for teaching fractions, significantly improved learners' conceptual understanding.

Early intervention using manipulative materials has also been shown to improve addition operation skills among young learners. Anderson et al. (2022) reported that many elementary students struggle with mental arithmetic and multi-digit calculations as early as Grade 2. Their findings highlight the importance of incorporating engaging and tangible learning strategies, including manipulatives and structured practice activities, to strengthen computational fluency in the early grades.

Product development studies further support the effectiveness of manipulative materials. Yuliwijayanti et al. (2021) developed wooden manipulative tools for teaching addition, which received high validation ratings from experts and positive feedback from students. The study concluded that tangible learning materials are highly effective in improving young learners' understanding of mathematical concepts.

Local intervention programs also demonstrate the potential of structured support in improving numeracy skills. Reyes et al. (2024) implemented Project BIBO, a numeracy intervention program that provided tutorials, home visits, and supplementary learning activities. The program significantly improved learners' arithmetic performance, indicating the effectiveness of targeted instructional interventions. Similarly, Layug et al. (2021) emphasized the need to sustain and expand such programs to address persistent inequalities in mathematics achievement.

Despite the positive outcomes of these initiatives, national numeracy assessments still reveal considerable difficulties among learners in performing the addition operation (Reyes et al., 2024). These findings show that additional innovative and learner-centered instructional strategies are needed to strengthen foundational mathematical skills.

## Framework of the Study

This study is anchored on established learning theories and instructional design principles that explain how young learners acquire knowledge and develop foundational mathematical skills. These theories provide the conceptual foundation for the development of a Manipulative Drill Package (MDP) aimed at enhancing the performance of Grade 1 learners in addition operation. The study is supported by Edward Thorndike's Connectionism Theory, Piaget's Cognitive Development Theory, Bruner's Spiral Curriculum, Skinner's Operant Conditioning Theory, and Allen's Successive Approximation Model (SAM). These theories are appropriate for the present study because they collectively explain how learners develop understanding through readiness, repeated practice, reinforcement, and developmentally appropriate instructional strategies. Moreover, these theories support the use of manipulative materials and structured drills as effective approaches for improving learners' mastery of addition operation.

Thorndike's Connectionism Theory explains that learning occurs through the formation of associations between stimuli and responses, which become stronger through repetition and reinforcement. Thorndike proposed three major laws of learning: the Law of Readiness, the Law of Exercise, and the Law of Effect. The Law of Readiness

states that learners perform better when they are mentally and physically prepared to learn. In the context of early mathematics education, this principle highlights the importance of ensuring that instructional activities match the developmental level of the learners (Xhomara, 2026). This concept is supported by Piaget's Cognitive Development Theory, which explains that children progress through different stages of cognitive development and that their ability to understand concepts depends on their developmental stage. Learners in the early primary years are generally in the pre-operational or early concrete operational stage, where they learn best through concrete experiences rather than abstract explanations. As a result, the use of manipulatives allows learners to physically interact with numbers and mathematical ideas, making abstract concepts such as addition easier to understand (Piaget, 1969). In relation to the present study, this theory supported the identification of the learners' level of performance in addition operation and the determination of least mastered competencies, as learners' readiness and cognitive stage influence their ability to perform mathematical tasks.

Bruner's theory of instruction, particularly the Spiral Curriculum, further supported the development of the Manipulative Drill Package. Bruner proposed that learning should be organized in such a way that fundamental ideas are introduced in simple forms and revisited repeatedly with increasing complexity as learners' cognitive abilities develop. According to Bruner, readiness to learn does not depend solely on maturation but also on the structure of instruction and the strategies used by the teacher. In mathematics education, the spiral approach allows learners to repeatedly encounter addition concepts through progressively challenging activities. In this study, the manipulative drill activities are designed to provide repeated exposure and structured practice in addition operation, enabling learners to gradually strengthen their understanding of number relationships and improve their performance. This theoretical perspective supported the development of the Manipulative Drill Package prototype that addresses the identified needs and least mastered competencies of the learners (Bruner, 1960).

Another important component of Thorndike's theory is the Law of Exercise, which emphasizes that learning is strengthened through repetition and practice. The more frequently a stimulus-response connection is practiced, the stronger the association becomes. In mathematics learning, repeated practice helps learners develop fluency in addition operation. Manipulative drills provide opportunities for learners to practice addition operation in a structured and engaging manner. Through consistent exposure to these activities, learners develop greater familiarity with number relationships and improve their computational skills. The Law of Exercise supported the design of the Manipulative Drill Package as it emphasizes the importance of repeated practice in achieving mastery of mathematical concepts. This principle also supports the validation and development of the instructional material, as the package aims to provide consistent and meaningful practice that enhances learners' performance (Aqsha and Saprin, 2026).

The Law of Effect, another principle proposed by Thorndike, explains that behaviors followed by satisfying outcomes are more likely to be repeated, while those followed by unpleasant outcomes are less likely to occur. This concept highlights the importance of positive learning experiences in encouraging learners to continue engaging in academic tasks. Skinner expanded this principle through his Operant Conditioning Theory, which emphasizes that behavior can be strengthened through reinforcement. Positive reinforcement, such as praise, rewards, or successful completion of tasks, increases the likelihood that learners will repeat the desired behavior. In the context of mathematics instruction, when learners successfully complete addition tasks using manipulatives and receive positive feedback, they become more motivated and confident in performing similar tasks. This theoretical perspective supports the design of manipulative drills that create enjoyable and rewarding learning experiences for students. It also supports the analysis of the research results by explaining how reinforcement and positive experiences influence learners' engagement and performance in addition operation (Skinner, 1960).

The development of the instructional material in this study was also guided by Allen's Successive Approximation Model (SAM), which is an instructional design framework that emphasizes iterative development, evaluation, and refinement of instructional products. SAM shows that educational materials should be developed through cycles of design, testing, feedback, and improvement to ensure that they effectively meet the needs of learners. In the present study, the Manipulative Drill Package is developed based on the identified least mastered competencies of Grade 1 learners in addition operation. The package is then subjected to validation to ensure its effectiveness and appropriateness for classroom use. This framework supports the

process of developing and refining the instructional material to ensure that it addresses the learners’ needs and improves their mathematical performance (Allen, 2012).

These theories also guided the analysis and interpretation of the research results. Thorndike’s Connectionism Theory and the Law of Exercise help explain improvements in learners’ performance as a result of repeated practice through manipulative drills. Piaget’s Cognitive Development Theory provides insight into how the use of concrete materials supports learners’ conceptual understanding of addition. Bruner’s Spiral Curriculum explains how repeated exposure to mathematical concepts through structured activities can gradually strengthen learners’ mastery of addition skills. Meanwhile, Skinner’s Operant Conditioning Theory explains how positive reinforcement and successful learning experiences influence learners’ motivation and engagement. Finally, Allen’s SAM model explains how the systematic development and validation of the instructional package contribute to its effectiveness as a learning tool (Xhomara, 2026). The integration of these theories provides a comprehensive theoretical foundation for the present study. Thorndike’s Connectionism Theory emphasizes readiness, practice, and reinforcement as essential components of learning; Piaget’s Cognitive Development Theory highlights the importance of developmentally appropriate instruction; Bruner’s Spiral Curriculum supports the progressive reinforcement of concepts through repeated exposure; Skinner’s Operant Conditioning Theory explains the role of reinforcement in shaping learning behavior; and Allen’s Successive Approximation Model provides a systematic framework for developing and refining instructional materials. Together, these theories guide the development of the Manipulative Drill Package and provide a strong theoretical basis for addressing the specific objectives of the study, including determining the learners’ level of performance in addition operation, identifying the least mastered competencies, and developing and validating an instructional package that supports learners’ mathematical development. Through the integration of these theoretical perspectives, the study ensures that the instructional intervention is grounded in sound educational principles and aligned with the goal of improving the addition performance of Grade 1 learners.

## CONCEPTUAL FRAMEWORK

The development of the output is anchored on the Successive Approximation Model by Michael Allen, which comprises three major phases namely Preparation, Iterative Design, and Iterative Development. Allowing the instructional material to be systematically planned, designed, and improved. Preparation Phase. This phase served as the initial foundation of the study, where the researcher focused on a comprehensive Needs Analysis. During this stage, the researcher identified the specific learning needs of the students and determined the competencies that required improvement. This involved examining the level of performance of Grade 1 students in both addition and subtraction to pinpoint the least mastered competencies. Data were collected through diagnostic tests (pre-tests) and a review of existing learner performance records. The results of this analysis helped define the objectives of the study and generated the initial ideas for developing a Manipulative Drill Package (MDP) designed to bridge the identified learning gaps.

