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# Enhancing Arithmetic Skills of Alternative Learning System Junior High School in Magallanes District Through the Use of Abacus

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## Abstract.

This study investigated the effectiveness of abacus-based learning in improving the arithmetic skills of Alternative Learning System (ALS) Junior High School learners in the Magallanes District. Thirty participants voluntarily engaged in the intervention, which incorporated both quantitative and qualitative measures. Pre- and post-tests were administered to determine changes in arithmetic performance, while survey questionnaires captured learners' perceptions and attitudes toward abacus use. The results revealed substantial improvement in learners' arithmetic proficiency following the intervention, with mean post-test scores significantly higher than pre-test scores. Statistical analysis confirmed the significance of these gains, while Pearson correlation results further supported the effectiveness of the intervention. Learners reported positive experiences, noting that the abacus made arithmetic easier, increased confidence, and enhanced enjoyment of mathematics. The findings indicate that the abacus functions not only as a computational tool but also as a motivational aid that fosters active engagement in arithmetic learning. The study recommends the integration of abacus-based activities into the ALS curriculum as a supplementary instructional strategy. Such integration can bridge gaps in fundamental skills, promote inclusive education, and equip learners with the confidence and competence to handle arithmetic tasks.

**Keywords:** Abacus-Based Learning, Alternative Learning System (ALS), Arithmetic Skills Enhancement, Interactive Learning Tools, Junior High School, Mathematics Education

## 1.0 Introduction

The Alternative Learning System (ALS) in the Philippines serves as a vital educational pathway for out-of-school youth and adults who are unable to access or complete traditional schooling. It



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provides an avenue for learners to achieve functional literacy, complete basic education, and acquire life skills that enhance employability and social participation. Within the Magallanes District of Agusan del Norte, ALS programs cater to both elementary and junior high school learners, many of whom face systemic challenges, including limited access to resources, socio-economic barriers, and deficiencies in foundational academic competencies. Among these challenges, a particularly persistent concern is the lack of proficiency in arithmetic skills, which serves as a cornerstone of mathematical learning and everyday problem-solving.

Arithmetic proficiency is more than a gateway to advanced mathematics; it is a critical life skill that underpins logical reasoning, financial literacy, and career readiness. Learners with strong arithmetic foundations are more likely to succeed academically, pursue higher education, and access better employment opportunities (Siegler & Lortie-Forgues, 2017). However, ALS Junior High School learners in Magallanes have consistently struggled with basic operations such as addition, subtraction, multiplication, and division. These gaps hinder their ability to transition to higher levels of education and limit their long-term career prospects. Addressing this deficiency requires innovative instructional approaches that are practical, engaging, and tailored to the diverse needs of ALS learners.

One such approach is the integration of the abacus as an instructional tool. Historically used as a counting device, the abacus has been recognized as a powerful aid in developing mental calculation, spatial awareness, and number sense. Recent studies affirm its pedagogical value: Chen and Wu (2018) reported that abacus training enhanced computational fluency among primary learners, while Smith and Lee (2020) observed improvements in secondary students' mathematical performance through abacus instruction. Robinson (2019) further highlighted that abacus-based interventions foster positive attitudes toward mathematics by reducing learner anxiety and improving motivation. These findings suggest that abacus use is not only effective in enhancing numerical skills but also in shaping learner confidence and attitudes towards mathematics.

Despite the promising evidence, research on abacus-based learning remains limited within non-traditional education settings such as ALS. Most prior investigations have centered on formal school contexts, leaving a gap in understanding how such tools may address the learning challenges of out-of-school learners who have varied educational backgrounds and learning styles. This study, therefore, seeks to fill this gap by examining the effectiveness of abacus integration in enhancing arithmetic skills among ALS Junior High School learners in Magallanes District.

The purpose of this study is twofold: first, to determine the extent to which the abacus improves learners' arithmetic skills as measured by pre- and post-assessments, and second, to explore learners' perceptions and attitudes towards abacus-based learning. By addressing both cognitive and affective domains, this research contributes to a holistic understanding of how traditional yet innovative tools can transform arithmetic learning in alternative education contexts.

