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EFFECTIVENESS OF A DEVELOPED CONTEXTUALIZED NUMERACY SELF-INSTRUCTED MODULE IN ENHANCING THE NUMERACY SKILLS OF ALTERNATIVE LEARNING SYSTEM (ALS) LEARNERS

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ABSTRACT

This study examined the effectiveness of the Developed Contextualized Numeracy Self-Instructed Module (CNSIM) as an intervention to enhance the numeracy skills of Alternative Learning System (ALS) Junior High School learners in Guimba West District, Division of Nueva Ecija. A quasi-experimental research design was used to determine changes in learners' numeracy skills before and after the intervention, employing a one-group pretest-posttest approach. The respondents were 60 ALS learners selected through total enumeration sampling. The primary instrument for gathering data was a test questionnaire made by the researcher, while the CNSIM was used as the intervention. The instrument and the developed module were validated by the experts and piloted to ensure reliability, clarity, and appropriateness. Frequency and percentage distribution, mean, standard deviation, and paired-samples t-test were used to analyze the data. Results showed that most of the respondents were aged 16–21 years (50.0%), predominantly male (70.0%), and had a low level of education, with 50.0% having completed only Grade 7. Most of the learners were also from low-income households. Before the implementation of the CNSIM, learners obtained a mean score of 19.55 (SD = 5.90), indicating low to moderate numeracy skills in number sense, basic operations, problem-solving, and real-life application. After the intervention, the mean score increased to 25.08 (SD = 6.34), indicating improved numeracy performance. The paired-samples t-test revealed a mean difference of 5.53 with a computed t-value of 11.45 ($df = 59$, $p < 0.001$), indicating a statistically significant improvement in learners' numeracy skills. These results confirm that the Developed Contextualized Numeracy Self-Instructed Module (CNSIM) is an effective instructional material in enhancing numeracy performance among ALS learners.

KEYWORDS*: Alternative Learning System, Contextualized Learning, Mathematics Education, Numeracy Skills, Self-instructed Module.*

INTRODUCTION

Mathematics is an essential life skill that enables individuals to manage daily activities such as budgeting, shopping, transportation, time management, employment-related tasks, and informed decision-making. Numeracy refers not only to the ability to perform mathematical computations but also to the capacity to apply mathematical concepts meaningfully in real-life situations. For learners in the Alternative Learning System (ALS), numeracy plays a crucial role in improving functional literacy and enhancing opportunities for employment, further education, and active participation in the community.

The ALS in the Philippines serves out-of-school youth and adult learners who were unable to complete formal education due to poverty, early employment, family responsibilities, migration, health issues, and other social circumstances. As a result, ALS Junior High School learners show diverse backgrounds and varying levels of numeracy competence. Many learners re-enter schooling after long interruptions and often demonstrate limited mastery of basic operations such as addition, subtraction, multiplication, and division. Difficulties in solving word problems and applying mathematics to real-life situations are also commonly observed. Persistent numeracy challenges have been well documented in local settings. Ocampo (2021) reported that ALS students showed low performance in math and problem-solving abilities. According to Mangao Jr. et al. (2024), ALS learners consistently performed poorly in mathematics-related competencies on the Functional Literacy Test (FLT) in Cavite Province. Additionally, Serato, Binaloga, and Bautista (2025) discovered deficiencies in basic arithmetic abilities, such as word problems, fractions, decimals, and percentages, with socioeconomic characteristics heavily affecting performance.

Globally, numeracy challenges remain evident. Silberstein (2021) reported that learners in various countries continue to struggle with essential numeracy skills despite formal schooling, emphasizing the need for contextualized instruction. In adult education, Gale (2020) highlighted that vulnerable learners often experience significant numeracy gaps that affect their daily functioning, reinforcing the importance of learner-centered and context-based interventions. Many existing teaching resources are generic, abstract, and unrelated to students' actual experiences. The rural, agricultural, and small-business environment of locales like the Guimba West District is often not reflected in standard coursework. Because of this, students struggle to connect mathematical ideas to real-world scenarios, which results in low enthusiasm, limited comprehension, and poor mathematical skill retention.

Contextualized instruction helps learners connect mathematical concepts to familiar experiences such as market transactions, farm budgeting, household expenses, and income computation. Meanwhile, self-instructional modules support flexible and independent learning, which is essential in ALS settings where learners study at different paces with limited direct supervision. Despite the growing acknowledgment of contextualized and self-directed learning methodologies, there are still few empirical researches that particularly look at the efficacy of contextualized self-instructed numeracy modules in the context of ALS. This study directly addresses this empirical gap.