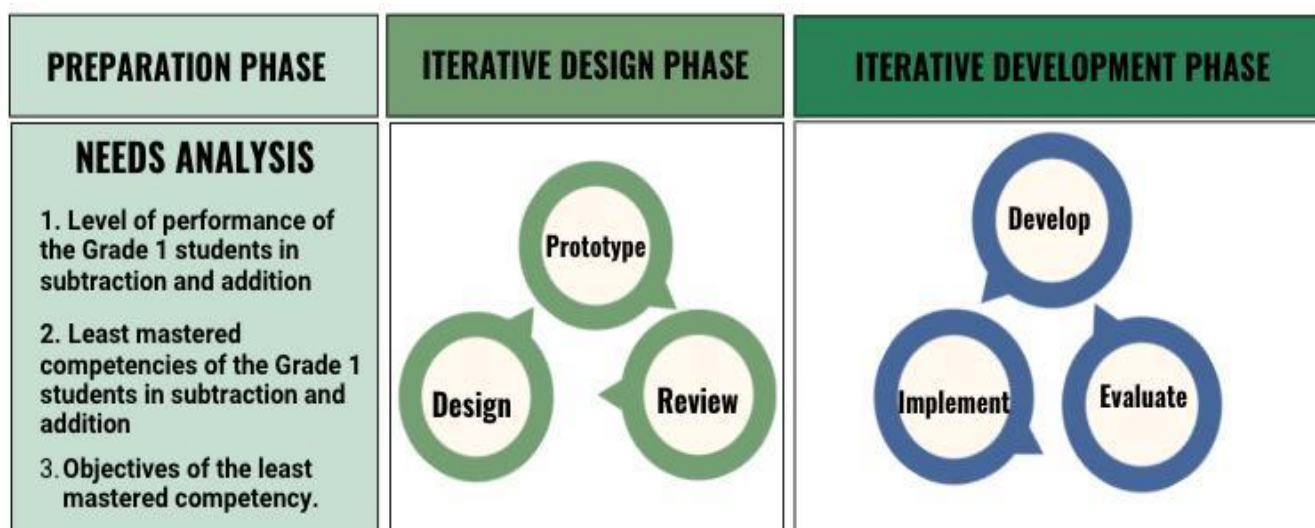


Figure 1. The Research Illustration

Iterative Design Phase. This phase focusing on a cyclic process of Design, Prototype, and Review. In this phase, the conceptual framework of the MDP was translated into a preliminary version of the instructional material. The researcher created a prototype based on the requirements identified during the preparation phase. This prototype then underwent a review process to ensure that the design was mathematically sound and pedagogically appropriate for Grade 1 pupils. This iterative approach allowed for adjustments and refinements to be made to the MDP's structure and mechanics before it moved into full development.

Iterative Development Phase. In this phase the study transitioned into the actual creation and refinement of the instructional package through the stages of Develop, Implement, and Evaluate. The researcher finalized the physical and instructional components of the MDP, ensuring the material was ready for use. However, a significant limitation of this study was that while the development and evaluation stages were conducted to ensure the material's quality and validity, the Implementation stage was not fully executed.

Consequently, the research focused on the design and validation of the tool rather than its application in a live classroom setting. This phase concluded with an evaluation of the developed material to ensure it met the pre-defined objectives of the study.

### **Statement of the Problem**

This study generally aimed to develop a Manipulative Drill Package (MDP) to enhance the performance of Grade 1 learners in addition operation at Cervantes Central School, located in Concepcion, Cervantes, Ilocos Sur. Specifically, it sought to answer the following questions:

1. What is the level of performance of Grade 1 learners in the addition operation?
2. What are the least mastered competencies based on the learners' performance in addition operation?
3. What prototype of a Manipulative Drill Package can be developed based on the identified needs of the learners?
4. What valid Manipulative Drill Package can be developed to address these needs?

### **Importance of the Study**

The findings of this study may be beneficial to the following:

**Grade 1 Pupils.** The developed Manipulative Drill Package for Addition Operation for Grade 1 may help learners improve their performance in addition, making the learning process enjoyable and interactive.

**Grade 1 Mathematics Teachers.** The developed Manipulative Drill Package could serve as an instructional tool to enhance the performance level of the learners in addition and increase student engagement.

**Pre-Service Teachers.** The study may offer insights and effective strategies, particularly the use of the Manipulative Drill Package for addition operation for Grade 1, to improve the teaching of addition lessons for early grade learners.

**Parents.** The developed Manipulative Drill Package (MDP) serves as a valuable resource for parents, enabling them to actively participate in their child's mathematical development. By providing structured and easy-to-use materials, it helps parents guide their children through addition exercises at home with ease.

This collaboration between home and school strengthens the learner's foundation while making the teaching process more manageable and less stressful for the parents.

**Future Researchers.** The results and methodologies used in this study may serve as a reference or basis for related research focusing on improving numeracy skills through instructional materials and manipulative tools.

## Definition of Terms

To ensure a clear understanding of the study, the following terms are defined operationally:

**Performance Level.** This refers to the demonstrated ability of Grade 1 learners in performing the addition operation as measured by assessment tools, and it helps categorize students' academic progress.

**Grade 1 Learners.** These pertain to the students enrolled in the first year of primary education at Cervantes Central School, Concepcion, Cervantes, Ilocos Sur.

**Least Mastered Competencies.** These are the specific competencies or concepts that students find most difficult, as indicated by assessment results. Identifying these competencies helps guide instructional interventions.

**Prototype.** A preliminary version of a tool, resource, or instructional material created to meet specific learning needs. It is subject to evaluation and improvement before final implementation.

**Develop.** This refers to the process of designing, creating, and refining educational tools or strategies to enhance learning outcomes. This involves research, evaluation, and iterative revision.

**Manipulative Drill Package (MDP).** It is a collection of hands-on, interactive materials and activities designed to reinforce mathematical concepts through tactile and visual learning. The MDP aims to support conceptual understanding and skill mastery in addition operation.

## METHODOLOGY

This chapter outlines the methodology employed in the study to address its objectives. It discusses the research design, population and locale of the study, respondents, research instruments, data gathering procedures, statistical treatment of data, data categorization, and ethical considerations.

### Research Design

The study utilized a developmental research design, which aimed to design, develop, and validate a Manipulative Drill Package (MDP) intended to enhance academic performance in addition operation. Developmental research is a systematic methodology used to create and evaluate instructional tools, interventions, or materials through iterative stages of planning, design, development, and validation. According to Richey and Klein (2007), developmental research emphasizes producing effective instructional materials while simultaneously studying the development process.

### Population and Locale of the Study

The study was conducted during the School Year 2025–2026 at Cervantes Central School, located in Barangay Concepcion Cervantes, Ilocos Sur. The main participants were the Grade 1 learners enrolled in the said school. Their performance in addition operation was assessed to identify the least mastered competencies, which served as the basis for developing the MDP.

In addition, the members of the Oral Examination Committee (OrEC) at Ilocos Sur Polytechnic State College–Cervantes Campus and teachers from DEPED served as validators of the developed MDP. They were selected based on the following criteria: expertise in mathematics or early childhood education; background in instructional materials development; willingness to participate and provide feedback; and highly expert in Instructional Materials.

<b>Respondents</b>	<b>Number</b>
Learners	22
Validators	6
<b>Total</b>	<b>28</b>

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## Research Instrument

The following research instruments were used:

**Performance Test.** It contained 30 items (multiple choice) and assessed the learners' proficiency in addition from the 1st to the 2nd grading periods. It was designed based on the Table of Specifications aligned with the Matatag Curriculum.

**Validation Checklist.** The checklist adapted from the Learning Resources Management and Development System (LRMDS) of the Department of Education, was used to evaluate the developed MDP. It assessed the material's content quality, format, presentation, and organization.

## Data Gathering Procedures

Before conducting this study, the researcher requested permission from the school principal and the Grade I adviser of Cervantes Central School to involve the Grade I pupils as respondents.