The significance of the study lies in its potential to inform curriculum innovation in ALS programs. If proven effective, the abacus may serve as a low-cost, accessible, and interactive supplementary tool that bridges arithmetic learning gaps. Furthermore, its integration supports the Department of Education's broader agenda of providing inclusive, quality, and equitable education for all. Ultimately, this study advances the discourse on educational equity by demonstrating how traditional learning tools can be recontextualized to meet contemporary educational needs.





## 2.0 Methodology

This section outlines the research framework, participants, instruments, procedures, and ethical safeguards employed in the study. By adopting a structured methodological approach, the study ensured that the results obtained were both reliable and valid, while also aligning with the standards of rigor required in educational research.

### 2.1 Research Design

The study employed a descriptive quantitative research design to evaluate the effectiveness of abacus-based learning in enhancing the arithmetic skills of Alternative Learning System (ALS) Junior High School learners in the Magallanes District. The design enabled the collection and analysis of baseline and post-intervention data through pre- and post-tests, supported by survey results on learner perceptions and attitudes. This design was selected to capture both the measurable improvements in arithmetic performance and the subjective experiences of learners.

### 2.2 Research Locale

The research was conducted in the Magallanes District of Agusan del Norte, Philippines, where ALS programs are actively implemented. The district encompasses a diverse group of learners with varying socio-economic backgrounds. The setting was selected because of the evident need for strategies that address deficiencies in arithmetic among ALS Junior High School learners.

### 2.3 Research Participants

A total of 30 ALS Junior High School learners participated in the study. Participants were selected based on voluntary involvement and availability during the intervention period. The group was diverse in terms of age, gender, and educational background, ensuring a balanced representation of learner profiles. This sample size was deemed sufficient to provide reliable findings while remaining manageable for data collection and analysis.

### 2.4 Research Instruments

Two primary instruments were employed:

1. Pre- and Post-Test Assessments – Designed to measure learners' proficiency in basic arithmetic operations (addition, subtraction, multiplication, and division). These tests were equivalent in difficulty and served as baseline and post-intervention measures of arithmetic performance.
2. Survey Questionnaire – A Likert-scale instrument was used to gather learners' perceptions and attitudes toward abacus-based learning. Statements focused on perceived usefulness, ease of use, confidence, enjoyment, and motivation. Responses were rated on a 5-point scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

### 2.5 Data Gathering Procedure

The study followed a structured process:

1. Orientation – Learners were briefed on the objectives of the research and the use of the abacus. Informed consent was obtained before participation.
2. Pre-Test Administration – Learners completed a baseline test to assess their arithmetic proficiency.



3. Intervention – A series of structured learning sessions using the abacus was conducted. These sessions integrated tactile, visual, and mental arithmetic strategies aligned with ALS curriculum standards.
4. Post-Test Administration – Following the intervention, learners completed a test equivalent in structure and difficulty to the pre-test.
5. Survey Distribution – Learners completed the perception and attitude survey to provide qualitative insights into their experiences.

## 2.6 Data Analysis

Data were analyzed using descriptive and inferential statistics. Mean scores were computed for pre- and post-test results to evaluate improvements in arithmetic proficiency. A paired-sample t-test was conducted to determine the significance of the observed differences. Pearson correlation analysis was performed to examine the relationship between pre-test and post-test scores. Survey responses were summarized using weighted means and verbal descriptions to reflect learners' perceptions and attitudes.

## 2.7 Ethical Considerations

The study adhered to ethical standards in educational research. Informed consent was obtained from all participants, and parental consent was secured for minors. Confidentiality was ensured by assigning codes to participants instead of using names. Data were collected solely for research purposes and presented in aggregate form to protect individual identities. Learners were informed of their right to withdraw at any stage without penalty.

## 3.0 Results and Discussion

This section presents the findings of the study, organized into quantitative results from pre- and post-test assessments and learners' perceptions and attitudes based on survey data. Each result is followed by an interpretation that links the findings to relevant literature and theoretical perspectives.

