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FOREWORD

It is with great enthusiasm that I welcome you to this issue of ACADEMIC FRONTIERS. As a peer-reviewed, multidisciplinary journal, we aim to provide a dynamic platform for scholars, educators, and researchers to share their latest academic insights and discoveries. Our mission is to foster a global community of intellectuals who are dedicated to advancing knowledge and sparking meaningful conversations across various fields of study.

In the pages that follow, you will find a collection of peer-reviewed articles, research papers, and abstracts, each selected to reflect the most recent trends and developments in academia. These works represent the collective efforts of scholars and researchers from around the world, each offering unique perspectives that challenge, inspire, and provoke thought.

At ACADEMIC FRONTIERS, intellectual growth is a shared journey that transcends disciplines. Our commitment to publishing a wide range of topics—from innovative research methodologies and theoretical explorations to practical applications and interdisciplinary studies—reflects our dedication to supporting scholars at all stages of their academic endeavors.

As we navigate a rapidly evolving global landscape, the importance of research and knowledge-sharing has never been more profound. In this issue, you will find work that not only contributes to the advancement of knowledge but also highlights the crucial role that academia plays in shaping our world. These contributions serve as a reminder of the power of research to foster change, inspire progress, and create a better future for all.

I extend my deepest gratitude to our contributors, whose expertise and dedication have made this journal possible. I also express sincere thanks to our readers for their continued support and engagement. It is through your involvement that ACADEMIC FRONTIERS continues to grow into a vibrant and inclusive space for intellectual exchange and discovery.

As you immerse yourself in this issue, I invite you to reflect on the diverse range of ideas presented and consider how they might contribute to your own work and academic journey. Together, let us explore the frontiers of knowledge and celebrate the vital role of research in advancing human understanding.

Thank you for being a part of ACADEMIC FRONTIERS.

With warm regards,

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The Impact of Water, Sanitation, and Hygiene (WASH) on Enhancing Basic Education Services and Facilities

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Abstract.

This study examined the impact of Water, Sanitation, and Hygiene (WASH) facilities on enhancing educational outcomes at Carmen Central Elementary School. Data from 30 teachers, school administrators, and 30 students were collected using a Likert-scale survey employing a descriptive-correlational methodology. The study found improved WASH services positively impacted learners' health, attendance, and academic performance. The study recommends further teacher training in hygiene education, greater collaboration with local organizations, and regular assessments to ensure facility upkeep. The school could foster a healthier, more productive learning environment by emphasizing student involvement and enhancing WASH programs.

Keywords: Water, Sanitation, Hygiene (WASH), Basic Education, Educational Services

1.0 Introduction

Water, Sanitation, and Hygiene (WASH) programs are essential in creating conducive learning environments in schools. In the Philippines, the Department of Education (DepEd) has mandated WASH initiatives through DepEd Order No. 10, s. 2016, aiming to reduce absenteeism and improve health outcomes among students. Despite the policy support, significant gaps persist in infrastructure and implementation, particularly in rural schools like Carmen Central Elementary School, which face challenges in providing adequate facilities.

While global studies have highlighted the importance of WASH (WHO, 2020; UNICEF, 2019), localized data on its specific impact on basic education services in Philippine elementary schools is still underexplored. This study, therefore, seeks to address this gap by examining the current status of WASH facilities and their influence on educational outcomes in a rural school setting. Specifically, the study aims to assess the quality of WASH facilities, the correlation between WASH and students' health and attendance, and the roles of various stakeholders in sustaining these programs.

In particular, this research also highlights the intersection of public health and educational equity, focusing on how improving WASH infrastructure can create an environment where all students—regardless of gender, socio-economic status, or physical abilities—can thrive academically. In schools with inadequate WASH services, absenteeism due to preventable health issues such as waterborne diseases and poor sanitation can significantly disrupt learning. Exploring how WASH programs can alleviate these challenges and enhance the overall educational experience is essential.

This study hypothesizes that effective WASH programs significantly improve students' health, attendance, and academic performance. The study is guided by the Comprehensive WASH in Schools Policy (DepEd, 2016) and WHO's Health-Promoting Schools model, both of which emphasize the link between

adequate WASH infrastructure and educational outcomes.

2.0 Methodology

2.1 Research Design

The study employed a descriptive-correlational research design to explore the relationship between Water, Sanitation, and Hygiene (WASH) facilities and educational outcomes. The descriptive aspect aimed to provide a detailed account of the current state of WASH services at Carmen Central Elementary School, assessing the availability, functionality, and impact of water supply, sanitation facilities, and hygiene education. This approach included collecting baseline data on the WASH infrastructure and services in the school.

The correlational component sought to analyze the relationship between the quality of WASH facilities and key educational metrics such as students' health, school attendance, and academic performance. The study used surveys and data analysis to determine whether improvements in WASH infrastructure were associated with better health outcomes, higher attendance rates, and improved academic performance. Through this design, the study identified potential patterns and correlations, providing a foundation for future interventions in WASH programs at schools.

2.2 Research Locale

The research was conducted at Carmen Central Elementary School in Carmen, Agusan del Norte, Philippines. This public educational institution serves as a representative setting for the study, as it is situated in a region that faces diverse challenges related to access to basic sanitation, water, and hygiene services. The school's context provides a valuable case for investigating the intersection of WASH facilities and educational outcomes. The location is particularly relevant to the study due to the ongoing efforts by the Department of Education (DepEd) to improve the quality of educational services through enhanced WASH infrastructure, making it an ideal site for examining the effectiveness of these initiatives in a local school environment.

2.3 Research Participants

The study's participants were carefully selected to ensure that the data gathered would provide a broad perspective on the impact of WASH facilities on education. A total of 30 teachers, including school administrators and non-teaching personnel, participated in the survey. These participants offered valuable insights from an educational and administrative standpoint, sharing their observations on how WASH facilities have affected the school environment, students' health, and learning experiences. Thirty students were randomly selected to participate, representing a cross-section of the school's population. This group provided first-hand feedback on their experiences with WASH services, offering a student-centered view of how the facilities influence their health, attendance, and academic performance. The combination of perspectives from both staff and students allowed for a holistic understanding of the impact of WASH infrastructure at the school.

2.4 Research Instrument

The data for this study were collected using a Likert-scale survey, a widely used tool for measuring attitudes, perceptions, and opinions in educational research. The survey assessed various aspects of WASH facilities, including the availability, functionality, and impact of water, sanitation, and hygiene services. Specific items in the survey addressed key factors such as:

- The availability and quality of clean drinking water.
- The condition and accessibility of sanitation facilities (e.g., toilets, handwashing stations).
- The integration of hygiene education within the school curriculum.
- The effectiveness of health and illness reporting systems in addressing health concerns.

The survey was structured to capture objective and subjective responses, allowing for a nuanced understanding of the WASH program's influence on students' health and educational outcomes.



2.5 Data Gathering Procedure

The research followed a structured data collection process, ensuring clarity and consistency. Permission to conduct the study was sought from the school principal, who approved distributing the survey forms. The researcher personally distributed the surveys to all participants, ensuring the instrument's controlled and ethical administration. The surveys were carefully designed to be completed in a manageable time frame, with clear instructions for all respondents. Participants were encouraged to provide honest and thoughtful answers, ensuring the data accurately reflected their perceptions and experiences with the WASH facilities. Once the surveys were completed, the data were compiled, entered into a database, and analyzed using statistical methods to identify significant patterns, trends, and correlations relevant to the research questions.

2.6 Ethical Considerations

This study adhered to ethical standards set forth for research involving human participants. Informed consent was obtained from all participants, and the purpose and scope of the study were communicated to them. Students' consent was also obtained from their parents or guardians to ensure voluntary participation. Confidentiality and anonymity were assured to safeguard all participants' rights and privacy. Personal identifiers were not collected, and all responses were anonymized in the analysis phase. Furthermore, participants were informed of their right to withdraw from the study at any point without any negative consequences. Ethical integrity was maintained throughout the study, with a commitment to upholding the highest standards of research practice.

3.0 Results and Discussion

This section presents the study's findings regarding the impact of Water, Sanitation, and Hygiene (WASH) facilities at Carmen Central Elementary School on various educational outcomes. The results are discussed in the context of their implications for students' health, attendance, and academic performance, focusing on the key areas of clean water availability, sanitation facilities, hygiene education, and health reporting systems.

3.1 Availability of Clean Water

The results revealed that the school provides high access to clean drinking water. According to the survey responses, 80% of participants rated the availability of clean water as a significant contributing factor to student well-being and academic performance. The table below summarizes the frequency distribution of responses regarding clean water availability.

Table 1. Frequency and Percentage Distribution of Responses on the Availability of Clean Water

Item	Frequency	Percentage (%)
The school provides an adequate supply of clean water	25	83.3%
The availability of clean water improves learners' well-being	28	93.3%
Learners have easy access to clean drinking water	30	100%
Regular maintenance ensures water safety and cleanliness	22	73.3%
The availability of clean water reduces absenteeism	18	60%

The data show that students and staff regard clean water availability highly, with 100% access to clean drinking water during school hours. However, regular maintenance of the water supply needs improvement, as indicated by the moderate rating of 73.3%.

3.2 Sanitation Facilities

Sanitation facilities were another key focus of the study. The findings suggest that while the school provides sufficient sanitation facilities, there is a need for more consistent maintenance. The table below summarizes the responses related to the sanitation facilities at the school.

**Table 2.** Frequency and Percentage Distribution of Responses on Sanitation Facilities

Item	Frequency	Percentage (%)
The school provides clean and functional toilets	29	96.7%
Sanitation facilities are regularly cleaned	20	66.7%
There is a separate toilet facility for boys and girls	25	83.3%
The school's sanitation facilities accommodate learners with disabilities	22	73.3%
Sanitation issues contribute to learners' absenteeism	18	60%

The results show that most respondents felt that sanitation facilities are adequate, but maintenance practices require improvement, with a notable 33.3% rating the regular cleaning as insufficient. Furthermore, the data suggest that while gender-sensitive facilities are in place, accommodations for learners with disabilities could be enhanced.

3.3 Personal Hygiene Education

The survey indicated that hygiene education is integral to the school's curriculum, contributing to students' overall health and well-being. The responses show that personal hygiene education positively impacts students' health practices. Below is a summary of responses related to personal hygiene education.