Theoretical Framework

This study is anchored on the Constructivist Learning Theory, primarily proposed by Jean Piaget and further expanded by Lev Vygotsky. Constructivist theory posits that learning is an active process in which learners construct new knowledge by building on their prior experiences, existing understanding, and interactions with their environment (Piaget, 1972; Vygotsky,

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1978). Jean Piaget emphasized that learners develop understanding through the processes of assimilation and accommodation, wherein new information is integrated into existing cognitive structures and modified when learners encounter unfamiliar experiences (Piaget, 1972). Lev Vygotsky highlighted the significance of language, cultural background, and social contact in the learning process, introducing the Zone of Proximal Development (ZPD) to describe the gap between independent performance and potential development under guided instruction (Vygotsky, 1978). In this study, the CNSIM functions as a form of instructional scaffolding aligned with Vygotsky's ZPD. Although the learners study independently, the module is carefully structured with step-by-step lessons, guided examples, practice exercises, reflective activities, and self-check assessments that support gradual learning progression.

METHODOLOGY

Research Design

This study employed a quasi-experimental research design, specifically the one-group pretest–posttest design, to determine the effectiveness of the Developed Contextualized Numeracy Self-Instructed Module (CNSIM) in enhancing the numeracy skills of ALS Junior High School learners. A quasi-experimental research design is a quantitative approach used to examine the effect of an intervention when random assignment of participants to experimental and control groups is not possible (Cranmer, 2022). This design is highly appropriate for educational research where ethical, administrative, or practical constraints limit the use of randomization (Doc McKee, 2024).

Research Locale and Respondents

The study was conducted in the Alternative Learning System (ALS), Guimba West District, located in the municipality of Guimba, Nueva Ecija, under the Schools Division of Nueva Ecija. Guimba is a first-class agricultural municipality, and the western district is composed of several barangays that are predominantly rural and residential in nature. The respondents of the study consisted of all 60 ALS Junior High School learners enrolled in the district during the School Year 2025–2026. The study utilized total enumeration sampling, meaning all identified learners with observed difficulties in basic numeracy skills were involved in the research.

Research Instruments and Procedures

The primary tool utilized in this study was a researcher-made pretest and posttest questionnaire developed to assess the numeracy skills of ALS Junior High School learners before and after implementing the developed CNSIM. The test included four core domains: number sense, basic mathematical operations, problem-solving skills, and application of numeracy in daily life. To ensure reliability, the instrument underwent pilot testing among 20 ALS learners from the adjacent Guimba East District (who were not included in the main study). The instrument gained a significance level of $p = 0.001$ under internal consistency testing. Content and face validation were established by a panel of experts comprising module writers, mathematics educators, and research advisers. A pretest was administered to determine baseline performance. Following the pretest, the CNSIM was distributed and implemented during scheduled learning sessions for a period of four (4) weeks. The module was entirely self-paced; facilitators monitored progress using checklists but refrained from providing direct mathematical content instruction to preserve the module's self-instructed integrity. After the four-week period, the posttest was administered under identical testing conditions.

Statistical Treatment

Data were encoded and analyzed using both descriptive and inferential statistical techniques. Frequency counts and percentage distributions were employed to profile demographic characteristics and categorize pretest and posttest domain scores. The mean and standard deviation were used to track overall performance shifts. To examine relationships between continuous demographic variables such as age, income, and education with the mean gain score, the Pearson Product-Moment Correlation was applied. Meanwhile, the Point-Biserial Correlation was utilized to determine the association between the dichotomous variable (sex) and the mean gain score. Finally, a Paired-Samples t-test was conducted at the 0.05 level of significance to compare pretest and posttest mean scores, establishing the statistical significance of the numerical interventions.

RESULTS

Socio-Demographic Profile of Respondents

The socio-demographic characteristics of the 60 responding ALS JHS learners are detailed across Tables 1 through 4.

Table 1: Distribution of respondents in terms of age

Age	f	%
16-21 Years Old	30	50.0
22-27 Years Old	12	20.0
28-33 Years Old	6	10.0
34-39 Years Old	6	10.0
40-45 Years Old	2	3.3
46-51 Years Old	1	1.7
52-57 Years Old	3	5.0
Total	**60**	**100.0**

Table 1 demonstrates that exactly half of the population (50.0%) consists of young adults within the 16–21 age bracket, though non-formal education demands include older adult learners stretching up to 57 years of age.