**Table 1.** *Pre-Test and Post-Test Results of Practical Abacus Application*

| Student No. | Pre-Test | Post-Test |
|-------------|----------|-----------|
| 1           | 10       | 21        |
| 2           | 9        | 20        |
| 3           | 12       | 23        |
| 4           | 8        | 21        |
| 5           | 9        | 17        |
| 6           | 11       | 22        |
| 7           | 13       | 24        |
| 8           | 9        | 19        |
| 9           | 8        | 20        |
| 10          | 7        | 18        |
| 11          | 10       | 21        |
| 12          | 8        | 17        |
| 13          | 9        | 19        |
| 14          | 7        | 19        |
| 15          | 6        | 20        |
| 16          | 15       | 25        |
| 17          | 11       | 21        |
| 18          | 9        | 18        |
| 19          | 10       | 23        |



**Table 1 (Continued).** *Pre-Test and Post-Test Results of Practical Abacus Application*

| Student No. | Pre-Test | Post-Test |
|-------------|----------|-----------|
| 20          | 9        | 20        |
| 21          | 4        | 18        |
| 22          | 6        | 19        |
| 23          | 8        | 20        |
| 24          | 9        | 20        |
| 25          | 6        | 19        |
| 26          | 7        | 18        |
| 27          | 7        | 19        |
| 28          | 8        | 20        |
| 29          | 10       | 23        |
| 30          | 11       | 22        |

Table 1 displays the learners' performance in arithmetic before and after the abacus intervention. Results revealed a marked improvement, with the mean pre-test score of 8.87 rising to a post-test mean of 20.20. Statistical analysis confirmed that this increase was highly significant, as indicated by the paired-sample *t*-test ( $t = -42.92$ ,  $p < 0.001$ ). The strong Pearson correlation ( $r = 0.78$ ) further supported the reliability of the improvement, showing a consistent positive relationship between pre- and post-test scores.

These findings highlight the efficacy of the abacus in strengthening computational skills. Similar results were reported by Chen and Wu (2018), who noted that abacus instruction significantly improved the arithmetic performance of primary students. Likewise, Smith and Lee (2020) found that secondary learners demonstrated increased computational fluency when the abacus was integrated into mathematics instruction. In the present study, the abacus functioned not only as a tool for computation but also as a cognitive scaffold that allowed ALS learners to visualize and manipulate numbers more effectively, thereby reducing errors and enhancing confidence in problem-solving.

**Table 2.** *Mean Distribution on Perceptions of Abacus Learning*

| Perceptions of Abacus Learning                                   | Mean        | Verbal Description    |
|--|-------------|-----------------------|
| The abacus has helped me understand arithmetic concepts better.  | 4.30        | Strongly Agree        |
| Using the abacus has made arithmetic calculations easier for me. | 4.43        | Strongly Agree        |
| The abacus has improved my mental calculation skills.            | 4.13        | Agree                 |
| I enjoy using the abacus in my arithmetic learning.              | 4.63        | Strongly Agree        |
| The abacus has increased my confidence in solving problems.      | 4.50        | Strongly Agree        |
| <b>Total Mean Score</b>  | <b>4.40</b> | <b>Strongly Agree</b> |

Table 2 indicates that learners held overwhelmingly positive perceptions of abacus-based learning, with a total mean score of 4.40 (Strongly Agree). The highest-rated statement was enjoyment of abacus learning ( $M = 4.63$ ), while the lowest, though still favorable, was the perception that it improved mental calculation skills ( $M = 4.13$ ). These findings imply that learners not only acknowledged the utility of the abacus but also viewed it as an enjoyable and confidence-boosting experience.

The results are consistent with Robinson (2019), who emphasized that abacus instruction fosters learner engagement and reduces mathematics-related anxiety. Positive perceptions are particularly crucial in the ALS context, where learners often enter programs with negative prior experiences in formal schooling. By enhancing learners' motivation, the abacus intervention addressed both the cognitive and affective domains of learning.





