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The effect of providing additional food for students on improving the quality of education in Atuka Village, Mimika District

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Abstract
Purpose: This study aims to analyze the impact of the Supplementary Feeding Program (PMT) on education quality in Kampung Atuka, Mimika Regency, with a focus on academic achievement, attendance rates, and dropout rates. It also considers nutritional status as a mediating factor, and parental support and learning environment as moderating factors.
Research Methodology: The study applied a quantitative approach using descriptive statistics, Spearman correlation, and multiple linear regression, supported by mediation and moderation tests. To complement the quantitative data, qualitative analysis was carried out through interviews with students, teachers, and parents, providing contextual insights into the program's effectiveness.
Results: The findings indicate that PMT does not directly and significantly affect academic performance or student attendance but improves nutritional status, which is positively associated with academic achievement. The learning environment and parental support were not found to significantly moderate the relationship between PMT and education quality. Nevertheless, both students and teachers observed benefits such as increased energy and better focus during learning activities.
Conclusions: The research concludes that PMT's role in improving education quality can be optimized when combined with nutritional education programs, active parental involvement, and comprehensive education policies.
Limitations: The study is limited by contextual challenges such as household eating patterns and the limited diversity of supplementary food provided, which reduce the overall impact of PMT.
Contribution: This study contributes to policy discourse by highlighting the importance of integrating PMT with broader nutritional and educational strategies. It offers practical recommendations for local governments, education offices, and schools to strengthen PMT implementation and achieve greater improvements in education quality in remote regions.

Keywords: *Academic Achievement, Nutritional Status, Student Attendance, Supplementary Feeding Program, Remote Education*

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1. Introduction

Education is a fundamental element in the development of a nation, with the quality of human resources produced being a key determinant of societal progress and welfare. In Indonesia, efforts to improve education quality have become a national agenda outlined in Law Number 20 of 2003 on the National

Education System (Harianto, 2021). However, the realization of equitable quality education still faces challenges, particularly in remote areas with geographical, economic, and infrastructure constraints. A concrete example of this is Atuka Village in Mimika Regency, Papua, which continues to face various obstacles in improving educational quality (Werang, Wea, & Wolomasi, 2022). Data from the Mimika Regency Education Office indicates that the student attendance rate at elementary schools in this area is only 70%, with an average final exam score of 65, lower than the district average of 72. Moreover, the dropout rate is as high as 15%, reflecting a serious challenge in sustaining children's education in this region (Shanty et al., 2024).

One of the factors affecting the low educational quality in Atuka Village is the nutrition problem experienced by students. Previous studies have shown that malnutrition can negatively impact students' concentration, memory, and cognitive development (Kar, Rao, & Chandramouli, 2008). The Principal of Atuka Elementary School, Marius Yohanes Tepa, emphasizes that many students often miss school due to illness or lack of energy caused by inadequate nutrition. Previous research has proven that nutritional interventions in the form of Supplementary Feeding Programs (PMT) have a positive impact on children's health status and cognitive development. Pollitt, Watkins, and Husaini (1997) found that toddlers who received PMT exhibited higher cognitive development scores compared to those who did not receive similar interventions. Similarly, Wang, Shinde, Young, and Fawzi (2021) revealed that providing supplementary food at school contributed to increased student attendance and concentration in class.

However, despite the numerous studies on the impact of PMT on education, no study has specifically examined the impact of PMT on education quality in Atuka Village, Mimika Regency. Therefore, this study aims to analyze the impact of providing supplementary food on education quality in this area, considering key indicators such as academic achievement, attendance rates, and dropout rates. Furthermore, this study also identifies mediating factors such as students' nutritional status and health, as well as moderating factors such as parental support and learning environment that may influence the effectiveness of PMT. Thus, this research will not only provide empirical insights into the effectiveness of PMT but also offer strategic recommendations for local governments in optimizing nutrition-based education policies.