Table 3. Frequency and Percentage Distribution of Responses on Personal Hygiene Education

Item	Frequency	Percentage (%)
The school provides regular personal hygiene education	27	90%
Hygiene education has increased learners' awareness of good hygiene practices	28	93.3%
Personal hygiene lessons have improved hygiene habits	30	100%
Hygiene education has reduced the spread of illnesses	24	80%
Teachers are well-trained to deliver hygiene education	29	96.7%

The results reveal that hygiene education is highly regarded, with 100% of respondents agreeing that personal hygiene education has improved student health behaviors and reduced illness. Furthermore, most teachers (96.7%) are well-trained to deliver hygiene lessons, ensuring that the program is effectively implemented.

3.4 Health and Illness Reporting

The effectiveness of the school's health and illness reporting system was another significant factor analyzed. The data suggest that the reporting system is generally well-managed but could benefit from improved communication and response times. The table below presents the frequency distribution of responses related to health and illness reporting.

Table 4. Frequency and Percentage Distribution of Responses on Health and Illness Reporting

Item	Frequency	Percentage (%)
The school has an efficient health reporting system	26	86.7%
Health issues are addressed promptly when reported	23	76.7%
Learners are encouraged to report health concerns	28	93.3%
Regular health checks are conducted	25	83.3%
Parents are promptly informed when their child is ill	27	90%

The data indicate that the school's health reporting system is effective, with 86.7% of respondents agreeing that health issues are addressed promptly. However, the system could be further strengthened, particularly in terms of communication with parents and faster response times.

3.5 Overall Impact on Learners' Health and Academic Performance

Finally, the overall impact of WASH facilities on learners' health and academic performance was assessed. The data show that the availability of clean water, sanitation facilities, hygiene education, and health reporting systems collectively contribute to a healthier learning environment, leading to improved attendance and academic outcomes.

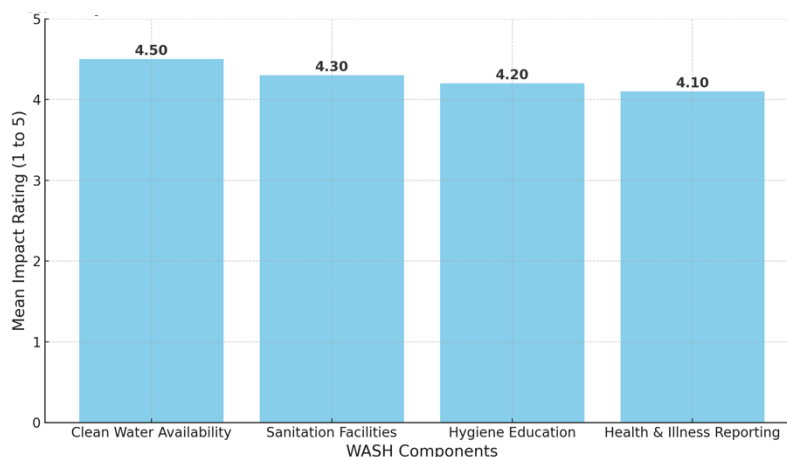


Figure 1. The Impact of WASH Facilities on Learners' Health and Academic Performance

The figure demonstrates a clear positive correlation between the availability of WASH facilities and students' health and academic performance. Respondents reported that improvements in WASH infrastructure led to a healthier school environment, reducing absenteeism and enhancing students' ability to concentrate and perform academically.

3.6 Discussion

The findings indicate that WASH facilities at Carmen Central Elementary School significantly positively impact students' health and academic outcomes. Access to clean water, functional sanitation facilities, and adequate hygiene education were identified as key factors contributing to students' overall well-being. The results align with previous studies that emphasize the importance of WASH infrastructure in reducing absenteeism and improving learning outcomes. However, areas need improvement, particularly in maintaining sanitation facilities and the speed of health issue reporting. Further investment in these areas could enhance the effectiveness of the WASH program and contribute to even better educational outcomes.

4.0 Conclusion

This study provides compelling evidence that the Water, Sanitation, and Hygiene (WASH) facilities at Carmen Central Elementary School are crucial in enhancing students' health, improving attendance, and fostering better academic performance. The positive effects of accessible clean water, functional sanitation facilities, and hygiene education were consistently highlighted by both teachers and students. These facilities contribute not only to the physical well-being of the learners but also to a healthier learning environment, which in turn supports their educational outcomes.

While the existing WASH infrastructure at the school has demonstrated effectiveness in addressing the essential needs of the students, several areas for improvement were identified. Regular maintenance of water and sanitation systems, enhanced collaboration among stakeholders (including school administrators, teachers, and local communities), and a continued focus on hygiene education are key recommendations to optimize the current facilities. Strengthening these areas will ensure that the WASH program provides a safe, supportive, and health-promoting environment that allows students to focus on their education and participate fully in school activities.



Expanding the integration of WASH practices across all school activities, coupled with further investments in infrastructure and training, can create long-term positive outcomes for student health and academic performance. By addressing these gaps and fostering a holistic, sustainable approach to WASH, the school can enhance the overall learning experience and contribute to better health outcomes, ultimately improving all students' education quality.

5.0 Contributions of Authors

Maria Teresa T. Rebosada: Research conception, data collection, and writing.

6.0 Conflict of Interests

The author declares no conflict of interest.

7.0 Acknowledgment

The author acknowledges the school principal, teachers, students, and staff for their participation and support throughout the study.

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Parental Involvement in Educational Advocacy on Improving Academic Performance of 4Ps Beneficiaries

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Abstract.

This study investigates how parental involvement and educational advocacy influence the academic performance of Pantawid Pamilyang Pilipino Program (4Ps) beneficiaries at Buhang Elementary School, Magallanes, Agusan del Norte. Grounded in Vygotsky's socio-cultural theory and Bronfenbrenner's ecological systems theory, the research highlights the significance of parental support and the learning environment. A quantitative survey was employed to gather data from 30 parents/guardians of 4Ps students. Results revealed that although parents acknowledge their educational roles, socio-economic challenges and limited time often hinder active engagement. Teachers emerged as crucial enablers of advocacy and support, guiding parents in monitoring and engaging with their children's academic needs. The study introduced Project PARENTS—Promoting Active Responsibility and Engagement through Nurturing, Training, and Support—as a strategic intervention to address awareness, communication, and participation gaps. This multi-activity initiative, including parenting workshops, PTCs, and family advocacy campaigns, aims to strengthen home-school collaboration. The study concludes that improving academic performance among 4Ps beneficiaries requires a holistic approach centered on empowering parents and building strong partnerships between schools and communities.

Keywords: Parental Involvement; Educational Advocacy; Academic Performance; 4Ps Beneficiaries; Rural Education

1.0 Introduction

In rural Philippine schools, particularly at Buhang Elementary School, 4Ps student beneficiaries often underperform academically. The root of this issue includes a lack of parental involvement and low advocacy for education within economically challenged households. Despite government support through conditional cash transfers, many parents lack awareness or the capacity to contribute to their children's academic success effectively. The disconnect between school efforts and home support weakens the learning continuity essential to student achievement.

Building on Vygotsky's (1978) notion that social interaction plays a critical role in cognitive development, and Bronfenbrenner's (1979) model highlighting environmental influence, this study posits that improving student performance requires engaging the family system, especially parental advocacy and awareness. Numerous studies (e.g., Epstein, 2018; Wang & Eccles, 2020) affirm that consistent and intentional parental involvement leads to improved academic outcomes, better behavior, and school engagement.

In this context, the study investigates how parent-school collaboration, strengthened through targeted strategies, can uplift the academic trajectory of marginalized learners. The findings aim to inform policy and practice in rural educational settings and contribute to a more inclusive and effective implementation of 4Ps.



2.0 Methodology

2.1 Research Design

This study adopted a quantitative-descriptive research design, deemed appropriate for systematically capturing and analyzing parental involvement and educational advocacy patterns among 4Ps beneficiaries. Through this design, the research quantified attitudes, behaviors, and perceived challenges parents face in supporting their children's education. A structured survey instrument served as the primary tool for data collection, enabling the researcher to obtain measurable insights on various dimensions of parent-school engagement. The design also allowed for correlational analysis to explore how specific aspects of parental involvement might influence students' academic performance.

2.2 Participants and Sources of Data

The respondents consisted of thirty (30) parents or guardians of children enrolled at Buhang Elementary School, who were active beneficiaries of the Pantawid Pamilyang Pilipino Program (4Ps). These participants were selected through purposive sampling, guided by the following criteria: (1) they must have a child enrolled in the school for at least one academic year, (2) they must be officially recognized 4Ps recipients, and (3) they must be willing and available to participate in the study. These criteria ensured respondents could provide relevant and informed perspectives regarding their children's academic development and involvement in school-related activities.

2.3 Research Instrument

To gather data, the researcher developed a structured questionnaire anchored on a 5-point Likert scale, with responses ranging from "Strongly Disagree" (1) to "Strongly Agree" (5). The instrument was composed of multiple sections designed to evaluate the following domains:

- Parental awareness of educational roles,
- Parent-teacher collaboration,
- Advocacy for the value of education,
- Home-based academic support practices, and
- Barriers to parental engagement.

The questionnaire underwent content validation by education professionals and school research advisers to ensure relevance, clarity, and alignment with the study objectives. A pilot test was also conducted among a similar group of parents to establish internal consistency and improve item wording based on feedback.

2.4 Data Gathering Procedure

Data was collected during scheduled school-based orientations and meetings where participating parents were present. The researcher personally distributed and collected the questionnaires on-site to ensure high return rates and clarify any ambiguities. Participants were given sufficient time and support to complete the forms in a stress-free environment. This direct approach safeguarded the accuracy of responses and encouraged participant engagement in the research process.

2.5 Data Analysis

The collected data were encoded, organized, and subjected to descriptive statistical analysis using measures such as frequency counts, percentage distributions, and weighted mean scores. These metrics were used to interpret general trends and levels of agreement among respondents. Furthermore, a correlation matrix was generated to explore interrelationships among the identified variables (e.g., between parent-teacher collaboration and home-based support), shedding light on how each factor may contribute to the overall academic performance of the learners. Microsoft Excel and SPSS were used to facilitate statistical computations and generate visual data representations.



2.6 Ethical Considerations

The study strictly adhered to established ethical research protocols. Informed consent was obtained from all participants, ensuring they were fully aware of the purpose, scope, and voluntary nature. Respondents were assured of confidentiality and anonymity, and their responses were used exclusively for academic purposes. Data were stored securely, and access was limited to the principal investigator. The research proposal underwent ethical review and was formally approved by the School Research Committee before implementation.