The researcher administered the performance test to the Grade 1 pupils. Their papers were collected, checked, and analyzed to determine the least mastered competencies in addition.

The researcher created a specific plan that served as the foundation for the materials. This plan involved aligning the instructional goals with the identified least mastered competencies. The objectives, lesson content, and activities were based on the MATATAG Curriculum Guide before proceeding to the development of the Manipulative Drill Package. In this phase, the researcher established clear learning objectives, selected appropriate mathematical manipulatives, and outlined engaging and developmentally appropriate activities for Grade 1 pupils. An iterative process was employed, meaning that ideas were continually refined through cycles of planning, drafting, and feedback, allowing the design to evolve and improve before final development. This approach ensured that the drill package was both effective in targeting specific learning gaps and suitable for the learners' cognitive level.

The researcher developed a Manipulative Drill Package for Addition Operation for Grade 1 based on the least mastered competencies taken from the results of the pre-test. The researcher created a concrete, interactive, and engaging manipulative drill package. This phase was focused on the creation and refinement of all components of the package, ensuring that they directly addressed the identified learning gaps and catered to diverse learning styles. The goal was to produce a ready-to-implement resource that effectively built proficiency and supported the development of the least mastered competencies.

After developing the MDP, it was subjected to validation by the experts. Based on their feedback and suggestions, the MDP for addition operation was created and subsequently validated. The comments and recommendations provided by the validators were incorporated to enhance the quality of the MDP for addition operation.

## Statistical Treatment

To ensure the systematic analysis and interpretation of data, appropriate statistical tools were employed. Frequency count and percentage were used to identify the level of performance and the least mastered competencies of the Grade 1 learners in addition operation. This allowed the researcher to determine which specific skills required targeted intervention. Meanwhile, to assess the quality of the developed Manipulative Drill Package (MDP), the weighted mean was used. This helped interpret the evaluators' feedback based on the established criteria from the LRMDS evaluation checklist, covering areas such as content, format, presentation, and organization.

## Data Categorization

The following scales were used to interpret the data gathered in this study:

The table below was used to determine the level of performance of students in Addition operation.

This scale was used to determine the least mastered competencies.

RANGE OF SCORES	INTERPRETATION
1-6	Not Meet Expectation
7-12	Fairly Satisfactory
13-18	Satisfactory
19-24	Very Satisfactory
25-30	Outstanding
SCALE	Interpretation
50% and Below	No Mastery/Least Learned Skill
51% - 74%	Nearly Mastered
75% - 100%	Mastered

The table below was used to determine the validity of the developed Manipulative Drill Package.

RANGE OF SCORE	INTERPRETATION
3.25-4.00	Very Satisfactory
2.50-3.24	Satisfactory
1.75-2.49	Fairly Satisfactory
1.00-1.74	Not Meet Expectation

### Ethical Consideration

To uphold ethical standards, this study prioritized the rights, safety, and well-being of all participants. Prior to participation, learners and their guardians were fully informed of the study’s objectives, procedures, and any potential risks. Participation was strictly voluntary, with no coercion involved, and participants had the right to withdraw from the study at any point without penalty. Confidentiality and privacy were maintained by ensuring that all personal and academic information was treated with strict anonymity.

To ensure the integrity of the research process, all references, data sources, and related materials were properly cited and acknowledged to avoid plagiarism and maintain academic honesty. The presentation of results was conducted with transparency, objectivity, and accuracy, and any potential conflicts of interest were disclosed to preserve the credibility of the study. **r III**

## RESULTS AND DISCUSSION

This chapter presents the results of the analysis and interpretation of data in relation to the study on the development and evaluation of the proposed Manipulative Drill Package for Addition Operation for Grade 1.

### Level of Performance of Grade 1 Learners

Table 1 presents the level of performance of Grade 1 learners on addition operations.

**Table 1. Level of Performance of Grade 1 Learners**

RANGE	INTERPRETATION	FREQUENCY	PERCENTAGE
1-6	Not Meet Expectation	0	0%
7-12	Fairly Satisfactory	3	13.63%
13-18	Satisfactory	3	13.63%
19-24	Very Satisfactory	10	45.45%
25-30	Outstanding	6	27.27%

The distribution of scores reveals that the largest proportion of learners (45.45%) obtained scores within the “Very Satisfactory” level with an overall average performance score of 20. This indicates that the majority of the students have moved beyond basic recognition and are demonstrating a reliable and consistent ability to process and solve addition operations accurately.

By reaching a Very Satisfactory level, these learners are successfully developing the foundational skills necessary for broader scientific advancement and economic development (Ucang, 2022; Verdeflor & Pacadaljen, 2021). Achieving this benchmark aligns these students with the global educational priorities outlined in Sustainable Development Goal 4 (SDG 4), which advocates for inclusive and quality education for all learners. The results show that the students are not merely meeting an academic requirement but are acquiring an essential life skill that supports their long-term personal development.

The findings imply that the current pedagogical approach is highly effective in fostering mathematical proficiency at an early stage. Because the students have attained a Very Satisfactory average, they possess the prerequisite cognitive readiness to transition from simple arithmetic to more complex mathematical tasks. This success reinforces the notion that strengthening numeracy in Grade 1 is a vital component of development, ensuring that learners are equipped to respond to emerging challenges and opportunities (Skovsmose, 2021) as they progress through their academic journey.

The distribution of scores are the following with 27.27% in the “Outstanding” range (25–30). Collectively, this means that 72.72% of the learners performed at above-average levels, suggesting that the majority have developed a strong grasp of basic addition concepts.

Meanwhile, 13.63% of the learners were classified as “Satisfactory” and another 13.63% as “Fairly Satisfactory”. Notably, no learner fell under the Did Not Meet Expectations category, indicating that all learners have at least a minimum level of competency in addition. However, the presence of learners in the lower performance brackets reflects some degree of variability in skill acquisition, particularly in achieving mastery-level understanding.

The results show that foundational numeracy skills in addition have been effectively developed among most learners. The high concentration of learners in the “Very Satisfactory” and “Outstanding” categories indicates not only procedural competence but also a level of conceptual understanding appropriate for Grade 1. This implies that learners are generally able to perform addition tasks with accuracy and consistency, possibly using both symbolic and visual strategies.

On the other hand, the proportion of learners in the “Fairly Satisfactory” and “Satisfactory” levels indicates that while basic understanding is present, some learners may still rely heavily on concrete representations (e.g., counting objects or fingers) and may not yet have fully internalized addition concepts. This highlights the transitional stage of early numeracy development, where learners move from concrete to semi-concrete and abstract thinking.

The present findings are consistent with existing literature on early numeracy development. Studies by Andaya and Cañedo (2025) found that Grade 1 learners in the Philippines often achieve Very Satisfactory levels in basic mathematical skills when instruction is grounded in a strong and well-structured foundational curriculum. This aligns with the high percentage of learners in the upper performance categories observed in the current study.

Similarly, Clements and Sarama (2024) emphasized that developmentally appropriate and systematic instruction significantly improves young learners’ mathematical performance. Their work highlights the importance of aligning teaching strategies with learners’ cognitive development, which may explain the overall high achievement levels in this study.

Furthermore, the findings support the results of Buluran (2020), who reported that the use of interactive and manipulative-based instructional tools enhances learners’ engagement, confidence, and accuracy in solving mathematical problems. This corroborates the implication that introducing a Manipulative Drill Package could further improve the performance of learners, particularly those in the lower achievement brackets.

Chen and Zhang (2024) noted that while young learners may demonstrate basic computational skills, continuous support is necessary to strengthen their numerical awareness and conceptual understanding. This supports the observation that some learners, despite achieving satisfactory levels, still require targeted intervention to reach full mastery.

**Least Mastered Competencies on Addition Operation**

Table 2 presents the distribution of Grade 1 learners’ performance across specific addition competencies.