In the academic realm, this study contributes to strengthening human capital theory, which emphasizes the importance of investing in human resources from an early age. According to Becker (1975), investing in education, including children's nutrition, can enhance the productivity and quality of human resources in the long term. The findings of this study will also enrich previous studies by providing empirical evidence on how PMT programs can improve education quality in remote areas with unique socio-economic and cultural characteristics. Practically, the results of this study are expected to benefit various stakeholders, including local governments, the Mimika Regency Education Office, schools, and the local community. The recommendations from this research can serve as a basis for the government in designing more effective policies to improve education quality in remote areas. Furthermore, this research can raise public awareness, especially among parents, about the importance of nutrition in supporting their children's education. With greater awareness, it is hoped that there will be an increase in community participation in supporting nutrition-based education programs.

To achieve these objectives, this study will use a quantitative approach with primary and secondary data analysis. Primary data will be collected through surveys of students, parents, and teachers to understand their perceptions and the direct impact of PMT on education quality. Meanwhile, secondary data will be obtained from official reports from the Mimika Regency Education Office and previous studies related to nutrition interventions and education. This approach enables the research to provide comprehensive and evidence-based analysis in evaluating the effectiveness of PMT in improving education quality in Atuka Village. Thus, this study is expected to fill existing research gaps and contribute to the development of nutrition-based education interventions in remote areas. The results of this study are also expected to serve as a reference for education policies in other regions facing similar challenges. With an evidence-based approach and appropriate intervention strategies, it is hoped that

the quality of education in Atuka Village can significantly improve, creating a healthier, smarter, and more competitive generation in the future.

2. Literature Review

2.1 Theoretical Foundation

2.1.1 Human Capital Theory

Human Capital Theory views humans as a form of capital that can be invested in to enhance productivity and generate return on investment (ROI) in the form of higher income, improved welfare, and economic growth. Investment in human capital can be made in various ways, including through education, training, and health improvements (Cui, Wang, Liao, Fang, & Cheng, 2021). In the context of education, the Supplementary Feeding Program (PMT) can be regarded as a form of investment in human capital, particularly for early childhood (Lenihan, McGuirk, & Murphy, 2019).

PMT aims to meet children's nutritional needs, which are the foundation for optimal physical and cognitive development. Adequate and balanced nutrition will improve the body's endurance, concentration, and cognitive abilities of students, which in turn will impact academic performance and reduce dropout rates. This aligns with findings from research published in The Review of Economics and Statistics, which showed that school feeding programs significantly impact the improvement of cognitive test scores and academic achievement of students (Islamiah, Daengsari, & Hartiani, 2015; Martin & Guerrero, 2020; Schunk & DiBenedetto, 2020). With improved academic achievement and reduced dropout rates, it is hoped that a high-quality and competitive next generation will emerge. The improved quality of human resources will drive labor productivity and economic growth in the future. Research by Hanushek, Ruhose, and Woessmann (2017) in the book The Knowledge Capital of Nations: Education and the Economics of Growth indicates that improvements in education quality are positively correlated with a country's economic growth. Therefore, investment in human capital through PMT can be seen as a long-term investment that will provide significant returns in terms of economic development and societal welfare.

2.1.2 Nutrition and Cognitive Development Theory

The Nutrition and Cognitive Development Theory explains how nutritional status, particularly during growth and development, significantly influences brain development, learning abilities, and academic performance in children. Essential nutrients such as protein, iron, iodine, and omega-3 fatty acids play a crucial role in the formation and function of the brain, as well as in cognitive processes such as memory, attention, and problem-solving (Almatsier, 2001). The concept of critical periods in brain development suggests that there are specific times when the brain is highly sensitive to environmental influences, including nutrition. Malnutrition during these periods can cause permanent damage to brain development and negatively affect a child's cognitive abilities in later life. The Nutrients journal, showed that iron deficiency in early childhood can cause persistent cognitive developmental issues into adulthood (Adriani, 2016; Damayanti, 2016). Providing supplementary food (PMT) containing essential nutrients is expected to meet children's nutritional needs and support optimal cognitive development. With adequate nutrition, students will have better physical endurance, improved concentration, and better cognitive abilities, thus improving academic performance and reducing dropout rates. Research shows that school feeding programs contribute to the improvement of nutritional status and cognitive development in children in low and middle-income countries (Ridwan & Suryaalamsah, 2023; Sepriadi, Hardiansyah, & Syampurma, 2017).