3.0 Results and Discussion

This section presents the analyzed data gathered from 30 parents or guardians of 4Ps beneficiaries enrolled at Buhang Elementary School. The findings are organized according to five thematic dimensions aligned with the study's objectives: (1) Awareness of Parents' Role in Education, (2) Strengthening Parent-Teacher Collaboration, (3) Advocacy for the Value of Education, (4) Monitoring and Support of Academic Performance, and (5) Addressing Challenges in Parental Involvement. Each dimension is discussed alongside the implications of the findings, supported by relevant literature.

3.1 Awareness of Parents' Role in Education

As shown in Table 1, the overall mean score for this dimension is 3.47, interpreted as "Agree." This result suggests that while most parents acknowledge their importance in supporting their children's education, their level of active participation, particularly in school-related activities, remains limited. Statements relating to awareness of responsibilities and home-based support rated higher, while actual engagement in school events showed lower agreement levels.

This gap between understanding and active participation may reflect barriers such as a lack of time, confidence, or socio-economic constraints. As supported by Epstein (2019), meaningful involvement requires not only awareness but also an enabling environment that promotes parent-school collaboration.

Table 1. Mean Distribution of Awareness of Parents' Role in Education

Statements	Mean	Verbal Description
Parents recognize the significance of their involvement in their child's academic progress.	3.60	Agree
Parents understand the importance of monitoring their child's learning at home.	3.50	Agree
Parents know how their actions influence their child's attitude toward education.	3.30	Neutral
Parents actively participate in school activities and events.	3.16	Neutral
Parents are informed about their responsibilities in supporting their child's education.	3.80	Agree
Total Mean Score	3.47	Agree

3.2 Strengthening Parent-Teacher Collaboration

This dimension received a mean score of 3.69, which also falls under the "Agree" interpretation (Table 2). Respondents affirmed that regular communication with teachers, active participation in identifying learning challenges, and openness to feedback helped address academic issues and improve student motivation.

Kraft and Rogers (2019) emphasized that effective collaboration strengthens mutual trust and reinforces shared responsibility for student outcomes. The results of this study confirm the critical role that consistent communication plays in bridging school-home expectations.



Table 2. Mean Distribution on Strengthening Parent-Teacher Collaboration

Statements	Mean	Verbal Description
Regular parent-teacher meetings help address academic challenges.	3.83	Agree
Communication fosters better student outcomes.	3.70	Agree
Teachers involve parents in identifying and addressing academic concerns.	3.90	Agree
Parents are receptive to teacher feedback and suggestions.	3.43	Agree
Collaborative efforts enhance student motivation and engagement.	3.57	Agree
Total Mean Score	3.69	Agree

3.3 Advocacy for the Value of Education

This dimension recorded a high mean score of 4.42, categorized as “Strongly Agree” (Table 3). Teachers were found to play a proactive role in promoting the value of education among families. They engaged in conversations emphasizing long-term educational benefits, often framing education as a means to break the cycle of poverty, which resonated with 4Ps households. Parents reported increased motivation to advocate for their children’s schooling and actively encourage attendance and participation. These outcomes are supported by Jeynes (2018), who emphasizes the transformative impact of teacher-led educational advocacy on parental mindset and commitment.

Table 3. Mean Distribution on Advocacy for the Value of Education

Statements	Mean	Verbal Description
Teachers encourage parents to advocate for education within their families and communities.	4.60	Strongly Agree
Teachers discuss the long-term benefits of education with parents of 4P's beneficiaries.	4.30	Strongly Agree
Teachers provide strategies for parents to emphasize the importance of education at home.	4.56	Strongly Agree
Teachers inspire parents to view education as a means to break the cycle of poverty.	4.63	Strongly Agree
Teachers collaborate with parents to create a shared vision of educational success for students.	4.00	Strongly Agree
Total Mean Score	4.42	Strongly Agree

3.4 Monitoring and Support of Academic Performance

With a mean score of 4.49, this area had one of the highest levels of agreement (Table 4). Parents appreciated how teachers consistently provided feedback, learning tools, and encouragement to help them support their children’s learning at home. The data suggest that structured teacher support enhances parental confidence and routine establishment, which is crucial for sustained academic improvement.

Fan and Williams (2018) emphasized that proactive support and teacher feedback enable parents to develop habits that positively affect students’ learning behavior and performance.



Table 4. Mean Distribution on Monitoring and Support of Academic Performance

Statements	Mean	Verbal Description
Teachers update parents regarding their child's academic performance and attendance.	4.47	Strongly Agree
Teachers give parents specific recommendations to improve their child's academic success.	4.56	Strongly Agree
Teachers encourage parents to establish routines that support homework and study time.	4.67	Strongly Agree
Teachers provide learning materials or tools to assist parents in supporting their child's studies.	4.37	Strongly Agree
Teachers acknowledge and support parents' efforts in monitoring their child's progress.	4.37	Strongly Agree
Total Mean Score	4.49	Strongly Agree

3.5 Addressing Challenges in Parental Involvement

This dimension also recorded a mean score of 4.49, underscoring the success of teachers' flexible and culturally responsive approaches (Table 5). Adjustments in meeting schedules, accessible language in communication, and socio-contextual understanding helped overcome the barriers faced by many 4Ps families.

These findings echo Smith et al. (2019), who argue that addressing structural and cultural barriers is essential to equitable and sustainable parental involvement.

Table 5. Mean Distribution on Addressing Challenges in Parental Involvement

Statements	Mean	Verbal Description
Teachers help parents overcome barriers to active involvement in their child's education.	4.77	Strongly Agree
Teachers address cultural or social factors that may limit parental engagement.	5.00	Strongly Agree
Teachers provide flexible options for parents to participate in school activities and meetings.	4.03	Agree
Teachers collaborate with parents to address time or resource constraints affecting parental involvement.	4.27	Strongly Agree
Teachers adapt strategies to meet the unique needs of parents of 4P's beneficiaries.	4.57	Strongly Agree
Total Mean Score	4.49	Strongly Agree

3.6 Comparative Analysis Across Dimensions

A comparison of the five thematic areas is visualized in Figure 1, which shows that the strongest parental agreement lies in academic monitoring and challenge accommodation, while awareness and collaboration scored lower. This implies that while external support by teachers is effective, internal factors like initiative and time availability still limit full engagement.

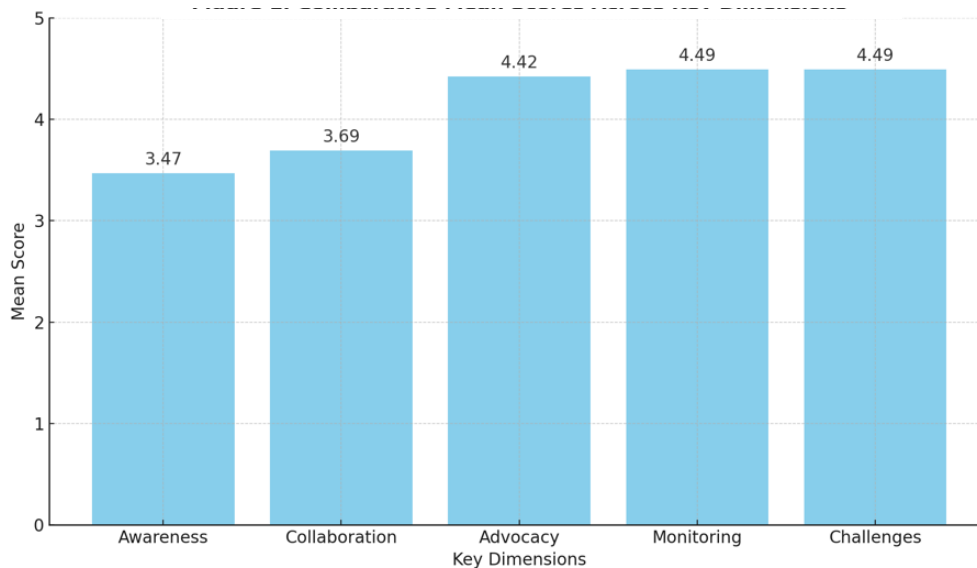


Figure 1. Comparative Mean Scores Across Key Dimensions

3.7 Correlation Matrix Summary

A key finding from the correlation analysis revealed a strong positive relationship ($r = 0.8256$) between parent-teacher collaboration and academic monitoring, affirming that increased communication and shared goal-setting directly strengthen parents' capacity to support learning at home. Conversely, a negative correlation ($r = -0.7729$) was noted between parental awareness and educational advocacy, indicating that although parents may understand their role, this awareness does not automatically lead to active advocacy without guidance or motivation. This paradox highlights the critical role of schools as catalysts, bridging knowledge and action by offering mentorship, inspiration, and supportive platforms. These patterns echo the assertions of Goodall (2022), who noted that effective parental involvement hinges not merely on information but on engagement through empowerment.

4.0 Conclusion

The findings of this study underscore the critical role of parental involvement in the academic success of students, particularly for marginalized groups such as the Pantawid Pamilyang Pilipino Program (4Ps) beneficiaries. It is evident that when parents are actively engaged in their children's education, through informed advocacy and consistent collaboration with teachers, there is a noticeable improvement in student performance and well-being. However, while parental involvement is recognized as a key determinant of educational success, the study highlights several challenges that need to be addressed to maximize its impact.

The research confirms that teachers play a pivotal role in facilitating this involvement. Teachers not only educate students but also act as advocates who empower parents by providing them with the necessary tools, information, and encouragement to support their children's academic journeys actively. Structured interventions, such as Project PARENTS, are essential in bridging the gap between parental recognition of their roles and their practical involvement in school activities. Through workshops, advocacy campaigns, and peer support networks, this program enables parents to overcome the barriers that hinder their participation,



such as a lack of time, resources, or awareness.

Despite the clear benefits of parental involvement, the study also reveals that socio-economic barriers and initial low awareness among many parents remain significant obstacles. These challenges are compounded by parents' multiple responsibilities and limited access to education or information about how best to support their children's learning. Therefore, efforts to build awareness and engage parents need to be sustained over time, with targeted programs that address both practical and psychological barriers.

The Project PARENTS initiative proposed by the study is a comprehensive approach that not only encourages parents to take an active role in their children's education but also seeks to create a supportive environment where these efforts are nurtured. This holistic approach fosters long-term engagement, helping to break the cycle of poverty by improving educational outcomes and, consequently, the social mobility of children in the 4Ps program.