**Table 2. Least Mastered Competencies on Addition Operation**

Competencies	Objectives	Item Number	Percentage	Interpretation
Illustrate addition of numbers with sums up to 20 using a variety of concrete and pictorial models and describes addition as “counting up,” and “putting together.”	correctly solves problems with sum up to 10.	1-3,5	80.5%	Mastered
	correctly identify numbers as “putting together” and “counting up”	4,6	72.5%	Nearly Mastered
	correctly solves problems with sum up to 20.	7-10	86.25%	Mastered
1. Illustrate by applying the following properties of addition, using sums up to 20 a. the sum of zero and any number is equal to the number, and b. changing the order of the equal to the number.	solve equations involving the addition of zero to a constant or variable.	11-15	80%	Mastered
	correctly identify the similar order that equal to the number.	16-20	70%	Nearly Mastered
2. Solve problems (Given orally or in pictures) involving addition with sums up to 100 without regrouping.	correctly solve two digits by two digits with sum up to 100 in the given word problem.	21-25	53.6%	Nearly Mastered
	correctly solve two digits by one digit with sum up to 10 in the given word problem.	26-27	50%	No Mastery
	correctly solve two digits by two digits with sum up to 50 in the given word problem.	28-30	54.66%	Nearly Mastered

The table shows that the learners have almost mastered all the competencies however there is a notable decline in their performance in Competency 3, which involves solving word problems. The performance of the students in this competency fell within the Nearly Mastered and No Mastery levels specifically in solving two-digit by two-digit addition problems with sums up to 100 (53.6%) and up to 50 (54.66%) which are both interpreted as Nearly Mastered, while solving two-digit by one-digit problems (50%) was classified as No Mastery. These results indicate that learners experience substantial difficulty when required to apply addition skills in contextualized and language-based situations.

Across the three competencies, learners demonstrated strong performance in basic and procedural addition skills. Under Competency 1, which focuses on illustrating addition using concrete and pictorial models, two objectives were categorized as Mastered: solving problems with sums up to 10 (80.5%) and sums up to 20 (86.25%). This shows that learners are proficient in performing addition when tasks are straightforward and supported by visual or concrete representations.

Similarly, in Competency 2, which involves applying the properties of addition, learners showed Mastery in solving equations involving the addition of zero (80%). This reflects an understanding of identity property in operational terms. However, performance dropped to Nearly Mastered with 70% in identifying equivalent expressions involving order which is about commutative property, suggesting that learners may struggle with abstract relational thinking despite being able to compute correctly.

The findings shows that learners possess adequate procedural fluency in addition, particularly when tasks are presented in structured and familiar formats. The high performance in basic computation and use of visual models indicates that foundational numeracy skills are well established. However, the decline in performance in tasks involving conceptual explanation, properties of operations, and word problems reflects limitations in deeper mathematical understanding.

The results are consistent with existing research on early mathematics learning. Murillo and Tan (2022) found that learners often struggle with word problems due to the added cognitive demand of interpreting language before applying mathematical operations. This supports the observed low performance in Competency 3. Similarly, Pellissier (2023) explained that young learners frequently encounter difficulties in translating real-life situations into mathematical representations, which aligns with the challenges observed in solving contextualized addition problems in this study.

Furthermore, Anderson et al. (2022) emphasized that effective mathematics instruction should integrate conceptual understanding with real-world applications to improve learners' problem-solving skills. Magtolis (2023) also highlighted the importance of contextualized learning experiences in enhancing mathematical comprehension among early-grade learners.

The findings are supported by broader research indicating that procedural fluency often develops earlier than problem-solving ability. Learners may demonstrate competence in computation but still struggle with higher-order thinking tasks that require interpretation and application (Clements & Sarama, 2024).

This performance implies that the transition from abstract arithmetic to the linguistic and analytical processing required for word problems represents a major cognitive hurdle for these learners. These results shows that the students are still in the process of building the structured framework that supports logical reasoning and informed decision-making as described by Skovsmose (2021). Furthermore, the lack of mastery in more complex problem-solving indicates a potential delay in acquiring the foundational skills necessary for the scientific advancement and economic development highlighted by Uchang (2022) and Verdeflor and Pacadaljen (2021).

### **Designing and Developing the Prototype**

The Manipulative Drill Package (MDP) was developed based on the least-mastered competencies identified in the Grade 1 learners' performance test, with a focus on improving addition skills with sums up to 100 without regrouping. The original prototype was designed with six progressive levels, each represented by a distinct theme (Levels 1–6), as shown in Figure 2. These themes included "Egg Counting" (Level 1), dog addition models

(Level 2), bird manipulatives (Level 3), and game-based activities for higher sums (Levels 4–6). This design was intended to create visual diversity and sustain engagement through varied interactive contexts.

Upon validation, it shows that the MDP be streamlined into a single consistent theme, such as a Poultry Farm, to maintain coherence and reduce cognitive distraction. Adopting a single theme allows learners to connect activities sequentially, reinforcing the continuity of the learning experience from the first to the final level.



**Figure 2. Initial Design of the MDP**

For example, students can progress from collecting eggs (Level 1) to managing a full “farmyard” scenario in Level 6, where addition problems are embedded in contextualized, playful activities.

The prototype uses recycled cardboard and simple materials to create a tactile, hands-on experience. Physical manipulatives—including artificial eggs, clay, and cups—allow students to concretely represent numerical values, enabling a transition from concrete to abstract thinking. This aligns with research by Tandika et al. (2022), who emphasize that manipulatives suited to developmental stages are critical in early mathematics learning. Similarly, Dharmas (2023) reported that manipulative instructional materials enhance learner engagement and understanding, particularly for diverse learning needs.

The progression of levels in this program is intentionally structured to build mathematical proficiency through increasing complexity and varied engagement strategies. The journey begins with Level 1, which introduces addition for sums between 1 and 20 using basic egg counting. Level 2 extends these sums to the 21–40 range, utilizing visual aids to help students distinguish between tens and ones. As students move to Level 3, they tackle sums from 41 to 60 by incorporating games that arrange eggs in circles to solve vertical addition problems.

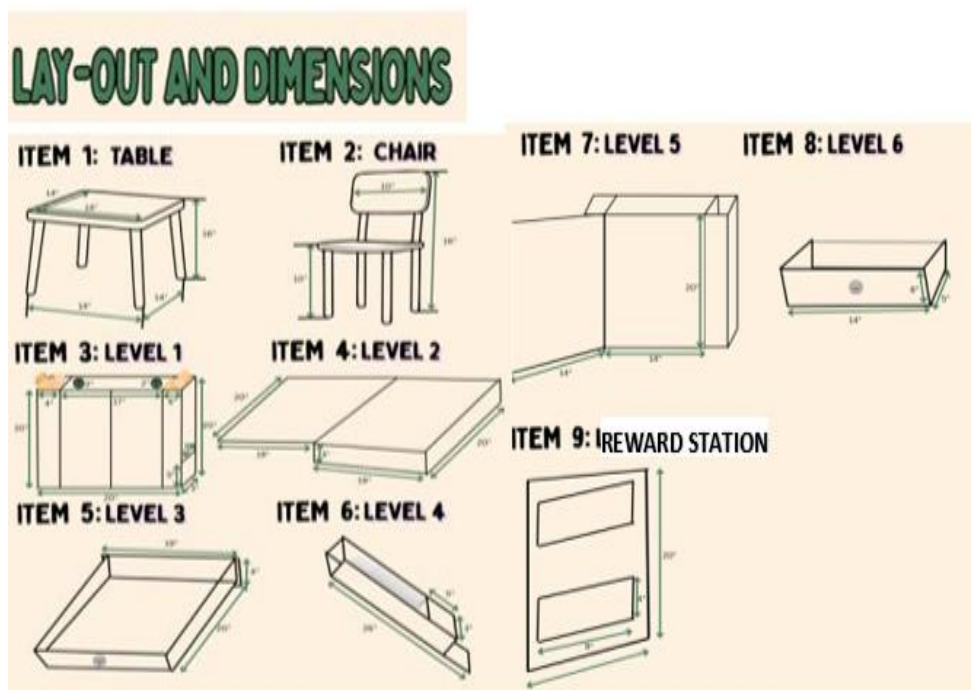
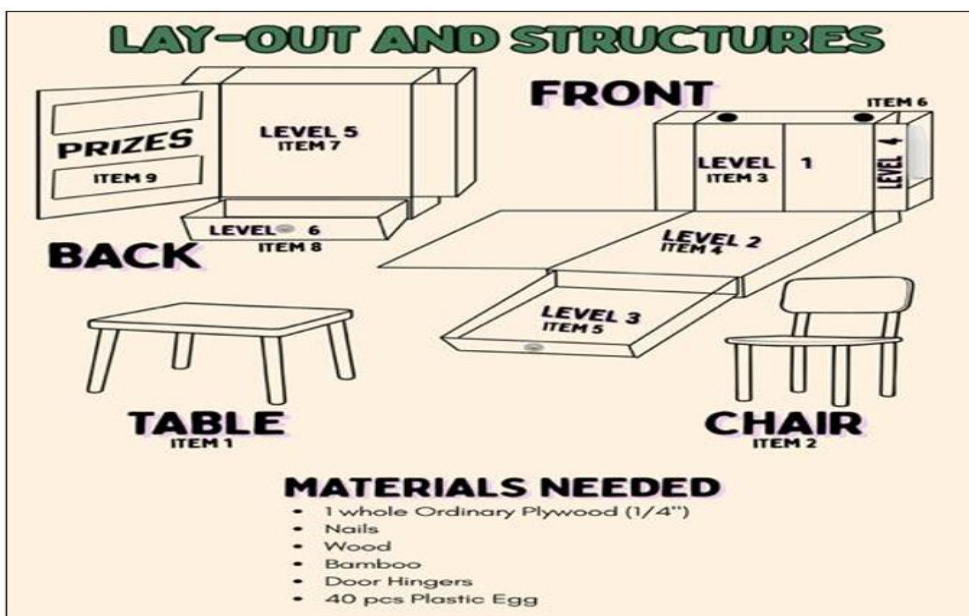
The difficulty continues to scale in Level 4, which focuses on sums between 61 and 80 to increase numerical complexity. To maintain engagement as the numbers grow, Level 5 covers sums from 81 to 100 and integrates playful manipulatives, such as a “flying chicken,” to complete tasks. Finally, Level 6 culminates the experience with puzzle-type word problems covering the full 1–100 range, effectively reinforcing both computation and real-world application skills.