2.1.3 Constructivism Theory (Piaget, Vygotsky)

Constructivism Theory, pioneered by Jean Piaget and Lev Vygotsky, emphasizes the active role of students in constructing their own knowledge and understanding through interactions with the environment and learning experiences. Piaget proposed that children learn through assimilation and accommodation processes, where they integrate new information into existing schemes and modify these schemes when confronted with contradictory information. Meanwhile, Vygotsky stressed the importance of social interaction and guidance from adults or more competent peers in the child's learning process, known as the Zone of Proximal Development (ZPD).

In the context of the Supplementary Feeding Program (PMT), constructivism theory suggests that PMT serves not only as a means to fulfill physiological needs but also supports students' active learning processes. By meeting their nutritional needs, students will have better energy and concentration to actively participate in learning activities, explore their surroundings, and interact with teachers and peers. This is consistent with findings from research by Jurado & Rosales (2020) in the International Journal of Educational Research journal, which showed that students who received breakfast at school had higher levels of attention and participation in class.

Additionally, PMT can increase students' motivation and self-confidence, which are key factors in the constructivist learning process. When students' basic needs are met, they are more motivated to learn and develop their potential. Research by Shenia, Maksum, and Affandi (2025) in the Jurnal Ilmu Pendidikan showed that providing supplementary food to elementary school students positively influenced their learning motivation and academic achievement. Thus, PMT can be viewed as one strategy to create a conducive learning environment and support student-centered learning processes in line with the principles of constructivism.

2.1.4 Maslow's Hierarchy of Needs Theory

Maslow's Hierarchy of Needs Theory, proposed by Abraham Maslow, classifies human needs into five hierarchical levels, starting from the most basic physiological needs to the highest level of self-actualization. Maslow argued that individuals are motivated to fulfill needs at the lower levels before advancing to higher levels. Physiological needs, such as food, water, and sleep, form the foundation for meeting other needs (Bari & Hidayat, 2022; Dhaniswara, Adhitama, & Darmawan, 2023). In the context of education, Maslow's theory indicates that fulfilling students' basic needs, including nutrition, is a prerequisite for achieving learning success. Students who experience hunger or malnutrition will struggle to focus on lessons, which can affect academic performance and increase the risk of dropping out. Supplementary feeding (PMT) can help meet students' physiological needs, allowing them to focus more on learning and reach their full potential.

Research by González Olivares, Navarro, Sánchez-Verdejo, and Muelas (2020) in the Motivation and Emotion journal showed that meeting physiological needs is positively correlated with psychological well-being and intrinsic motivation. Students whose basic needs are met tend to feel secure, confident, and more motivated to learn. This is supported by research by Gallegos, Eivers, Sondergeld, and Pattinson (2021) in the Child Development journal, which found that participation in school feeding programs was associated with increased concentration, positive behavior, and reduced emotional problems in children. Furthermore, fulfilling physiological needs through PMT can help students move up to higher levels of Maslow's hierarchy, such as the need for belonging, esteem, and ultimately self-actualization. With sufficient energy and concentration, students can actively participate in social activities, develop their talents and interests, and achieve their life goals. Therefore, PMT impacts not only physical and cognitive aspects but also the psychological and social aspects of students in their journey toward self-actualization.

2.2 Conceptual Framework

The conceptual framework of this study explains the relationship between the Supplementary Feeding Program (PMT) as the independent variable and education quality as the dependent variable. This relationship is mediated by factors such as nutritional status and student concentration, and moderated by parental support and the learning environment.

1. Independent Variable: Supplementary Feeding Program (PMT) PMT is an intervention in the form of providing food with adequate nutritional value to meet children's daily needs. According to human capital theory (Becker, 1993), investment in health and education, including supplementary feeding, can enhance human resource quality by improving children's nutritional status, which impacts educational performance.
2. Mediator Variables: Nutritional Status and Learning Concentration Nutritional Status: Good nutritional status allows students to have sufficient energy for activities, including learning. Research by Abdi, Ngala, and Kaindi (2021) shows that supplementary feeding significantly

affects the improvement of children's nutritional status. Children with good nutritional status have stronger immune systems and are less likely to be absent from school.