In conclusion, this study contributes to the growing body of evidence that supports the collaborative relationship between parents, teachers, and schools as a fundamental factor for the success of educational programs. Moving forward, it is recommended that schools continue to implement and expand parental engagement initiatives, particularly in rural areas, and that government and non-government organizations provide additional support for parental empowerment. These efforts will not only improve academic outcomes for 4Ps beneficiaries but also promote the overall well-being and success of future generations.

5.0 Contributions of Authors

Jeryl Ann J. Robas – research design, data collection, analysis, project development, and manuscript writing.

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The author declares no conflict of interest.

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Lived Experiences of Secondary Mathematics Teachers during the Transition from Modular Instruction to Face-to-Face Classes: A Phenomenological Study

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Abstract.

This phenomenological study delves into the lived experiences of secondary mathematics teachers in the Southeast Cabadbaran district, exploring the challenges and strategies encountered during the transition from modular instruction to face-to-face teaching amidst the COVID-19 pandemic. The research identifies critical obstacles such as learning retention, significant knowledge gaps, and students' mental health and behavioral adjustments. Despite these hurdles, teachers observed notable positive outcomes, including the development of greater student self-reliance and resilience. Through adaptive teaching strategies, peer support, and professional development, teachers navigated these transitions with perseverance and creativity. The findings underscore the complexities inherent in such a significant educational shift, offering insights and recommendations for future educational practices, focusing on bridging learning gaps in mathematics.

Keywords: COVID-19 pandemic, modular instruction, face-to-face teaching, educational transition, student engagement, learning gaps, mental health, adaptive teaching strategies, professional development

1.0 Introduction

The COVID-19 pandemic triggered an extraordinary and unforeseen disruption to education systems worldwide. In the Philippines, as in many other countries, this led to an urgent shift in how learning was delivered. In response, the Department of Education (DepEd) swiftly adopted modular instruction as the primary learning mode, particularly for students in remote and rural areas who lacked access to reliable internet or digital devices (Auditor & Mutya, 2022). Modular learning, which relies on printed materials delivered to students for independent study, quickly became the preferred solution to maintain educational continuity in the face of social distancing and lockdown measures.

While modular learning allowed education to continue, it also presented substantial challenges, especially in subjects like mathematics, which are traditionally taught through interactive, hands-on methods that require direct teacher-student engagement. Teachers were left to create their materials, adjusting content to be more self-explanatory and reducing opportunities for immediate feedback. Consequently, students were often left to grapple with complex concepts without the usual support of classroom interaction. Despite modular instruction's widespread implementation and popularity (Anzaldo, 2021), its challenges became evident, particularly in fostering student engagement and ensuring sustained learning outcomes. Teachers reported significant difficulty in maintaining student motivation, monitoring progress, and addressing misconceptions in real-time.



As schools began transitioning back to face-to-face classes after nearly two years of remote learning, the learning gaps, especially in foundational subjects like mathematics, became starkly visible (Murphy, 2020). Many students returned to the classroom, struggling to recall basic mathematical concepts they had previously learned, let alone progress to more complex topics. For mathematics teachers, the return to in-person learning meant not only grappling with these learning deficits but also re-establishing the dynamics of the classroom environment. Teachers were faced with the task of bridging these gaps while simultaneously addressing the mental health challenges that had accumulated among students, many of whom had spent much of their learning time isolated from their peers and teachers.

This study explores the lived experiences of secondary mathematics teachers in the Southeast Cabadbaran district in the province of Agusan del Norte. Focusing on their reflections on the transition from modular learning to face-to-face classes, this research sheds light on how teachers navigated the complex and often overwhelming task of re-engaging students in the learning process, addressing learning gaps, and supporting their students' mental and emotional well-being. Teachers were tasked with delivering content and maintaining a supportive environment that could foster students' resilience, self-efficacy, and overall well-being (Villar et al., 2022).

Given the rapid shift in education due to the pandemic, this research is crucial for understanding how teachers adapted to this new learning landscape and how these adaptations may shape future teaching practices. It will contribute to our understanding of the long-term impacts such transitions have on student learning and teacher development, providing insight into strategies that may enhance future educational responses during times of crisis (Roschelle et al., 2020). Understanding these dynamics will help address the current educational challenges and inform future efforts to create more flexible, responsive, and resilient educational systems.

2.0 Methodology

2.1 Research Design

This study uses a descriptive phenomenological approach, which is commonly employed to explore the lived experiences of individuals in a particular context (Sundler et al., 2019). Phenomenology allows for an in-depth exploration of personal perceptions, experiences, and challenges teachers face as they transition from modular instruction to face-to-face classes (Dieumegard et al., 2019). This method is particularly effective for capturing the nuanced changes teachers experienced during the COVID-19 educational transition.

2.2 Research Locale

The research was conducted in the Southeast Cabadbaran district, which includes a diverse range of secondary schools facing urban and rural challenges during the transition period. These schools represent a microcosm of the broader educational system in the Philippines, providing a relevant setting for understanding how teachers navigated this transition (Caganan & Buenvinida, 2021).

2.3 Research Participants

The study involved six secondary mathematics teachers from the district who had experience teaching both during the modular period (2021-2022) and in face-to-face classrooms (2022-2023). Purposive sampling was used to select teachers who had directly experienced the challenges of transitioning between these two teaching modalities (Canonizado, 2021).

2.4 Research Instrument

Data were collected through semi-structured interviews, allowing for an open discussion while ensuring all research objectives were addressed. Additionally, an online survey was distributed to collect quantitative data regarding teachers' challenges and strategies (Sankey, 2021). This mixed-methods approach effectively captures the complexity of teachers' lived experiences during such a significant educational transition (Jamon et al., 2021).



2.5 Data Gathering Procedure

The data collection process involved obtaining formal permission from educational authorities and distributing a survey via Google Forms. Interviews were conducted virtually due to pandemic restrictions. Ethical guidelines were strictly followed, including obtaining informed consent and ensuring the anonymity of participants' responses (Anderson, 2019).

2.6 Ethical Considerations

In line with research ethics, participants were fully informed about the purpose of the study, the voluntary nature of their participation, and their right to withdraw at any time. Confidentiality was maintained throughout the study, and pseudonyms were used to ensure the anonymity of participants (Frechette, 2020).

3.0 Results and Discussion

This section presents the study's findings logically, followed by the corresponding discussion. Where necessary, tables and figures are used to illustrate key points.

3.1 Teachers' Experiences with Modular Instruction

Teachers described the modular instruction period as both a challenge and an opportunity. The primary difficulties were related to the scarcity of learning resources and the lack of student engagement. Teachers often found themselves creating their learning activity sheets (LAS) and adapting lessons to meet the unique needs of their students. Many students struggled to understand the material independently, leading to low assessment performance.

The scarcity of resources and lack of student engagement are consistent with findings from other studies (Murphy, 2020; Garcia & Weiss, 2020). Below is a table summarizing the frequency of challenges reported by teachers during modular instruction.

Table 1. Frequency of Challenges Encountered by Teachers during Modular Instruction

Challenge	Frequency	Percentage (%)
Lack of learning resources	6	100
Student disengagement	5	83.3
Difficulty in student comprehension	5	83.3
Need for teacher-generated content	4	66.7

This table reflects the most common challenges teachers face in adapting to the modular learning modality. The overwhelming issue of a lack of resources and student disengagement aligns with studies emphasizing the challenges posed by limited teacher-student interaction during modular learning (Haser et al., 2022).

3.2 Transition to Face-to-Face Instruction

When the schools returned to face-to-face instruction, teachers noticed a significant gap in students' understanding of basic mathematical concepts. For example, many students had not mastered fundamental arithmetic operations or algebraic skills necessary for progressing to more advanced topics. Teachers reported spending substantial time revisiting these concepts before moving forward with the planned curriculum.

The learning gaps observed are consistent with research on the effects of distance learning, highlighting the challenges in maintaining knowledge retention without direct teacher support (Dela Peña, 2022). The need to revisit foundational concepts before advancing to more complex material is a significant concern for educators. The following graph illustrates the percentage of teachers who reported various learning gaps upon returning to face-to-face classes.

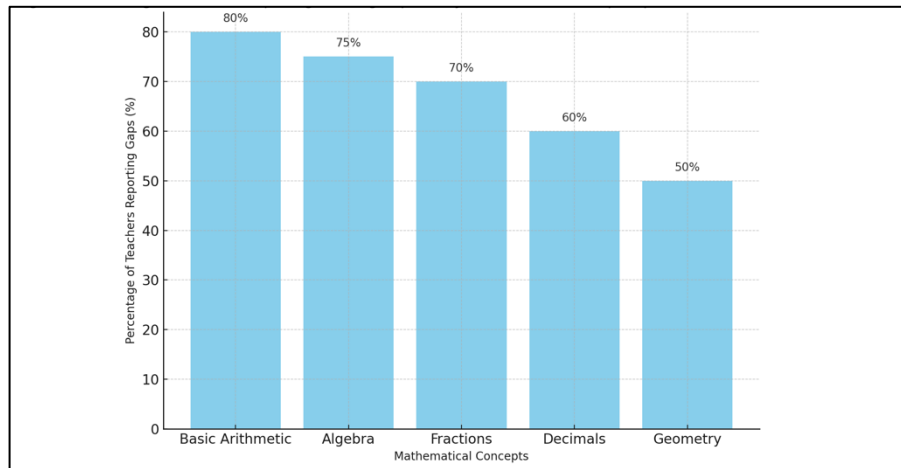


Figure 1. Percentage of Teachers Reporting Learning Gaps in Key Mathematical Concepts Upon Transition to Face-to-Face Classes

This graph underscores the significant gaps in student learning, particularly in foundational mathematical skills. Addressing these gaps will require targeted interventions and additional time allocated for review (Sawchuck & Sparks, 2020).

3.3 Mental Health and Behavioral Shifts Among Students

Teachers reported noticeable changes in students' behavior, including lower motivation, lack of discipline, and increased anxiety. Many students struggled with transitioning back to the classroom environment, which led to challenges in re-engaging them in the learning process. Teachers observed that students were not as focused and had a shorter attention span than pre-pandemic times.

The behavioral shifts observed in students align with findings from other studies, which highlight how the pandemic has exacerbated mental health issues among learners (Barbayannis et al., 2022; Vadivel, 2020). The chart below represents the frequency of behavioral issues observed by teachers during the transition back to face-to-face instruction.