Table 2: Distribution of respondents in terms of sex

Sex	f	%
Male	42	70.0
Female	18	30.0
Total	**60**	**100.0**

As presented in Table 2, the sample is predominantly male, accounting for 70.0% of the total total enumeration cohort.

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Table 3: Distribution of respondents in terms of highest educational attainment

Highest Educational Attainment	f	%
Grade 7	30	50.0
Grade 8	16	26.7
Grade 9	14	23.3
Grade 10	0	0.0
Total	**60**	**100.0**

Table 3 highlights distinct educational deficits, as half of the total respondents (50.0%) had separated from formal schooling immediately following or during Grade 7.

Table 4: Distribution of respondents in terms of monthly family income

Monthly Family Income	f	%
Below 5,000	7	11.7
5,001-10,000	34	56.7
10,001-15,000	11	18.3
15,001-20,000	6	10.0
20,001 and above	2	3.3
Total	**60**	**100.0**

Table 4 shows the economic distribution of the learners. A significant majority (56.7%) originate from households earning a modest monthly income of ₱5,001–₱10,000.

Pre-Intervention Baseline Numeracy Skills

The baseline performance data collected before the deployment of the contextualized intervention modules are structured within Tables 5 through 8.

Table 5: Numeracy skills in terms of number sense before CNSIM implementation

Number Sense	Description	f	%
Score 0-3	Needs Improvement	41	68.3
Score 4-6	Satisfactory	19	31.7
Score 7-8	Proficient	0	0.0
Total		**60**	**100.0**

Table 5 highlights severe initial gaps in number sense conceptual skills, with 68.3% failing to clear the introductory operational thresholds and zero students testing at a proficient tier.

Table 6: Numeracy skills in terms of basic mathematical operations before CNSIM implementation

Basic Mathematical Operations	Description	f	%
Score 0-2	Needs Improvement	4	6.7
Score 3-5	Satisfactory	45	75.0
Score 6-7	Proficient	11	18.3
Total		**60**	**100.0**

Table 6 demonstrates that algorithmic operations were the strongest domain at baseline, with three-quarters of the learners (75.0%) presenting satisfactory functional mechanics.

Table 7: Numeracy skills in terms of problem-solving skills before CNSIM implementation

Problem-Solving Skills	Description	f	%
Score 0-7	Needs Improvement	40	66.7
Score 8-14	Satisfactory	17	28.3
Score 15-20	Proficient	3	5.0
Total		**60**	**100.0**

Analytical problem-solving presented significant challenges at baseline, as shown in Table 7, with 66.7% of the cohort falling into the lowest performance bracket.

Table 8: Numeracy skills in terms of application of numeracy in daily life before CNSIM implementation

Application of Numeracy in Daily Life	Description	f	%
Score 0-4	Needs Improvement	21	35.0
Score 5-10	Satisfactory	36	60.0
Score 11-15	Proficient	3	5.0
Total		**60**	**100.0**

Table 8 shows that 60.0% of the learners could execute basic applications of mathematics to routine real-life challenges, though advanced reasoning remained undeveloped.

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Post-Intervention Numeracy Performance

Following the four-week modular implementation period, post-test assessments yielded the shifts documented within Tables 9 through 12.

Table 9: Numeracy skills in terms of number sense after CNSIM implementation

Number Sense	Description	f	%
Score 0-3	Needs Improvement	34	56.7
Score 4-6	Satisfactory	25	41.7
Score 7-8	Proficient	1	1.7
Total		**60**	**100.0**

Table 9 indicates positive structural growth within number sense, as satisfactory allocations increased markedly to 41.7%.

Table 10: Numeracy skills in terms of basic mathematical operations after CNSIM implementation

Basic Mathematical Operations	Description	f	%
Score 0-2	Needs Improvement	2	3.3
Score 3-5	Satisfactory	26	43.3
Score 6-7	Proficient	32	53.3
Total		**60**	**100.0**

As shown in Table 10, over half of the responding population (53.3%) attained full mastery and proficiency in executing basic math algorithms post-intervention.

Table 11: Numeracy skills in terms of problem-solving skills after CNSIM implementation

Problem-Solving Skills	Description	f	%
Score 0-7	Needs Improvement	14	23.3
Score 8-14	Satisfactory	37	61.7
Score 15-20	Proficient	9	15.0
Total		**60**	**100.0**

Table 11 reveals a substantial structural redistribution in problem-solving competence, with the satisfactory segment expanding to comprise 61.7% of the learners.