*Table 3. Mean Distribution on Attitudes towards Abacus Learning*

| Attitudes towards Abacus Learning                              | Mean        | Verbal Description    |
|--|-------------|-----------------------|
| Learning arithmetic with the abacus has been enjoyable for me. | 4.26        | Strongly Agree        |
| I feel motivated to learn and practice arithmetic with it.     | 4.43        | Strongly Agree        |
| I believe the abacus is a useful tool for improving skills.    | 4.10        | Agree                 |
| I would recommend using the abacus to other students.          | 4.36        | Strongly Agree        |
| I think the abacus should be part of the curriculum.           | 4.50        | Strongly Agree        |
| <b>Total Mean Score</b>  | <b>4.36</b> | <b>Strongly Agree</b> |

Table 3 reflects learners' attitudes toward abacus learning, with an overall mean of 4.36 (Strongly Agree). The strongest agreement was for the statement advocating its inclusion in the curriculum ( $M = 4.50$ ), demonstrating that learners view the abacus not as a temporary intervention but as a valuable and sustainable learning tool. The lowest-rated item, though still positive ( $M = 4.10$ ), affirmed the perception that the abacus is a valuable aid for arithmetic proficiency.

These findings underscore the motivational impact of the abacus, resonating with Smith and Lee (2020), who observed that learners trained in abacus methods exhibited greater persistence in mathematics. The positive attitudes documented in this study suggest that the abacus enhances learners' disposition toward mathematics, contributing to a cycle of increased engagement, confidence, and achievement.

## 4.0 Conclusion and Recommendations

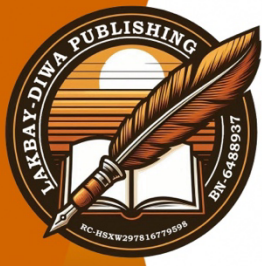
The present study demonstrated the effectiveness of abacus-based instruction in enhancing the arithmetic skills of Alternative Learning System (ALS) Junior High School learners in the Magallanes District. The results revealed a significant increase in arithmetic performance from pre-test to post-test scores, underscoring the abacus as an effective tool for improving computational proficiency. Beyond measurable gains in academic achievement, the findings also highlighted learners' positive perceptions and attitudes toward abacus use, reflecting increased confidence, enjoyment, and motivation in mathematics learning.

These results validate the potential of the abacus as both a cognitive scaffold and a motivational instrument in mathematics instruction. For ALS learners, who often enter programs with weak foundational skills and limited positive experiences in formal education, the integration of such tools offers a practical and inclusive means of bridging learning gaps. By reinforcing both skill acquisition and learner confidence, the abacus addresses the dual challenge of competence and attitude that often impedes success in mathematics.

### 4.1 Recommendations

Based on the findings, the following recommendations are advanced:

1. Integration into ALS Curriculum – Abacus-based activities should be formally incorporated into arithmetic instruction within ALS programs as a supplementary strategy to strengthen computational skills.
2. Teacher Training and Professional Development – ALS teachers should receive regular training and workshops on abacus-based teaching strategies to ensure the effective and creative integration of the tool in diverse learning contexts.
3. Sustained Learner Engagement – Abacus learning should be introduced progressively, starting with basic operations and gradually progressing to more complex tasks, to maintain learner interest and reinforce skill mastery.
4. Replication in Other ALS Settings – Given the success of this intervention in Magallanes District, similar studies and implementations should be conducted in other districts to validate and expand its applicability across ALS programs nationwide.



5. Parental and Stakeholder Support – Parents, administrators, and community stakeholders should be encouraged to support abacus-based initiatives through advocacy, provision of resources, and monitoring of learner progress.
6. Future Research – Further studies may explore the long-term effects of abacus training, its impact on higher-order mathematical concepts, and its adaptability to digital learning platforms.

In conclusion, the abacus presents itself as an accessible, interactive, and effective instructional tool that can significantly improve arithmetic skills, reshape learner attitudes toward mathematics, and strengthen the quality of learning in ALS programs. Its integration aligns with the Department of Education's vision for inclusive and equitable education, offering a replicable model for addressing foundational skill gaps in alternative learning environments.

### 5.0 Contributions of Authors

Honey Grace Buyan – Conceptualization, data collection, analysis, and manuscript writing.

### 6.0 Conflict of Interests

The author declares no conflict of interest in the conduct and reporting of this research.

### 7.0 Acknowledgment

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