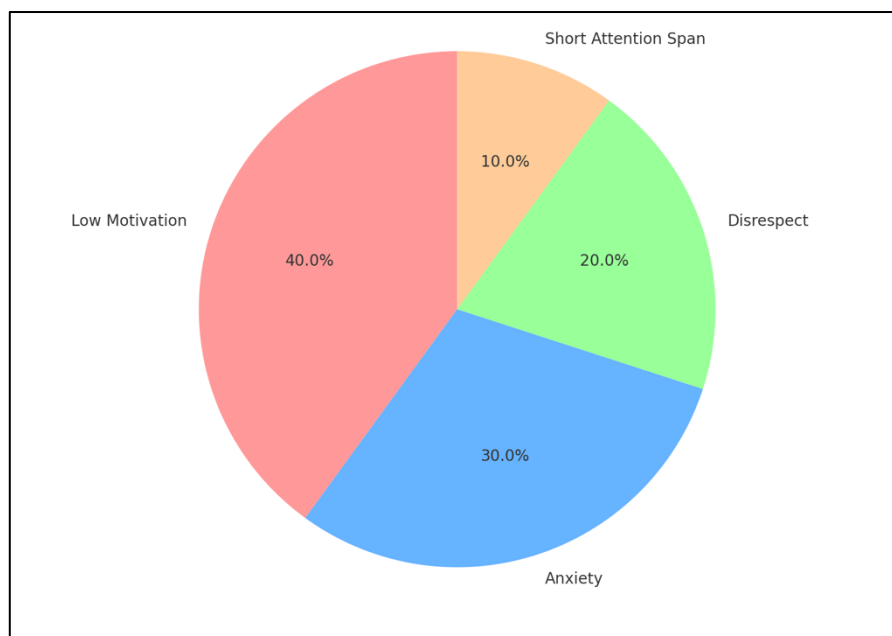


Figure 2. Behavioral Issues Reported by Teachers during the Transition to Face-to-Face Classes



As shown in the pie chart, **low motivation** and **anxiety** were the most common issues, echoing studies that emphasize the psychological impact of the pandemic on students' well-being (Gulmez & Ordu, 2022). These findings indicate a need for mental health support and strategies to help students adapt to the classroom environment after the disruptions caused by the pandemic.

3.4 Positive Outcomes of the Transition

Despite the challenges, teachers noted several positive outcomes of transitioning back to face-to-face learning. One significant improvement was the increased self-reliance of students. During modular learning, many students learned to seek answers independently through online resources, improving their problem-solving skills and fostering greater autonomy in their learning.

This shift towards increased independence aligns with findings by Sivrikova et al. (2021) and Ratten (2023), who observed that the necessity for self-directed learning during the pandemic led to long-term benefits, such as improved critical thinking and problem-solving abilities. The following table highlights the improvements in self-reliance reported by teachers.

Table 2. Teachers' Reported Improvements in Student Self-Reliance During Modular Learning

Improvement Area	Frequency	Percentage (%)
Independent problem-solving	5	83.3
Increased use of online resources	4	66.7
Ability to seek help autonomously	4	66.7

This table illustrates how students became more independent in their learning, which was a positive outcome despite the challenges of modular instruction. As Ratten (2023) noted, these skills will serve students well beyond the pandemic.

3.5 Strategies Employed to Overcome Challenges

In response to the challenges posed by the transition, teachers adopted various strategies, including differentiated instruction, peer tutoring, and personalized learning plans. Teachers also emphasized the importance of time management, allocating additional time to review basic concepts and address learning gaps.

The strategies teachers employ reflect best practices in addressing educational challenges during transitions. Differentiated instruction and peer tutoring are proven methods for addressing diverse student needs and fostering an inclusive learning environment (Bashir et al., 2021; Ratten, 2023). Below is a graph showing the percentage of teachers using different strategies to address challenges.

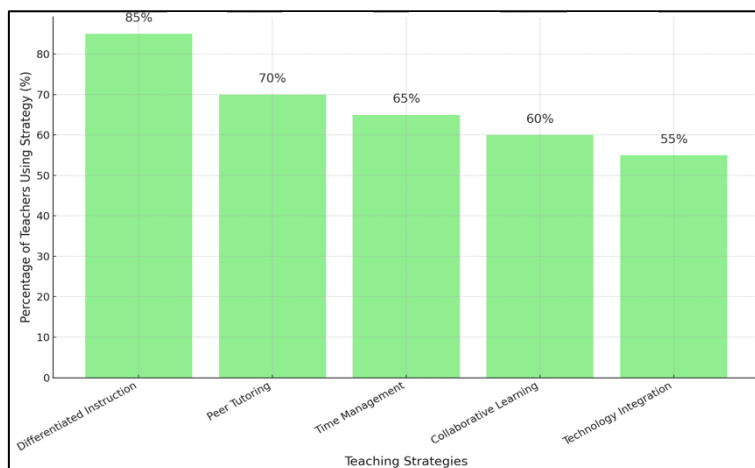


Figure 3. Behavioral Issues Reported by Teachers during the Transition to Face-to-Face Classes

This graph highlights the importance of using varied approaches to meet the needs of all students, particularly those who may have fallen behind during modular instruction. These strategies align with research suggesting that such adaptive techniques are essential for successful teaching during educational disruption (Bashir et al., 2021).

4.0 Conclusion

The transition from modular instruction to face-to-face classes revealed significant challenges for mathematics teachers, particularly regarding learning gaps, mental health issues, and behavioral changes in students. However, it also highlighted the resilience of both students and teachers, with positive outcomes such as increased student self-reliance and a greater focus on foundational knowledge. Teachers successfully adapted to these challenges by employing various strategies, including differentiated instruction, collaborative learning, and professional development. This study underscores the need for continued support and targeted interventions to address the educational gaps exacerbated by the pandemic, ensuring a more equitable and effective learning environment for all students.

5.0 Contributions of Authors

Edwin B. Ramos Jr. – Research design, data collection, analysis, writing, and supervision.

6.0 Conflict of Interests

The author declares no conflict of interest.

7.0 Acknowledgment

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Promoting Active Lifestyles Among Senior High School Students Through Innovative Esports-Based Physical Education Programs

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Abstract.

This study explores integrating esports into physical education (PE) programs to promote active lifestyles among senior high school students at Magallanes National High School. As technology dominates students' lives, a growing trend of prioritizing screen-based activities leads to sedentary behaviors that negatively impact physical health. This research leverages students' interest in esports to encourage participation in physical activities aligned with the Health-Optimizing Physical Education (HOPE) curriculum. Guided by planned behavior and self-determination theory, the study examines how esports-based PE programs can shape positive attitudes toward physical activity, enhance student engagement, and foster holistic development. Data were collected from 30 PE teachers through surveys, focusing on their perceptions, readiness, and awareness of esports integration. Findings revealed strong support for esports to promote physical activity, acknowledging its potential to improve fitness, teamwork, and time management. Teachers expressed readiness for implementation, with some concerns about resource limitations and the need for professional development. Based on these findings, the study proposes Project FIT (Fostering Innovative Teaching), an intervention program designed to equip teachers with the skills and resources necessary for successful esports-based PE implementation. This research underscores the feasibility of integrating esports into PE, highlighting its potential to bridge the gap between students' technological interests and physical activity goals, ultimately contributing to students' overall well-being.

Keywords: Esports, Active Lifestyles, Physical Education, Student Engagement, Innovative Teaching

1.0 Introduction

Technology significantly influences students' preferences and activities in today's digital age. At Magallanes National High School, a growing concern has emerged: the prioritization of academics and esports leading to sedentary behaviors among Grade 11 students. Recognizing this, the study aims to explore integrating esports into the Health-Optimizing Physical Education (HOPE) curriculum. This shift targets students' gaming interests to promote physical activity, addressing the challenge of making PE more engaging and relevant to contemporary youth.

Several studies emphasize the adverse effects of sedentary behavior, linking it to the rise of screen-based entertainment (Loftin et al., 2021; WHO, 2023). Emerging research suggests that integrating esports with physical activities could enhance engagement and offer new opportunities for fitness (Chung et al., 2022). Using the Theory of Planned Behavior (Ajzen, 1991) and Self-Determination Theory (Deci & Ryan, 1985), this study explores how esports-based PE could motivate students to lead more active lifestyles.

The research contributes to bridging the gap between technology and health in physical education by proposing an innovative, feasible approach to PE instruction.

2.0 Methodology

2.1 Research Design

The study employed a descriptive-correlational research design to explore the perceptions, readiness, and attitudes of physical education (PE) teachers regarding the integration of esports into the Health-Optimizing Physical Education (HOPE) curriculum. This design was chosen to understand the relationships between teachers' readiness to adopt esports-based PE programs and their perceptions of the feasibility and impact of such programs on student engagement and physical activity. The research used both qualitative and quantitative methods, gathering data through surveys that incorporated Likert-scale questions to quantify teachers' attitudes and perceptions.

2.2 Data Analysis

The collected data were analyzed using descriptive statistics to summarize teachers' responses, including calculating mean scores for each statement on the survey. These mean scores allowed for the assessment of the general agreement or disagreement on various topics related to the integration of esports into PE. Correlation analysis was conducted to examine the relationships between the teachers' readiness for esports integration and their perceptions of its feasibility and impact on student activity. Statistical software, SPSS Version 25, was used to conduct the data analysis, and the significance level was set at $p < 0.05$ to identify meaningful relationships.

2.3 Research Locale

The research was conducted at Magallanes National High School in Magallanes, Agusan del Norte, Caraga Administrative Region, Philippines. This location was chosen due to its active interest in enhancing its physical education curriculum and the high relevance of esports among students. The school also provides a suitable setting to examine how esports can be integrated into existing PE programs to address sedentary behaviors and promote active lifestyles among students.

2.4 Research Participants

The study included 30 physical education teachers from Magallanes National High School, selected through convenience sampling. These teachers were chosen based on their experience teaching physical education at the senior high school level and their willingness to participate in the study. The sample size was determined based on the school's total number of PE teachers and the study's objective to collect sufficient data to understand teachers' perceptions and readiness for esports integration. All teachers who met the inclusion criteria were invited to participate, and there were no exclusions based on gender or years of experience. The sample size of 30 participants was deemed appropriate for the descriptive-correlational design, ensuring the data gathered would provide meaningful insights into the perceptions of the school's PE staff.