Table 12: Numeracy skills in terms of application of numeracy in daily life after CNSIM implementation

Application of Numeracy in Daily Life	Description	f	%
Score 0-4	Needs Improvement	14	23.3
Score 5-10	Satisfactory	38	63.3
Score 11-15	Proficient	8	13.3
Total		**60**	**100.0**

Table 12 outlines positive outcomes for daily context applications, with satisfactory or higher achievements observed across 76.6% of the tested population.

Inferential Analysis and Hypothesis Testing

Correlational connections and differential performance significance parameters are organized within Tables 13 and 14.

Table 13: Significant relationship between socio-demographic profile and mean gain score

Mean Gain Score in Numeracy Skills	Sex	Age	Educational Attainment	Monthly Family Income	Interpretation
r	.000	-.241	.014	.450**	With a significant relationship
p	.999	.064	.916	.000	

** Correlation is significant at the 0.05 level (2-tailed)*

*** Correlation is significant at the 0.01 level (2-tailed)*

Table 13 shows that monthly family income holds a statistically significant relationship with structural score enhancement ($r = 0.450$, $p = 0.000$). Conversely, sex, age, and academic entry baselines yielded zero significant correlations ($p > 0.05$).

Table 14: Paired-samples t-test for pretest and posttest numeracy scores

Assessment Phase	Mean	Mean Difference	Std. Deviation	T	df	p-level	Interpretation
Pretest Scores	19.55	5.53	5.900	11.45	59	.000	With Significant Difference
Posttest Scores	25.08		6.340				

** Significant at 0.001 level*

Table 14 confirms a significant improvement from pretest ($M=19.55$) to post-test ($M=25.08$) values ($t(59) = 11.45$, $p < 0.001$). Consequently, the null hypothesis is rejected.

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Proposed Strategies

Based on the tracking of performance trajectories, a set of targeted educational interventions is outlined in Table 15.

Table 15: Proposed Instructional Strategies to Enhance Numeracy Skills

Strategy	Description	Purpose	Sample Activity
Contextualized Learning	Lessons are based on real-life situations familiar to ALS learners.	To make numeracy skills meaningful and applicable in daily life.	Solving problems involving budgeting, buying goods, or daily expenses.
Self-Paced Learning	Learners progress through the module at their own speed.	To address the different learning abilities and flexible schedules of ALS learners.	Learners complete modules independently within a given timeframe.
Step-by-Step Guided Instruction	Lessons provide clear, detailed examples before practice.	To strengthen the foundational understanding of basic operations.	Guided examples before independent exercises.
Drill and practice	Repetitive exercises are provided to reinforce learning.	To improve mastery and accuracy of numeracy skills.	Worksheets on addition, subtraction, multiplication, and division.
Immediate Feedback	Answer keys or solutions are provided after each activity.	To help learners identify and correct errors independently.	Self-check sections after each lesson.
Problem-Solving Tasks	Activities require the application of skills in real-life contexts.	To develop critical thinking and practical numeracy skills.	Word problems based on work and community situations.
Remediation and Small Group Instruction	Additional support is provided to struggling learners.	To assist learners who remain at the developing level.	Small group sessions focusing on the least-mastered skills.
Use of Visual Aids	Charts, diagrams, and illustrations support learning.	To enhance understanding, especially for low-performing learners.	Use of number lines and visual representations.

DISCUSSION

Socio-Demographic Profile and Learning Context

The findings revealed that most respondents were male (70.0%) and within the age range of 16–21 years old. Half of the respondents had reached only Grade 7, while none had reached Grade 10. In terms of socio-economic status, the majority belonged to low-income households earning ₱5,01–₱10,000 monthly. These results indicate that ALS learners are generally individuals who have experienced educational interruption and socio-economic disadvantage. This profile is consistent with DepEd (2022), which states that ALS primarily serves marginalized learners with limited access to formal education. Similarly, UNESCO (2021) emphasized that socio-economic barriers significantly affect learning continuity and academic achievement. This implies that in addition to addressing academic gaps, numeracy training in ALS must consider the social and economic circumstances of the learners, which have an impact on their performance and level of participation.