By anchoring all levels in a single contextualized theme (Poultry Farm), the MDP ensures continuity and helps learners relate mathematical problems to a familiar environment. This approach reduces cognitive load, enhances engagement, and provides opportunities for students to visualize real-life applications of addition, supporting the findings of Anderson et al. (2022) and Magtolis (2023), who emphasized contextualized learning in developing problem-solving skills.

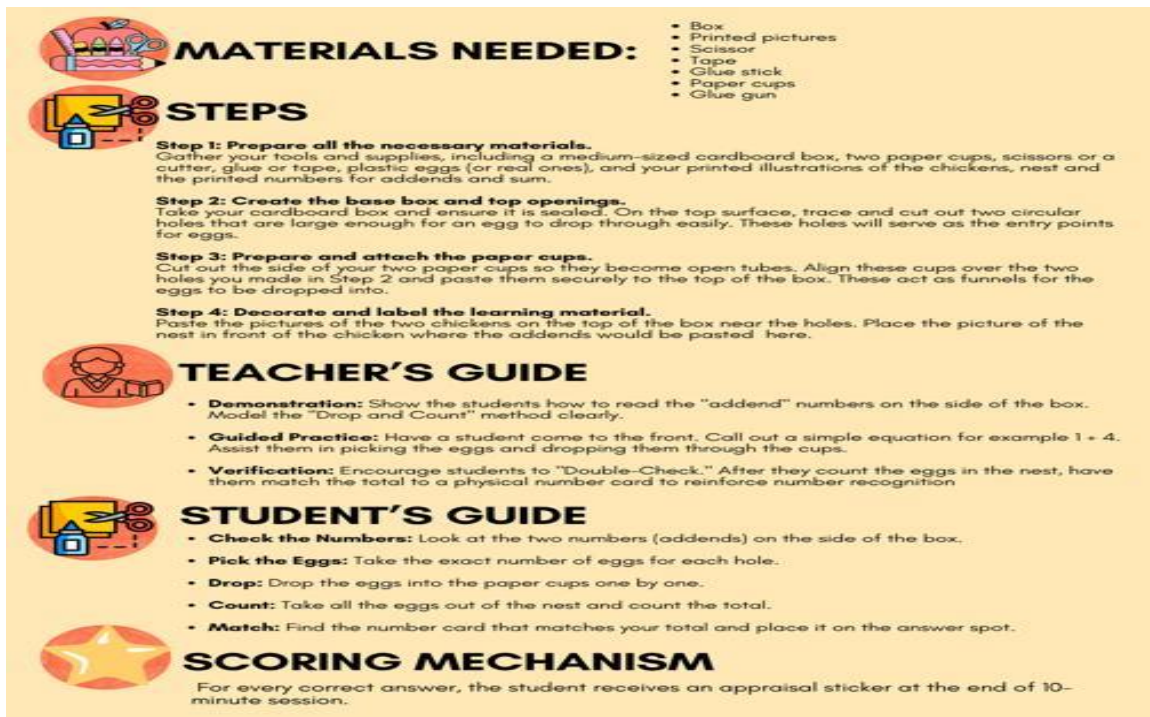
Finally, the MDP embodies learner-centered principles. Students actively manipulate objects, progress at their own pace, and experience a logical, sequential transition from concrete to abstract problem-solving. This ensures inclusivity, accommodates diverse learning needs, and fosters both confidence and competence in addition operations.

Figure 3 shows the initial layout and structure of the MDP, with each level occupying a designated compartment in the package. The front section included Levels 1, 2, 3, and 4, while the back section held Levels 5 and 6, along with a compartment for prizes. Additional components such as a table (Item 1) and chair (Item 2) were included to provide a stable workspace. The materials used were intentionally simple and accessible, including plywood, nails, bamboo, door hinges, and 40 pieces of plastic eggs, reflecting a low-cost, environmentally conscious approach while ensuring durability and usability.

Figure 4 shows the development and instructional implementation of the Egg Counting Manipulative Drill Package, including the materials needed, step-by-step construction procedures, teacher’s guide, student’s guide, and scoring mechanism used to facilitate learners’ understanding of addition concepts.



**Figure 3. Initial Layout and Structure of the MDP**



**MATERIALS NEEDED:**

- Box
- Printed pictures
- Scissor
- Tape
- Glue stick
- Paper cups
- Glue gun

**STEPS**

**Step 1: Prepare all the necessary materials.**  
Gather your tools and supplies, including a medium-sized cardboard box, two paper cups, scissors or a cutter, glue or tape, plastic eggs (or real ones), and your printed illustrations of the chickens, nest and the printed numbers for addends and sum.

**Step 2: Create the base box and top openings.**  
Take your cardboard box and ensure it is sealed. On the top surface, trace and cut out two circular holes that are large enough for an egg to drop through easily. These holes will serve as the entry points for eggs.

**Step 3: Prepare and attach the paper cups.**  
Cut out the side of your two paper cups so they become open tubes. Align these cups over the two holes you made in Step 2 and paste them securely to the top of the box. These act as funnels for the eggs to be dropped into.

**Step 4: Decorate and label the learning material.**  
Paste the pictures of the two chickens on the top of the box near the holes. Place the picture of the nest in front of the chicken where the addends would be pasted here.

**TEACHER'S GUIDE**

- **Demonstration:** Show the students how to read the "addend" numbers on the side of the box. Model the "Drop and Count" method clearly.
- **Guided Practice:** Have a student come to the front. Call out a simple equation for example  $1 + 4$ . Assist them in picking the eggs and dropping them through the cups.
- **Verification:** Encourage students to "Double-Check." After they count the eggs in the nest, have them match the total to a physical number card to reinforce number recognition

**STUDENT'S GUIDE**

- **Check the Numbers:** Look at the two numbers (addends) on the side of the box.
- **Pick the Eggs:** Take the exact number of eggs for each hole.
- **Drop:** Drop the eggs into the paper cups one by one.
- **Count:** Take all the eggs out of the nest and count the total.
- **Match:** Find the number card that matches your total and place it on the answer spot.

**SCORING MECHANISM**

For every correct answer, the student receives an appraisal sticker at the end of 10-minute session.

**Figure 4. Construction and Instructional Use of the Egg Counting Manipulative for Level 1**

The effectiveness of the Egg Counting material relies heavily on the teacher's role as a facilitator of learning. The instructional process begins with explicit demonstration, where the teacher models how to identify the addends and perform the "Drop and Count" method. This is followed by guided practice, during which learners are assisted in solving simple addition problems (e.g.,  $1 + 4$ ) through hands-on manipulation of the materials.