2.5 Data Gathering Procedure

Data were collected through a structured survey, which was distributed both in digital and printed formats to accommodate the teachers' preferences. The survey contained a series of Likert-scale questions that assessed various aspects of teachers' perceptions, readiness, and awareness of esports in PE. Teachers were given one week to complete and return the surveys. To increase response rates, reminders were sent periodically via email, and a follow-up in person was conducted. The survey responses were then compiled and analyzed to identify trends in teachers' attitudes and preparedness for esports integration into their PE programs.

2.6 Ethical Considerations

This study adhered to the ethical standards set by the Institutional Review Board (IRB) at Magallanes National High School and the Department of Education. Ethical approval was obtained prior to the commencement of the research. Informed consent was sought from all participants, who were assured of the voluntary nature of their participation and their right to withdraw from the study at any time without penalty. Participants were informed about the purpose of the study, the procedures involved, and the use of the data. Additionally, all responses were kept confidential, and no personally identifiable information was included in the final data analysis to ensure participant anonymity. Data were securely stored and accessible only to the researcher and authorized personnel.

3.0 Results and Discussion

This section presents an in-depth analysis of the findings, organized into five main themes: (1) awareness of the importance of physical activity, (2) perceptions of esports in physical education (PE), (3) feasibility of integrating esports into PE programs, (4) potential impact of esports-based PE programs, and (5) teacher readiness and support. Each theme is examined in detail, supported by the data from the tables, and discussed in light of existing literature to contextualize the findings and align them with previous research in the field.

3.1 Awareness of the Importance of Physical Activity

The first theme explores the teachers' awareness of the importance of physical activity for student well-being. This theme is crucial because understanding the importance of physical activity is fundamental to fostering healthy habits among students. The survey results reveal a strong consensus among the teachers about prioritizing physical education and addressing sedentary lifestyles. The data, presented in Table 1, offer insights into the level of awareness teachers have about the role of physical activity in promoting overall health and student development.

Table 1. Mean Distribution for Awareness of the Importance of Physical Activity

Awareness of the Importance of Physical Activity	Mean	Verbal Description
1. Physical activity is essential for maintaining students' overall well-being.	4.80	Strongly Agree
2. There is a growing concern about students' sedentary lifestyles.	4.76	Strongly Agree
3. Teachers play a crucial role in promoting active lifestyles among students.	4.36	Strongly Agree
4. Students often prioritize technology-based activities over physical activities.	4.56	Strongly Agree
5. A lack of innovative strategies limits students' engagement in physical activities.	4.60	Strongly Agree
Total Mean Score	4.61	Strongly Agree

The results from Table 1 demonstrate that teachers surveyed at Magallanes National High School exhibit a strong awareness of the importance of physical activity, with a total mean score of 4.61. Teachers strongly agreed that physical activity is essential for students' overall health ($M = 4.80$) and acknowledged the growing concern over sedentary lifestyles ($M = 4.76$). These findings align with the ever-increasing body of research that emphasizes the adverse effects of sedentary behavior, particularly among adolescents (Loftin et al., 2021; WHO, 2023).

Teachers also recognized the critical role they play in promoting physical activity ($M = 4.36$), reinforcing the idea that PE teachers can be key agents in combating sedentary behaviors. The challenge, however, remains that students often prioritize technology-based activities ($M = 4.56$), which reinforces the need for innovative strategies to engage students in physical activities. These findings are consistent with studies that suggest integrating technology into physical education can increase engagement (Chung et al., 2022).

In this context, esports-based physical education programs could offer a dynamic approach to overcoming the challenge of engaging technology-oriented students in physical activity.

3.2 Perception of Esports in Physical Education

The second theme investigates teachers' perceptions of integrating esports into physical education. Since esports is a digital form of entertainment, it is essential to understand how educators view its potential to engage students in physical activity. Table 2 presents the teachers' views on whether esports can be adapted for physical education and their alignment with students' interests in technology.

Table 2. Mean Distribution for Perception of Esports in Physical Education

Perception of Esports in Physical Education	Mean	Verbal Description
1. Esports can be adapted to promote physical activities among students.	4.53	Strongly Agree
2. Students show a high interest in sports-related activities.	4.43	Strongly Agree
3. Integrating esports into physical education can encourage student participation.	4.36	Strongly Agree
4. Esports aligns with modern students' technological preferences.	4.46	Strongly Agree
5. Teachers need training to implement esports-based physical education effectively.	4.40	Strongly Agree
Total Mean Score	4.44	Strongly Agree

As shown in Table 2, most teachers perceive esports as a viable tool for enhancing physical education. The mean score of 4.53 indicates that teachers agree that esports can be adapted to promote physical activity. This aligns with findings from Chung et al. (2022), who demonstrated that gamified fitness programs and augmented reality can successfully integrate technology with physical activity to engage students.

Teachers also acknowledged that students are highly interested in sports-related activities ($M = 4.43$) and that integrating esports into physical education could significantly increase participation ($M = 4.36$). These results are consistent with research suggesting that esports, when designed to incorporate physical activity, can foster greater student engagement in PE (Chung et al., 2022). However, teachers also highlighted the need for professional development ($M = 4.40$) to ensure they are equipped with the skills to effectively integrate esports into PE, pointing to a gap in teacher training that must be addressed for successful implementation.

3.3 Feasibility of Esports-Based Physical Education Programs

The third theme explores the feasibility of implementing esports-based physical education programs, focusing on whether schools have the resources and support needed to integrate esports into PE. Table 3 presents the data on the perceived feasibility of these programs, examining the availability of resources, alignment with the curriculum, and institutional support.

Table 3. Mean Distribution for Feasibility of Esports-Based Physical Education Programs

Feasibility of Esports-Based Physical Education Programs	Mean	Verbal Description
1. The school has resources to support esports-based physical education programs.	4.13	Agree
2. Esports programs can be designed to align with the HOPE curriculum.	4.40	Strongly Agree
3. There is administrative support for innovative physical education strategies.	4.23	Strongly Agree
4. Teachers can collaborate to develop esports-based physical activities.	4.40	Strongly Agree
5. Esports-based physical education programs are feasible, given current constraints.	4.30	Strongly Agree
Total Mean Score	4.30	Strongly Agree



Table 3 indicates that teachers generally perceive the integration of esports into physical education as feasible. While there are some resource limitations ($M = 4.13$), there is strong agreement that esports programs could align with the existing HOPE curriculum ($M = 4.40$). This supports the findings of Harrison & Carter (2021), who suggested that esports can be a complementary addition to traditional PE programs, enhancing the curriculum by offering a modern, engaging approach to physical activity.

The support from school administration ($M = 4.23$) and the ability for teachers to collaborate ($M = 4.40$) further highlight the feasibility of implementing esports-based physical education programs. However, challenges such as resource constraints, including technology and equipment, remain significant, as noted by participants. These challenges are consistent with the barriers identified in previous studies (Smith & Johnson, 2020), which emphasize the need for adequate funding and resources for the integration of innovative teaching strategies like esports.

3.4 Potential Impact of Esports-Based Physical Education

The fourth theme focuses on the potential impact of esports-based PE programs. This theme examines how integrating esports could affect students' physical fitness, teamwork, interest in PE, and overall development. Table 4 provides the data on the anticipated positive outcomes of esports-based programs.

Table 4. Mean Distribution for Potential Impact of Esports-Based Physical Education

Potential Impact of Esports-Based Physical Education	Mean	Verbal Description
1. Esports-based programs can improve students' physical fitness.	4.40	Strongly Agree
2. Integrating esports promotes teamwork and social skills among students.	4.43	Strongly Agree
3. This approach can enhance students' interest in physical education.	4.40	Strongly Agree
4. Students can develop better time management with structured esports activities.	4.40	Strongly Agree
5. Esports-based programs can reduce students' screen time for non-productive activities.	4.36	Strongly Agree
Total Mean Score	4.40	Strongly Agree

The results from Table 4 demonstrate that teachers firmly believe in the positive impact of esports-based physical education on students' physical fitness ($M = 4.40$) and social skills ($M = 4.43$). These findings align with the research of Miller & Johnson (2021), who found that esports could foster collaboration and improve social interaction among students. Additionally, the results indicate that esports-based programs could significantly enhance students' interest in physical education ($M = 4.40$), providing a modern and appealing avenue for engaging students in physical activity.

Teachers also noted that esports could help students manage their time better ($M = 4.40$) and reduce non-productive screen time ($M = 4.36$), highlighting the multifaceted benefits of esports integration. These findings underscore the potential for esports to contribute to students' overall development, both physically and socially.

3.5 Teacher Readiness and Support for Esports-Based Physical Education

The final theme examines the readiness of teachers to adopt esports-based teaching methods and the support they require to implement these programs successfully. Table 5 presents the data on teacher readiness, willingness to embrace esports, and the need for professional development.



Table 5. Mean Distribution for Teacher Readiness and Support

Teacher Readiness and Support	Mean	Verbal Description
1. Teachers are ready to adapt to esports-based teaching methods.	4.33	Strongly Agree
2. Professional development programs can help implement esports-based activities.	4.33	Strongly Agree
3. There is a willingness to incorporate esports into physical education classes.	4.50	Strongly Agree
4. Teachers feel confident in managing esports-based physical activities.	4.40	Strongly Agree
5. Teachers believe that esports integration will enrich the current HOPE curriculum.	4.50	Strongly Agree
Total Mean Score	4.41	Strongly Agree

The results from Table 5 suggest that teachers are highly supportive of integrating esports into physical education. With a total mean score of 4.41, teachers expressed strong confidence in adapting to esports-based teaching methods ($M = 4.33$) and integrating esports into PE classes ($M = 4.50$). Teachers also felt confident in managing esports-based physical activities ($M = 4.40$), which indicates that they are ready to embrace this innovative approach. However, professional development ($M = 4.33$) was identified as a key area for ensuring the effective implementation of esports-based PE programs. This need for ongoing training aligns with previous studies, such as those by Casey et al. (2018), who emphasized the importance of teacher preparation in the successful adoption of new educational strategies.

The results of this study suggest that integrating esports into physical education can be a highly effective strategy for promoting active lifestyles and engaging students in physical activities. Teachers are generally supportive of esports integration, recognizing its potential to enhance student engagement and foster both physical fitness and social skills. However, challenges such as resource limitations and the need for professional development must be addressed. The findings align with existing literature, confirming that esports can bridge the gap between students' technological interests and physical activity goals, ultimately contributing to students' overall well-being. Future efforts should focus on providing the necessary resources and training to ensure the successful integration of esports into PE curricula.