3. Learning Concentration: Improved nutritional status also impacts students' learning concentration. The nutrition and cognitive development theory states that adequate nutrition during growth supports brain development, enhances memory, and improves other cognitive abilities. Research by Safitri and Fitriana (2022) supports that students receiving PMT have better learning concentration, which contributes to improved academic performance.
4. Moderator Variables: Parental Support and Learning Environment Parental Support: The role of parents in ensuring that children optimally consume supplementary food and encourage them to stay in school is a key factor. Parental support can strengthen the positive impact of PMT on nutritional status and students' learning concentration.
5. Learning Environment: Educational facilities, availability of learning resources, and the quality of teaching staff are environmental factors that affect the effectiveness of supplementary feeding programs. With a supportive learning environment, students can maximize the potential enhanced by PMT.
6. Dependent Variable: Education Quality Education quality is measured through three main indicators:
    1. Academic Achievement: The average exam scores of students reflect cognitive ability improvements.
    2. Attendance Rate: The percentage of students attending school reflects their health level and motivation to learn.
    3. Dropout Rate: PMT is expected to reduce dropout rates as students are healthier and more motivated to study.

Relationships Between Variables Based on Theory and Previous Research

1. PMT directly affects nutritional status (mediator), which in turn increases learning concentration.
2. Nutritional status and learning concentration contribute to the improvement of education quality through increased academic achievement and student attendance (Nutrition and Cognitive Development Theory)
3. Parental support and the learning environment moderate the relationship between PMT and nutritional status/learning concentration, strengthening PMT's positive impact on education quality (Maslow's Hierarchy of Needs Theory)

2.3 Hypotheses

1. The Supplementary Feeding Program (PMT) has a positive and significant impact on improving education quality in Atuka Village, Mimika Regency.
2. Nutritional status and students' health mediate the effect of PMT on improving education quality.
3. Parental support and the learning environment moderate the effect of PMT on improving education quality.

3. Research Methodology

This study uses a mixed-methods approach, combining quantitative and qualitative approaches. The quantitative approach is used to measure the impact of PMT on education quality based on the predefined indicators, while the qualitative approach aims to understand the factors influencing the implementation of the PMT program in Atuka Village. The purpose of choosing this method is to obtain a comprehensive understanding of the impact of the Supplementary Feeding Program (PMT) on improving education quality in Atuka Village, Mimika Regency (Creswell & Creswell, 2017; Hanson, Creswell, Clark, Petska, & Creswell, 2005; Ivankova, Creswell, & Stick, 2006).

1. Quantitative Approach

The quantitative approach will be used to measure the impact of PMT on education quality indicators, including academic achievement, attendance rate, and dropout rate. Numerical data will be collected through school documents, such as student report cards, attendance records, and educational statistics. Descriptive and inferential statistical analyses, such as regression tests and difference tests, will be used

to test the research hypotheses and identify relationships between independent, mediator, moderator, and dependent variables (Sugiyono & Sutopo, 2021).

1. Population and Sample: The population in this study is all elementary school students in Atuka Village, Mimika Regency. The sample will be taken using purposive sampling, considering participation in the PMT program.
2. Data Collection Technique: Data will be collected through questionnaires distributed to students, parents, and teachers to measure the effectiveness of PMT on academic achievement, attendance rates, and dropout rates.
3. Data Analysis Technique: Quantitative data will be analyzed using linear regression to examine the relationship between PMT and education quality with the help of statistical software.

2. Qualitative Approach

The qualitative approach will be used to explore in-depth information about students, teachers, and parents' experiences related to the implementation and benefits of PMT, as well as other factors influencing education quality in Atuka Village. Qualitative data will be collected through semi-structured interviews with students, teachers, parents, and community leaders. Field observations and document studies will also be conducted to complement the qualitative data. Qualitative data analysis will use data reduction, presentation, and conclusion-drawing techniques (Bachri, 2010).

1. Research Location: Atuka Village, Mimika Regency.
2. Informants: Informants will include the school principal, teachers, parents of students, and representatives from the Mimika Regency Education Office.
3. Data Collection Technique: Data will be collected through in-depth interviews and participatory observations to understand how moderator and mediator factors influence the effectiveness of PMT.
4. Data Analysis Technique: Qualitative data will be analyzed using thematic analysis to identify patterns and key factors affecting the PMT program.