A crucial component of the process is the verification stage, where learners are encouraged to "double-check" their answers by matching the counted eggs with the corresponding number card. This promotes accuracy, reinforces number recognition, and strengthens conceptual understanding.

This instructional sequence is grounded in the Zone of Proximal Development (ZPD) and the principle of scaffolding, wherein the teacher provides structured support that is gradually reduced as learners gain independence. Through modeling, guidance, and verification, the teacher ensures that tasks remain within the learners' developmental capacity while progressively increasing their level of competence.

From the learner's perspective, the activity follows a clear and systematic five-step process. It begins with Checking the Numbers to identify the given addends, followed by Picking the Eggs, where the learner selects the correct number of eggs for each addend. Next, the learner must Drop the eggs into the funnels one at a time. The fourth step requires them to Count, which involves retrieving and counting the total number of eggs in the nest. Finally, the learner completes the process by Matching, selecting and placing the number card that corresponds to the computed sum.

This structured sequence promotes active engagement, allowing learners to construct meaning through direct interaction with the materials. The process not only strengthens computational skills but also enhances learners' confidence and motivation by making learning interactive and enjoyable.

The design and implementation of the Egg Counting material are supported by established learning theories. The step-by-step instructional approach reflects Gagné's Conditions of Learning (1985), particularly the stages of presenting the stimulus, providing learning guidance, and eliciting performance. These stages ensure that learners are systematically guided from initial exposure to mastery of the concept.

Furthermore, the integration of scaffolding aligns with socio-constructivist principles, emphasizing that learning occurs through guided interaction and meaningful experiences. The material acts as a mediating tool, enabling learners to internalize mathematical concepts through structured engagement.

The scoring system is designed to provide positive reinforcement and sustain learner motivation. For every correct response, learners receive a voucher or coupon, which can be exchanged for rewards at the end of the session. This mechanism encourages active participation and consistent effort during the activity.

This approach is supported by Edward Thorndike’s Law of Effect, which posits that behaviors followed by satisfying outcomes are more likely to be repeated. By associating correct responses with positive reinforcement, the MDP promotes repeated engagement in mathematical tasks, thereby strengthening learning outcomes.

The Egg Counting material exemplifies a structured, learner-centered, and theory-driven instructional tool. Its design integrates concrete manipulation, guided instruction, and positive reinforcement to address learners’ difficulties in addition. By aligning practical implementation with established educational theories, the material not only enhances computational skills but also fosters deeper conceptual understanding and sustained learner engagement.

**Quality of the Designed Prototype for MDP**

Table 3 presents the evaluation of the quality of the designed prototype of the Manipulative Drill Package (MDP) across three key factors: content, other findings, and additional requirements for manipulatives. The results provide insights into the strengths and areas for improvement of the developed instructional material

**Table 3. Quality of the Designed Prototype for MDP**

<b>Factor</b>	<b>Weighted Mean</b>	<b>Interpretation</b>
a. Content	2.96	Satisfactory
b. Other Findings	3.15	Not Present
c. Additional Requirements for Manipulatives	3.65	Satisfactory

With respect to Factor A, which focuses on the accuracy, relevance, and overall quality of the instructional material, the prototype obtained a weighted mean of 2.96, interpreted as Satisfactory. This factor covered several indicators, including alignment with learning competencies, ability to arouse learners’ interest, factual accuracy, currency of information, appropriateness of visuals, clarity of presentation, typographic design, usability, and durability. Despite being rated satisfactory, this factor recorded the lowest mean among the three, indicating that content-related aspects require further refinement. This shows the need to enhance clarity, improve visual-text integration, and ensure that the material more effectively supports mastery of the targeted competencies.

Regarding Factor B, the prototype yielded a weighted mean of 3.15, indicating that conceptual, factual, grammatical, and technical errors were “Not Present”. This indicates that the material is generally free from major inaccuracies and technical issues, reflecting a sound level of quality control in its development. However, the result also implies that minor revisions may still be necessary to further improve the overall reliability and precision of the instructional material.

For Factor C, which evaluates the quality of the hands-on and interactive components, the prototype achieved the highest weighted mean of 3.65, interpreted as Very Satisfactory. This indicates that the manipulative features of the MDP are highly effective in supporting learning. The evaluation highlighted the adequacy of support materials, the inclusion of structured and innovative activities, the safety and appropriateness of the materials, and their compatibility with learners’ motor skills. This finding underscores the strength of the MDP in promoting active, hands-on, and developmentally appropriate learning experiences.

Despite the generally positive evaluation, validators emphasized the need to improve the visual design, particularly in the selection and combination of colors. Suggestions such as “consider the colors of the text” and

“use appropriate color combinations” highlight the importance of visual clarity and aesthetic appeal in instructional materials. For young learners, who are highly responsive to visual stimuli, effective color use can significantly influence attention, engagement, and comprehension.

These findings shows that while the structural and manipulative aspects of the MDP are strong, enhancing visual presentation is essential to maximize its instructional effectiveness. Improving color contrast, readability, and layout organization can help emphasize key information and reduce cognitive load during learning tasks.

The importance of visual design in instructional materials is supported by several studies. Songkram (2020) found that visually engaging materials increase student participation and promote active learning. Similarly, Tandika et al. (2022) emphasized that well-designed instructional resources enhance learners’ interaction with content and improve understanding.

In the context of mathematics education, Almaki et al. (2023) reported that visually stimulating environments positively influence learners’ motivation and engagement, while Portana et al. (2021) highlighted that effective visual presentation supports comprehension by helping learners process mathematical information more efficiently.

Moreover, research indicates that readability and clarity are critical factors in instructional design. Dharmas (2023) and Talan (2021) emphasized that the use of appropriate font size, clear symbols, adequate spacing, and organized layout enhances learners’ ability to interpret and understand content. These findings support the validators’ recommendations to refine the visual aspects of the MDP.

Based on the findings, it is recommended that the MDP be further improved by enhancing its content clarity and visual design, particularly using appropriate color combinations, readable fonts, and well-organized layouts. These improvements will ensure that the material is both aesthetically appealing and instructionally effective.

Despite the need for refinement, the results indicate that the MDP is a promising instructional tool, particularly in its manipulative and interactive components. Therefore, it was recommended that teachers utilize the developed MDP as a supplementary instructional material in teaching addition concepts.

The integration of structured, engaging, and hands-on learning experiences was shown to improve learners' participation and conceptual understanding in mathematics (Tandika et al., 2022; Portana et al., 2021)Development and Validation of IMA Manipulative Drill Package was developed to help Grade 1 students practice and master addition. This Manipulative Drill Package (MDP) is named SUM- VANTES Poultry Farm. The name of the material is a combination of the math term "SUM" and the name of the municipality, Cervantes. This was done to make the tools contextualized, meaning they are designed to feel familiar and relevant to the local community where the students live.