4.0 Conclusion

The integration of esports into physical education programs offers a promising and innovative solution to address the growing concern of sedentary behaviors among students at Magallanes National High School. As technology increasingly dominates students' lives, traditional methods of promoting physical activity may no longer be sufficient to engage today's tech-savvy learners. The findings from this study suggest that esports, when strategically incorporated into the physical education curriculum, have the potential to significantly enhance student participation in physical activities, bridging the gap between students' technological inclinations and their physical activity goals.

The teachers at Magallanes National High School show a strong readiness to embrace esports-based physical education, recognizing its potential to engage students in a dynamic and modern way. Esports can foster not only physical fitness but also teamwork, time management, and social skills—critical aspects of holistic student development. These programs also hold the potential to reinvigorate students' interest in physical education, making it more relevant and engaging in the context of a technology-driven world.



4.1 Actionable Recommendations

Based on the findings, the following actionable recommendations are proposed to ensure the successful integration of esports-based physical education programs:

1. **Professional Development for Teachers:** It is essential to implement targeted professional development programs for PE teachers. These programs should focus on integrating esports into the PE curriculum, including training on how to use digital tools, manage esports-based physical activities, and align these activities with the HOPE curriculum. Regular workshops and seminars with experts in both esports and physical education can help teachers feel more confident and prepared.
2. **Resource Allocation:** Schools should prioritize investing in the necessary resources for esports-based PE programs. This includes securing hardware and software that support esports, as well as providing teachers with access to training materials and curriculum guides tailored to integrating esports in PE. Schools can seek funding through grants or partnerships with local businesses and educational organizations to ensure these resources are available.
3. **Collaborative Framework:** Establish a collaborative framework among PE teachers, administrators, and technology staff to develop and implement esports-based activities. By creating a Teacher Esports Support Network (TESN), educators can share resources, experiences, and strategies to enhance the integration process, ensuring consistency and sustainability across the school.
4. **Ongoing Evaluation and Feedback:** Establish a system for monitoring and evaluating the effectiveness of esports-based PE programs. This can include regular feedback from both students and teachers, surveys to measure engagement and physical activity levels, and an analysis of the overall impact on students' fitness. Continuous evaluation will help fine-tune the programs and identify areas that need improvement.

4.2 Reinforcement of Key Findings

The key findings of this study underscore the feasibility and potential impact of integrating esports into physical education. Teachers at Magallanes National High School are highly supportive of esports-based PE programs, with strong belief in their ability to improve students' physical fitness ($M = 4.40$) and enhance teamwork and social skills ($M = 4.43$). The integration of esports could also help students manage their time better and reduce non-productive screen time, providing a multifaceted approach to promoting active lifestyles.

The study clearly indicates that while resource limitations and the need for professional development remain challenges, the overall feasibility of esports integration is strong. Teachers' readiness to adopt esports in PE, coupled with their willingness to undergo necessary training, signals a positive outlook for the successful implementation of these programs. The results suggest that with proper resources, training, and institutional support, esports can play a transformative role in modernizing physical education and engaging students in physical activity in ways that align with their interests.

In conclusion, the integration of esports into physical education is not just a feasible initiative but a potentially transformative one. It offers an opportunity to make PE more relevant and appealing to students, fostering healthier, more active lifestyles while meeting their digital interests. With the proper support, this approach can become a cornerstone of a more interactive, engaging, and holistic approach to promoting physical activity and overall well-being among students.

5.0 Contributions of Authors

Irish Melody B. Dela Fuerta – Research design, data collection, analysis, writing, and revisions.

6.0 Conflict of Interests

The author declares no conflict of interest.

7.0 Acknowledgment

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

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Abstract.

This study investigates the effectiveness of abacus-based learning in enhancing arithmetic skills among Alternative Learning System (ALS) Junior High School students in the Magallanes District. A total of 30 students participated, selected based on voluntary participation and availability. The research used a mixed-method approach, combining qualitative and quantitative data through pre- and post-test assessments, surveys, and interviews. Results showed a significant improvement in arithmetic performance, with pre- and post-test comparisons indicating enhanced proficiency. Survey data highlighted positive student attitudes towards abacus learning, underscoring its value in improving engagement and confidence in arithmetic. The findings suggest that abacus-based instruction is an effective tool for enhancing arithmetic skills, offering potential for broader application within ALS and other educational contexts.

Keywords: Abacus-based learning; Arithmetic skills; Alternative Learning System (ALS); Educational innovation; Interactive learning tools

1.0 Introduction

The Philippines' Alternative Learning System (ALS) offers educational opportunities to out-of-school youth and adults. In the Magallanes District, ALS serves students from various backgrounds, particularly those with gaps in foundational academic skills. Among the areas that require significant improvement are arithmetic skills, which are essential not only for further educational pursuits but also for daily life and employment. Despite these challenges, traditional methods often fail to engage students effectively. This study explores the potential of the abacus—a tactile and interactive tool—to enhance arithmetic proficiency among ALS Junior High School students.

Research on abacus-based education has positively impacted arithmetic and cognitive skills, especially for students who benefit from alternative learning methods (Chen & Wu, 2018; Robinson, 2019). This study assesses whether abacus-based learning can improve arithmetic skills among ALS students in the Magallanes District, contributing to curriculum innovation within the ALS framework.



2.0 Methodology

2.1 Research Design

This study utilized a descriptive quantitative research design to assess the effectiveness of abacus-based learning in enhancing the arithmetic skills of Alternative Learning System (ALS) Junior High School students in the Magallanes District. The design is specifically chosen for its capacity to provide a precise and systematic evaluation of how the intervention (abacus learning) influences student performance in arithmetic. By employing pre-test and post-test assessments, the research sought to measure the students' improvement in key arithmetic operations—addition, subtraction, multiplication, and division—before and after the abacus intervention. This approach allows for directly comparing student progress, offering clear insights into the abacus' role in enhancing mathematical proficiency. Using a quantitative design also facilitated the statistical analysis of collected data, ensuring objectivity in evaluating the impact of the intervention.

2.2 Research Locale

The study was conducted in the Magallanes District, specifically within the Alternative Learning System (ALS) Junior High School program. ALS in the Philippines is a non-formal education program that caters to out-of-school youth and adults, providing them with an opportunity to complete basic education. The Magallanes District, located in a rural area, faces significant challenges, including limited access to educational resources and socioeconomic barriers. Within this context, ALS students often encounter difficulties in foundational academic subjects, particularly arithmetic, which can affect their overall academic progression. By selecting this district as the research site, the study aimed to explore how abacus-based learning could offer a promising and accessible solution to improve the arithmetic skills of students who struggle with traditional learning methods.

2.3 Research Participants

The study targeted 30 voluntary participants from the ALS Junior High School program in the Magallanes District. These students were selected based on their willingness to participate and availability during the intervention. Efforts were made to ensure a representative sample, including participants from various ages, educational backgrounds, and academic levels within the ALS Junior High School cohort. By selecting a diverse group, the research aimed to capture a comprehensive understanding of how abacus-based learning could impact students with different levels of prior knowledge and skills in arithmetic. This diversity also allowed for a broader evaluation of the effectiveness of the abacus method across varied student profiles. The 30 participants were given equal opportunity to volunteer, with no restrictions based on gender, age, or prior academic performance, ensuring inclusivity in the sample.

2.4 Research Instruments

To measure the effectiveness of the abacus-based intervention, the research employed two primary instruments:

1. **Pre- and Post-Tests:** These standardized assessments focused on basic arithmetic operations: addition, subtraction, multiplication, and division. The pre-test was administered before the abacus intervention, serving as a baseline for assessing the participants' existing arithmetic skills. The post-test was given after the intervention to measure any improvements in their arithmetic proficiency. Both tests were designed with equivalent difficulty levels to ensure a fair comparison of results.
2. **Survey Questionnaire:** A Likert-scale-based survey was distributed to gauge students' perceptions and attitudes toward using the abacus for learning arithmetic. The survey consisted of two sections:
 - **Perceptions of Abacus Learning:** This section assessed the students' understanding of how the abacus helped improve their arithmetic skills.
 - **Attitudes toward Abacus Learning:** This section measured the students' enjoyment, motivation, and overall attitude toward using the abacus as a learning tool. Each statement was rated on a 5-point scale (1 = Strongly Disagree to 5 = Strongly Agree), allowing the researcher to quantify the students' feelings toward the tool and its impact on their learning experience.



2.5 Data Gathering Procedure

The data gathering process was conducted in several stages to ensure thoroughness and accuracy in evaluating the abacus intervention:

1. Initial Assessment (Pre-Test): At the start of the research, all participants completed the pre-test to establish a baseline measure of their arithmetic abilities. This assessment covered basic arithmetic operations, which allowed the researchers to gauge their initial proficiency levels.
2. Abacus Intervention: The students underwent a structured abacus-based learning program to enhance their arithmetic skills. The intervention was conducted over several weeks, with students practicing various arithmetic problems using the abacus. ALS teachers facilitated the intervention, ensuring students received proper guidance throughout the learning process.
3. Post-Intervention Assessment (Post-Test): After the intervention, participants completed the post-test, which assessed their arithmetic skills in the same operations covered in the pre-test. This allowed for the direct comparison of their performance before and after the intervention.
4. Student Surveys: Students completed the survey questionnaire during and after the intervention to capture their perceptions and attitudes toward the abacus learning process. The surveys were administered in class, with ample time for students to respond thoughtfully.
5. Teacher Interviews: Additional qualitative data were gathered through interviews with ALS teachers. These interviews focused on their observations of student engagement, progress, and the practical challenges of using the abacus in the classroom. Teacher feedback provided valuable insights into the implementation and effectiveness of the abacus intervention, offering a more comprehensive view of its impact.

The data collection process was structured and systematic, ensuring that all aspects of the research, from testing to feedback, were carefully documented.