Baseline Numeracy Skills (Pre-Intervention)

Before the CNSIM was put into place, students' numeracy abilities were generally poor in all areas. In terms of number sense, problem-solving, and using numeracy in everyday situations, most respondents were categorized as "Needs Improvement," but basic mathematical operations demonstrated comparatively better performance. These results verify that ALS students have substantial deficiencies in basic mathematics when they first enroll in the program. This is consistent with reports from the OECD (2020) and UNESCO (2021) that students in non-formal education systems frequently have difficulty with numeracy because of interrupted schooling and little exposure to structured learning. Furthermore, the World Bank (2022) emphasized that socio-economic constraints contribute to low mathematical literacy due to limited access to learning resources and academic support. These conditions explain the weak baseline numeracy performance observed among respondents.

Post-Intervention Numeracy Performance

After the implementation of the CNSIM, a significant improvement was observed across all numeracy domains. Learners showed progression from “Needs Improvement” to “Satisfactory” and “Proficient” levels, particularly in basic mathematical operations, where more than half reached proficiency. After the intervention, learners were able to apply mathematical ideas in real-world scenarios, as evidenced by improvements in problem-solving abilities and the application of numeracy in everyday life. These findings corroborate DepEd's (2023) assertion that contextualized learning resources improve student performance and comprehension. In a similar vein, Schukajlow et al. (2021) discovered that contextualized problem-solving enhances student engagement and mathematical comprehension. Thus, the findings suggest that structured and contextualized interventions are effective in addressing numeracy gaps among ALS learners.

Effectiveness of the CNSIM and Learning Mechanisms

The improvement in learners’ numeracy skills can be attributed to the contextualized and self-instructed design of the CNSIM. By connecting mathematical concepts to real-life situations such as budgeting, measuring, and daily transactions, learners were able to construct meaningful understanding. This supports Constructivist Learning Theory, where Piaget (1972) emphasized learning through experience, while Vygotsky (1978) highlighted the importance of guided learning within the Zone of Proximal Development (ZPD). The CNSIM functioned as a scaffold that supported learners from assisted learning toward independent problem-solving. In addition, the self-paced structure of the module allowed learners to revisit lessons and learn independently, supporting Zimmerman’s (2020) view that self-regulated learning enhances academic achievement. Empirical studies by Ambayec et al. (2025) and Catador and Fernando (2024) further confirm that modular and intervention-based instruction significantly improve numeracy performance among low-achieving learners.

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The Influence of Income Dynamics

The statistically significant relationship identified between monthly family income and structural score gains (r = 0.450) warrants careful academic consideration. While age, gender, and academic entry thresholds do not restrict the educational utility of the CNSIM modules, financial stability directly shapes the environment in which independent self-study takes place. Learners from households earning more stable incomes can secure dedicated physical study spaces, maintain regular attendance without missing sessions for daily wage labor, and acquire supplementary materials. Conversely, lower-income learners face competing survival priorities that restrict study time. This mirrors findings by Sirin (2020) and Tan (2024), which show that socioeconomic context heavily influences the execution of self-paced learning.

CONCLUSION AND RECOMMENDATIONS

The study concludes that the demographic profile of the district's ALS learners reflects significant educational disruption and socioeconomic vulnerability, with many young males leaving formal schooling around Grade 7 and residing in low-income households. Prior to the intervention, these learners lacked essential conceptual and analytical numeracy skills, leaving them unprepared for equivalency testing or workplace demands. The implementation of the Contextualized Numeracy Self-Instructed Module (CNSIM) resulted in a statistically significant improvement in numeracy performance ($p < 0.001$), demonstrating its effectiveness across diverse ages and academic backgrounds. However, the learning gains were influenced by socioeconomic factors, highlighting the need for sustained institutional support for the most disadvantaged learners. Based on these findings, several recommendations are proposed. For ALS learners, it is advised that they consistently use the self-paced CNSIM modules to build independent study habits and apply their math skills to practical tasks such as budgeting and market calculations. For ALS facilitators, educators should adopt contextualized instructional materials and design localized learning tasks that connect abstract mathematical concepts to community realities, particularly in agriculture and economics. For school administrators, program coordinators should institutionalize the validated CNSIM across community centers and conduct quarterly training sessions on localized material development. For policymakers, the Department of Education should allocate increased funding for targeted, context-based non-formal learning resources and integrate localized instructional mandates into the national ALS curriculum framework. Finally, for future researchers, longitudinal replication studies with larger sample sizes and control groups are recommended to further examine how teacher intervention styles and student motivation influence learning outcomes.

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