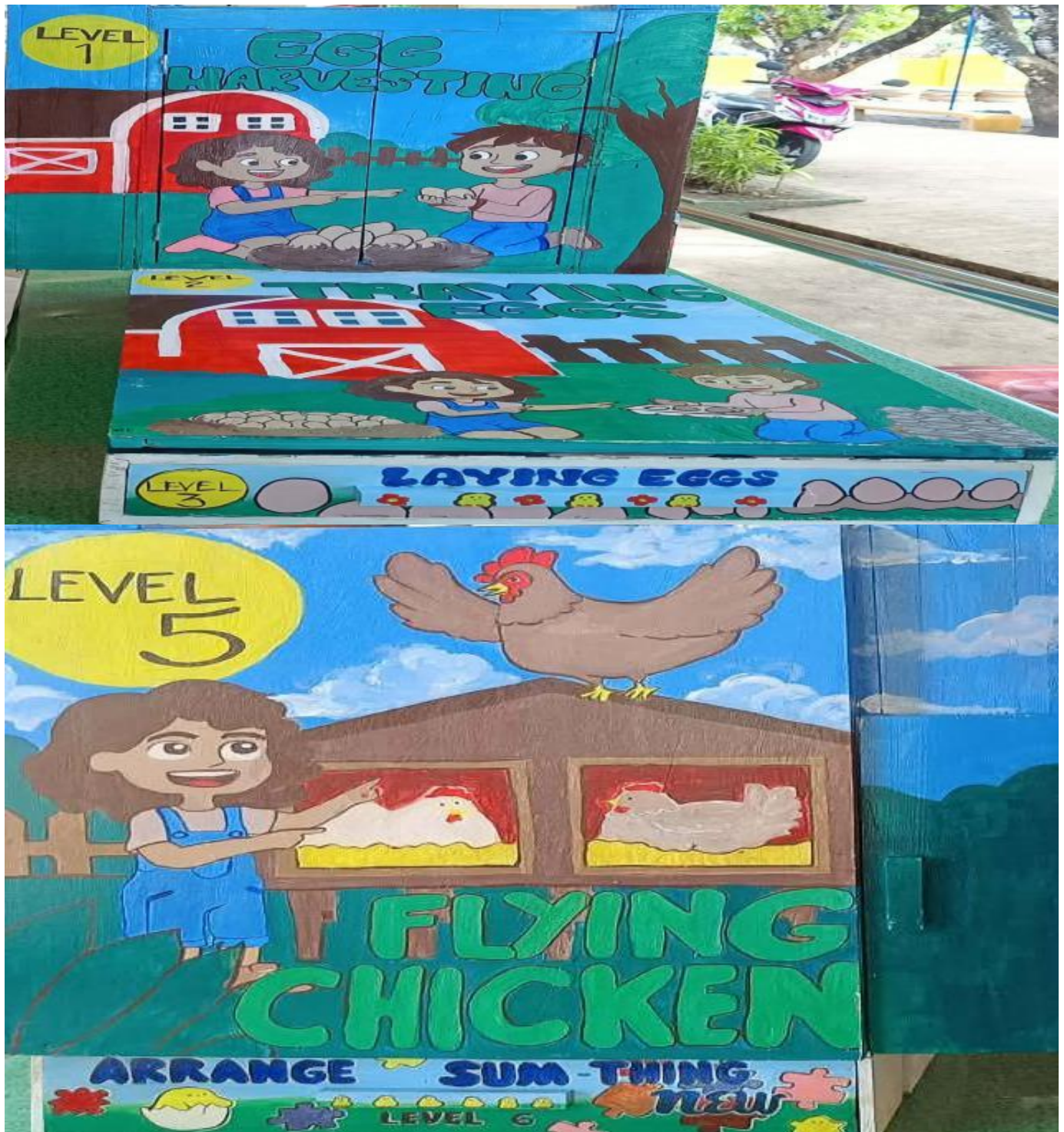
The SUM-VANTES Poultry Farm uses a farm theme to turn abstract math problems into concrete activities. By using a theme that reflects the local environment, the material makes learning more engaging for pupils. The package is divided into different levels, such as Egg Harvesting, where students use physical objects to solve addition tasks.

This hands-on design ensures that instead of just memorizing numbers, students can see and touch the items they are counting. This local and interactive approach helps Grade 1 learners build a stronger foundation in math through activities that feel like a natural part of their daily surroundings.

Figure 5 shows the whole instructional materials of the SUM- VANTES Poultry Farm Manipulative Drill Package (MDP). The SUM- VANTES Poultry Farm MDP is a complete instructional system featuring a Teacher’s Guide, which provides a detailed 6-level step-by-step guide tailored to each stage of the MDP.

Back

Front



**Figure 5. Developed Instructional Materials**

Figure 5 shows the improved and validated instructional materials for Level 1. The “Egg Harvesting” material serves as a structured introductory activity designed to teach early learners the fundamentals of addition. Using a poultry farm context, the activity connects abstract numerical concepts to real-life situations. The visual presentation of children collecting eggs supports problems such as  $7 + 2 = 9$ , promoting concrete understanding. The material also includes a clear objective: solving addition problems with sums from 1 to 20 without regrouping, thereby strengthening foundational number sense.



**Figure 6. Validated Instructional Materials for Level 1**

The "Egg Harvesting" image serves as a vibrant, structured introductory page for a Level 1 mathematics activity specifically designed to teach early elementary students the fundamentals of addition. The narrative focuses on a poultry farm, using the relatable task of collecting eggs to ground abstract numbers in a concrete, real-world context. Visually, the scene features two children interacting with a nest containing seven eggs while a boy holds two more, providing a subtle hint toward basic addition problems like  $7 + 2 = 9$ . This approach is highly effective for young learners, as it transforms a standard math lesson into a narrative-driven "mission" that can significantly reduce math anxiety and increase engagement.

Beyond the aesthetics, the document outlines a clear and measurable educational objective: students are expected to solve addition problems with sums between 1 and 20 with 100% accuracy. Crucially, the activity specifies that these problems will be solved without regrouping, meaning students will focus on simple place value where the sum of the ones column does not exceed nine. By keeping the complexity low and the visual rewards high, the activity builds a solid foundation in number sense. The clear "Level 1" labeling and the explicit goal at the bottom provide both teachers and students with a roadmap for success, ensuring the transition from counting physical objects to solving written equations is both smooth and rewarding.

Figure 7 presents the improved and validated instructional materials for level 2.

**Figure 7. Validated Instructional Materials for Level 2**



The “Traying Eggs” activity reflects a progression from Level 1 by introducing addition problems with sums ranging from 21 to 40. While maintaining the same thematic context, the activity increases complexity through two-digit addition without regrouping. This supports learners in developing place value understanding while still relying on visual and contextual cues.

Figure 8 shows the improved and validated instructional materials for Level 3.



**Figure 8. Validated Instructional Materials for Level 3**

At this level, learners solve addition problems with sums ranging from 41 to 60. The activity uses clay manipulatives to represent eggs, allowing students to physically group them by ones and tens. The concept of regrouping is introduced using a “chicken” as a visual aid to represent carrying, making abstract processes more concrete and intuitive.

Figure 9 shows the improved and validated instructional materials for Level 4.



**Figure 9. Validated Instructional Materials for Level 4**

The “Count and Stack the Cup” activity targets addition problems with sums from 61 to 80 without regrouping. It integrates physical coordination and cognitive skills through a game-based approach where learners match

problems with correct answers. The activity aims for at least 80% accuracy, reinforcing both engagement and mastery.

Figure 10 shows the improved and validated instructional materials for Level 5



**Figure 10. Validated Instructional Materials for Level 5**

This level presents a “road trip” themed activity that encourages learners to practice addition in an interactive and engaging environment. With clear numerical representations and structured tasks, the material promotes mastery of addition without regrouping while maintaining learner motivation through visually appealing design.

Figure 11 shows the improved and validated instructional materials for Level 6.



**Figure 11. Validated Instructional Materials for Level 6**

The Level 6 material features a puzzle-based activity set in a nature-themed environment. The design combines visual appeal and mathematical tasks to create an engaging learning experience, supporting learners in applying their acquired addition skills in more complex contexts.

Figure 12 shows the sample design of the SUM-VANTES Poultry Farm MDP Guide for Grade 1 teachers.

### ACKNOWLEDGEMENT

I would like to express my deepest gratitude to the talented individuals, **Ms. Crisha Nguslab**, and to **Mr. Pomposo C. Sanchez** whose artistic skills and technical expertise brought these instructional materials to life, specifically those who dedicated their time to drawing the visuals and meticulously designing the structure of the instructional materials to ensure they are both engaging and functional for young learners.

My sincere appreciation also goes to the panel of experts who validated the quality of these materials: **Jeremy G. Sanchez, EdD, Jenny Lyno S. Lisayon, MAEd, Rinbeth S. Riva, MAEE, Rodilyn C. Angligen, MSE and to Cathrine L. Tomas, PhD**, your rigorous evaluation across THE quality of the Instructional Materials provided the professional assurance that the SUM-vantes Poultry Farm Manipulative Drill Package meets the highest standards of content accuracy, safety, and pedagogical soundness.

To my external experts, **Ma'am Olivia Calpo, Hanna Mae Bugarin, and Ma'am Evangelista Juliana A. Farol**, who give their time and effective comments and suggestions to make my instructional material effective in the field.

Furthermore, I am profoundly grateful to my support system—my family, friends, and colleagues—whose unwavering encouragement and belief in this project provided the emotional and spiritual strength necessary to see this work through to completion. This achievement is a testament to the collaborative efforts of everyone involved, and I am honored to share this success with you.