2.6 Ethical Considerations

Ethical principles were a cornerstone of this study, ensuring that the research was conducted with the utmost respect for participants' rights and well-being:

1. Informed Consent: All participants, including their parents or guardians (where applicable), were fully informed about the study's purpose, procedures, and potential outcomes. Participants were informed that their participation was voluntary and that they could withdraw without facing any negative consequences. Consent was obtained in writing before participation, ensuring transparency and ethical compliance.
2. Confidentiality: All personal information was kept confidential to protect participants' privacy. Each participant was assigned a unique identification code, ensuring anonymity during data collection and analysis. No identifying information was shared with external parties, and all data was securely stored.
3. Right to Privacy: The study was conducted in a manner that respected the privacy of all participants. All data, including test scores and survey responses, was kept strictly private, with access limited to the research team. The results of the study were presented in aggregate form to further protect participants' identities.
4. No Harm to Participants: The research ensured that no physical or psychological harm was caused to the participants. The abacus learning intervention was designed to be a positive and engaging experience for students, with support provided to ensure that the students felt comfortable and encouraged.



3.0 Results and Discussion

3.1 Overview of Results

The results of this study demonstrate the significant impact of abacus-based learning on enhancing the arithmetic skills of Alternative Learning System (ALS) Junior High School students in the Magallanes District. The primary data collected through pre- and post-intervention assessments, coupled with students' perceptions of the abacus learning tool, clearly indicate a marked improvement in arithmetic proficiency. Additionally, qualitative feedback from both the students and the teachers provided valuable insights into the students' engagement and overall experience with the abacus method.

The findings underscore the effectiveness of using tactile, interactive learning tools, like the abacus, in engaging students and improving their skills. This section provides a detailed data analysis, including quantitative and qualitative aspects. It interprets the significance of the results in the context of the educational challenges faced by ALS students.

3.2 Pre-Test and Post-Test Results

To evaluate the effectiveness of the abacus-based learning intervention, a pre-test and post-test were administered to all participating students. The primary aim of these tests was to assess the improvement in arithmetic skills following the intervention. The tests focused on the core arithmetic operations: addition, subtraction, multiplication, and division, which are fundamental to a student's overall mathematical proficiency.

The pre-test was a baseline measure of each student's arithmetic abilities before the abacus intervention. At the same time, the post-test was administered after the students had engaged with the abacus-based learning program. This comparative approach allowed the researchers to gauge any changes in performance as a direct result of the intervention. Given that the participants were Junior High School students in the Alternative Learning System (ALS), many of whom faced challenges in traditional educational settings, the results were particularly significant in evaluating whether this alternative learning tool could address their learning gaps.

The analysis of these test results is crucial because it directly demonstrates the impact of the abacus method on student performance. The following table presents the pre-test and post-test results for each of the 30 students who participated in the study. By comparing these results, we can measure how much the abacus intervention improved the students' arithmetic proficiency.

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

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

Student No.	Pre-Test	Post-Test
16	15	25
17	11	21
18	9	18
19	10	23
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

Descriptive Analysis:

The pre-test and post-test results reveal a substantial improvement in students' arithmetic performance following the abacus intervention. The pre-test, which served as a baseline, had an average score of 8.87, while the post-test showed an average score of 20.2. This difference in mean scores indicates an 11.33-point increase, reflecting a significant enhancement in arithmetic skills.

The improvement in scores is consistent across all 30 students, with each student showing progress, ranging from modest increases to significant gains in their ability to perform basic arithmetic operations. For example, in the pre-test, the lowest score was 6, whereas in the post-test, the lowest score was 17, demonstrating a clear and consistent trend of improvement.

Statistical Analysis:

A paired t-test was conducted to determine whether the improvements were statistically significant. The t-test results revealed a significant difference between the pre-test and post-test scores ($t\text{-stat} = -42.92$, $p < 0.001$). The negative t-statistic value suggests that the post-test scores were consistently higher than the pre-test scores, and the p-value being less than 0.001 indicates that this difference is unlikely to have occurred by chance.

These findings confirm that the abacus intervention had a statistically significant impact on enhancing the arithmetic skills of ALS Junior High School students in the Magallanes District. The improvement in student performance strongly supports the hypothesis that the abacus is an effective learning tool for enhancing arithmetic proficiency.

3.3 Students' Perceptions of Abacus Learning

In addition to the quantitative results, students' perceptions of the abacus learning experience were also evaluated. A survey was administered to gauge students' opinions on how the abacus affected their understanding of arithmetic, their confidence in solving problems, and their overall enjoyment of learning. The following table summarizes the mean scores for the key items assessed in the survey, highlighting the overall positive reception of the abacus as a learning tool.

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

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

Interpretation of Perception Scores:

The results from the survey questionnaire, which measured students' perceptions of abacus-based learning, revealed overwhelmingly positive feedback. The total mean score of 4.40 indicates that the students had a strongly favorable view of the abacus as a learning tool. Specifically, the highest rated item, "I enjoy using the abacus in my arithmetic learning," had a mean score of 4.63, indicating that the students recognized the abacus's effectiveness and enjoyed the learning process itself.

The statement "Using the abacus has made arithmetic calculations easier for me" also garnered a high score (4.43), suggesting that students found the abacus an intuitive and effective tool for simplifying arithmetic problems. This aligns with the findings from the pre- and post-tests, where students demonstrated improved performance in arithmetic after the intervention. The high scores for confidence-related statements, such as "The abacus has increased my confidence in solving arithmetic problems" (4.50), indicate that the abacus learning tool improved skill and empowered students to tackle arithmetic challenges.

Qualitative Insights:

Students also expressed through the survey that they felt more confident and motivated to engage with arithmetic tasks after incorporating the abacus into their learning process. Many students mentioned that the visual and tactile nature of the abacus made abstract mathematical concepts more concrete and easier to understand. This aligns with existing literature on the use of tactile learning tools in mathematics, which suggests that such tools help to bridge the gap between theoretical concepts and practical application, especially for students with diverse learning needs.

3.4 Teachers' Observations

Teachers involved in the intervention also provided qualitative feedback, enriching the understanding of the quantitative results. They reported that students demonstrated increased engagement during arithmetic lessons when the abacus was used. Teachers observed that the students could visualize mathematical problems more clearly and approached arithmetic tasks with greater enthusiasm and focus.

One teacher noted that the tactile interaction with the abacus helped students retain mathematical concepts more effectively, providing them with a kinesthetic experience of performing arithmetic operations. This observation further corroborates the idea that interactive, hands-on learning tools like the abacus can improve conceptual understanding and problem-solving abilities.

3.5 Discussion and Implications

The pre- and post-test results, alongside students' perceptions, clearly indicate that the abacus is an effective educational tool for improving arithmetic skills among ALS Junior High School students. The substantial improvement in test scores and the overwhelmingly positive student feedback suggest that the



abacus helped bridge the gap in mathematical proficiency that many ALS students face. This is particularly important for students who have historically struggled with more traditional forms of arithmetic instruction.

The study also highlights the importance of interactive and tactile learning methods in enhancing student engagement and understanding. Students in the study were able to improve their arithmetic skills and experienced greater enjoyment, motivation, and confidence in their learning, which are critical for long-term academic success.

These findings have important implications for integrating abacus-based learning in the ALS curriculum and beyond. The abacus is an effective tool for improving arithmetic skills and a potential model for incorporating alternative learning strategies into educational systems that serve students with diverse learning needs. Future research could explore integrating other tactile tools and methods, comparing their impact on different subject areas and student populations.

4.0 Conclusion

This research strongly supports using abacus-based learning as a highly effective approach for improving arithmetic skills among Alternative Learning System (ALS) Junior High School students in the Magallanes District. The study's findings, based on quantitative data (pre- and post-test results) and qualitative feedback (student surveys and teacher observations), consistently demonstrate that the abacus intervention led to significant improvements in students' arithmetic proficiency.

The pre-test and post-test results show a marked enhancement in the students' ability to perform basic arithmetic operations, with a substantial increase in their mean scores, indicating a clear and measurable improvement. The paired t-test analysis further confirms the statistical significance of these improvements, highlighting that the differences in performance between the pre-test and post-test are not due to chance, but rather a direct result of the abacus intervention. These improvements are consistent across all participants, regardless of their initial skill levels, making it evident that the abacus is a universal tool that can effectively cater to students with varying degrees of arithmetic competency.

In addition to the quantitative improvements, the study gathered positive feedback from students regarding their experience with abacus-based learning. The survey revealed that students recognized the abacus as a valuable learning tool and expressed greater confidence, motivation, and enjoyment in their arithmetic lessons. These attitudinal changes are crucial because they indicate that the abacus does not just improve students' arithmetic skills and contributes to enhanced student engagement, which is often a key challenge in non-traditional education settings like ALS.

The qualitative feedback from ALS teachers further supports the effectiveness of the abacus. Teachers noted increased student participation, better focus, and improved retention of arithmetic concepts. The hands-on, interactive nature of the abacus allowed students to engage with the material tactilely, which, according to educational research, often leads to deeper learning, especially for students who struggle with abstract mathematical concepts.

Based on these findings, this study advocates for integrating abacus-based learning into the ALS curriculum and other educational programs designed for students who require alternative or non-traditional instructional methods. The evidence from this study suggests that the abacus is effective in teaching arithmetic and beneficial for fostering positive learning experiences among students who may face barriers in traditional classrooms. Given the low-cost, low-tech nature of the abacus, it also presents an economical and accessible solution for schools with limited resources, particularly in rural or underserved areas.

Moreover, this research underscores the need for innovative teaching strategies in alternative education systems. The positive outcomes observed in this study suggest that tactile, interactive tools like the abacus can provide significant advantages in developing foundational skills, such as arithmetic, in an engaging and effective manner. The success of the abacus intervention in this study could serve as a model for other districts and education systems aiming to improve the quality of education for students who require specialized teaching methods.



4.1 Implications for Future Research and Practice

While this study provides valuable insights into the effectiveness of abacus-based learning for ALS Junior High School students, it also opens up opportunities for further research. Future studies could explore the long-term impact of abacus learning on students' academic performance and retention of mathematical concepts beyond the immediate post-intervention period. Additionally, the application of the abacus could be extended to other subject areas in the ALS curriculum, offering a broader range of educational benefits.

Moreover, future research could assess the scalability of this intervention across different regions and student populations to determine its generalizability. Exploring the potential for integrating other tactile learning tools with the abacus or creating a hybrid interactive learning model could provide further insights into optimizing the educational experience for ALS students.

5.0 Contributions of Authors

Honey Grace Buyan: Data collection, analysis, and manuscript writing.

ALS Teachers: Implemented the abacus learning intervention and provided ongoing support to students.

6.0 Conflict of Interests

The author declares no conflict of interest.

7.0 Acknowledgment

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