### TABLE OF CONTENTS

- Acknowledgement ..... 1
- Introduction ..... 2
- Level 1:** Harvesting SUM egg ..... 5
- Level 2:** Traying SUM Eggs ..... 5
- Level 3:** Laying SUM Eggs ..... 7
- Level 4:** Hatching SUM Eggs ..... 10
- Level 5:** Flying SUM Chicken ..... 12
- Level 6:** Arranging SUM-thing New ..... 15
- Materials Needed for Constructing MDP ..... 17
- Layout and Structures ..... 18
- Layout and Dimensions ..... 19
- Costing ..... 21
- About the Developer ..... 22

### INTRODUCTION

Hi!

This guide is for Grade 1 Teachers. This guide provides a comprehensive guide on utilizing learning materials tailored for each instructional level. Every level includes specific objectives that students must master before proceeding to the next level of the MDP. This organized framework details how to apply these resources across various developmental milestones, ensuring that learners successfully achieve their goals while enjoying the concept of MDP.

The MDP is designed with six levels that guide learners through a progressive journey from foundational concepts to complex mastery.

LEVEL	NAME OF THE ACTIVITY	OBJECTIVES
1	EGG HARVESTING	sum up to 1 to 20
2	TRAYING EGG	sum up to 21 to 40
3	LAYING EGG	sum up to 41 to 60
4	BROODY CHICKEN	sum up to 61 to 80
5	FLYING CHICKEN	sum up to 81 to 100
6	LEARN SUM-thing NEW	sum up to 100

**CAUTION**

Please ensure all students avoid touching their eyes, nose, or mouth while handling clay and wash their hands thoroughly with soap and water immediately after the activity to prevent skin irritation.

**Happy Learning!**





**Figure 12. Sample designed of SUM-VANTES Poultry Farm MDP Guide for Grade 1 Teachers**

Figure 12 shows the sample design of the SUM-VANTES Poultry Farm MDP Guide for Grade 1 teachers.

The guide serves as a comprehensive manual that organizes all instructional components into a structured format. It includes a cover page, acknowledgment section, introduction, and safety precautions. Additionally, it provides detailed layouts, materials, and dimensions to assist teachers in constructing and implementing the instructional materials effectively.

Figure 13 shows the sample guide for Level 1.

**Number of tiles: 30**


**Level 1- Egg Harvesting**

- **Step 1:** The teacher presents a vertical addition problem and asks the student to get eggs depending on the number shown in the tens and ones columns.
- **Step 2:** Instruct the student to insert the eggs according to the number shown in the ones column into their corresponding hole. Eggs will automatically fall into the basket. Repeat the process for the second addends.
- **Step 3:** Direct the student to count all the eggs. This reinforces the standard algorithm of adding from right to left.
- **Step 4:** Once the physical count is complete, the student will identify the total sum and paste it on the basket.
- **Step 5:** Instruct the students to solve the word problem with a sum up to 20.

4

**LEVEL 1**

# HARVESTING SUM EGG



At the end of the activity, students would be able to solve the addition problems with sums up to 1-20 without regrouping with 100% accuracy.

3

**Figure 13. Sample Guide for Level 1**

This guide outlines the instructional procedure for the “Harvesting SUM Egg” activity. It includes a clear learning objective, required materials, and step-by-step instructions. The structured format ensures consistency across all levels and supports teachers in facilitating effective and organized classroom instruction.

## Validity Level of the Developed IMs

The table 3 presents the validity level of the Sum-Vantes Poultry Farm Manipulative Drill Package

**Table 4. Validity Level of the Sum-Vantes Poultry Farm Manipulative Drill Package**

Factor	Weighted Mean	Interpretation
a. Content	3.45	Very Satisfactory
b. Other Findings	4.00	Not Present
c. Additional Requirements for Manipulatives	3.97	Very Satisfactory

For Factor A, the MDP achieved a weighted mean of 3.45, earning a "Very Satisfactory" rating. This evaluation considered thirteen indicators, including reinforcement of mastery in learning competencies, the potential to arouse interest, factual accuracy, and provision of up-to-date information. It also assessed the relevance and suitability of visuals to the learners' age and interests, the clarity of the messages conveyed, the effectiveness of the typographic layout, the appropriateness of the material's size for school use, ease of handling, and durability. This score indicates that the instructional materials are accurate, logically organized, and highly relevant to the learning objectives. The content is appropriate for the target learners, ensuring that the core information is both clear and pedagogically sound.

Regarding Factor B, the package obtained a perfect weighted mean of 4.00, interpreted as "Not Present," reflecting the absence of errors. This factor screened for conceptual, factual, and grammatical errors, as well as technical issues such as computational mistakes or outdated information. The perfect score demonstrates meticulous attention to detail during development, confirming the technical integrity of the material.

For Factor C, the package received a weighted mean of 3.97, resulting in a "Very Satisfactory" interpretation. This assessment focused on seven indicators, including provision of adequate support materials, activity summaries, extension activities, and the promotion of innovative pedagogy. It also evaluated the safety of the manipulative, appropriateness of size for the intended audience, and the compatibility of manual tasks with students' motor skills. The high rating confirms that the MDP is not only an effective instructional tool but also safe, interactive, and age-appropriate.

The findings show that the Sum-vantes Poultry Farm Manipulative Drill Package effectively enhances numeracy skills, particularly addition, among the target learners. The overall mean of 3.81, with a qualitative interpretation of "Very Satisfactory," highlights the efficacy of interactive, manipulative-based learning in mastering mathematical concepts. High scores across individual categories reinforce the overall quality, reliability, and functionality of the package. These results indicate that the instructional tool meets rigorous validation standards and is ready for practical classroom application. The study demonstrates a strong alignment between high-quality content and robust technical features, illustrating the package's capacity to support meaningful learning outcomes.

## CONCLUSIONS

Based on the findings of the study, the following were concluded:

1. Foundational numeracy skills in addition have been effectively developed among most learners. The high concentration of learners in the "Very Satisfactory" and "Outstanding" categories indicates not only procedural competence but also a level of conceptual understanding appropriate for Grade 1.
2. Grade 1 learners demonstrated developing command of foundational numeracy. However, the presence of learners at lower proficiency levels, particularly in solving word problems involving sums up to 100 without regrouping, reveals a meaningful gap between procedural skill and conceptual application. This underscores the need for instructional support that bridges arithmetic fluency with contextual problem-solving.

3. The SUM-VANTES Poultry Farm Manipulative Drill Package was developed as a six-level, learner-centered instructional material directly responsive to the identified least mastered competencies of Grade 1 learners. Grounded in concrete and sequential learning experiences, the MDP provides a structured pathway for learners to move progressively from simple addition to solving problems with sums up to 100, making it a purposeful and contextually relevant prototype for early numeracy instruction.
4. Expert validation of the SUM-VANTES Poultry Farm MDP confirmed its overall Very Satisfactory quality across content, features, and accuracy dimensions. This affirms that the developed material is a valid and appropriate instructional tool aligned with the learning needs and developmental level of Grade 1 learners, signifying its readiness for classroom implementation in support of addition mastery.

## Recommendations

In light of the conclusions drawn from this study, the following recommendations are offered:

1. Grade 1 mathematics teachers may provide contextualized problem-solving activities that integrate addition drills with word problems to address the identified gap between computational fluency and practical application of addition skills.
2. Utilize physical counters or localized tactile materials to help learners visualize mathematical operations, specifically to support those currently at lower proficiency levels.
3. Grade 1 teachers may utilize the SUM-vantes Poultry Farm Manipulative Drill Package as a supplementary instructional tool to support learners in progressively mastering addition with sums up to 100 without regrouping through its six-level, hands-on design.
4. Future researchers may adopt the developmental research methodology and validation framework used in this study as a reference for designing and evaluating locally-contextualized manipulative instructional materials for other early numeracy competencies.

**GALUTAN, ANDRHEA JUSTINE C.** February 2026. **SUM-VANTES Poultry Farm: A Manipulative Drill Package for Addition.** Bachelor of Elementary Education. Ilocos Sur Polytechnic State College, Cervantes Campus, Cervantes, Ilocos Sur. Adviser: **JENNY LYNE S. LISAYEN, MAEd**

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