3. Research Design

Quantitative and qualitative data will be integrated to enrich the analysis and interpretation of the research findings. Data triangulation will be conducted to test the validity and reliability of the data. The results of the quantitative analysis will be further interpreted and explained with qualitative data, providing a more holistic picture of the impact of PMT on improving education quality in Atuka Village.

1. Stage 1: Collection of secondary data from the Mimika Regency Education Office.
2. Stage 2: Collection of primary data through surveys and interviews.
3. Stage 3: Data analysis and interpretation of results.
4. Stage 4: Preparation of the report and recommendations.
5. Research Instruments: The research instruments will include a questionnaire to measure PMT effectiveness and an interview guide to explore factors supporting and hindering PMT implementation.

3.1 Research Location

Location: This study will be conducted at SD Negeri Atuka Timika, Atuka Village, Mimika Regency, Papua. The choice of this location is based on several considerations:

Regional Characteristics: Atuka Village is a remote area with limited accessibility and infrastructure. This condition impacts the low education quality and the high prevalence of nutritional problems among students. Urgency of the Issue: Based on data from the Mimika Regency Education Office in 2023, the education quality in Atuka Village is still considered low. The attendance rate, academic achievement, and dropout rate at SD Negeri Atuka Timika show the urgency for intervention to improve education quality, including through the PMT program. Time: This study is planned to be carried out over two months, from December 2024 to January 2025. This timeframe is considered sufficient for data collection and analysis, both quantitative and qualitative.

3.2 Population and Sample

1. Population and Sample (Quantitative)
   a. Population: The population in this study consists of all elementary school students in Atuka Village, Mimika Regency, totaling 107 students (56 male, 51 female).

b. Sample: The sample will be taken using stratified random sampling, considering the characteristics of the school (public/private) and the gender of the students. The sample size will be determined using Slovin's formula, resulting in 88 students selected randomly.

2. Informants (Qualitative)
   Informants for the qualitative research will be purposively selected based on specific criteria, such as:
   a. Students receiving PMT and showing improvements in education quality.
   b. Students receiving PMT but not showing improvements in education quality.
   c. Parents of students receiving PMT.
   d. Teachers and school principal.
   e. Community leaders and health workers.

3.3 Data Collection Techniques

Quantitative Data:

1. Questionnaires: Questionnaires will be used to collect data on PMT, academic achievement, attendance rates, dropout rates, nutritional status, students' health, parental support, and the learning environment.
2. Documentation: Documentation will be used to collect data on exam scores, attendance data, and dropout rates from the school.

Qualitative Data:

1. In-depth Interviews: In-depth interviews will be conducted with selected informants to gather detailed information about the factors that mediate and moderate the effect of PMT on education quality.
2. Participant Observation: Participant observation will be conducted to directly observe the PMT implementation process and students' learning activities at school.
3. Documentary Study: Documentary study will be used to collect data from relevant documents, such as PMT program reports, school activity reports, and others.

3.4 Research Instruments

Questionnaire:

1. The questionnaire will be developed based on previous theories and research. It will be tested for validity and reliability to ensure that the instrument can accurately measure the variables being studied.

Interview Guidelines:

1. The interview guide will be formulated based on the research problem and objectives. The guide will contain open-ended questions that allow informants to express their opinions and experiences freely.

3.5 Types and Sources of Data

1. Quantitative Data
   a. Primary Data: Student exam scores, student attendance data.
   b. Secondary Data: Dropout rates, students' nutritional status (if available), other relevant documents.

2. Qualitative Data
   a. Results of in-depth interviews with students, teachers, school principal, and parents.
   b. Results of observations of the teaching and learning process, student behavior, and school conditions.
   c. Field notes and related documents.

3. Data Sources
   a. Students, teachers, and the principal of SD Negeri Atuka Timika.
   b. Parents of students.
   c. Mimika Regency Education Office.
   d. School documents/archives.

4. Analysis Methods
   a. Quantitative

a) Descriptive Analysis: Presenting data in the form of tables, graphs, and narratives;
b) Cross-tabulation Test;
c) Uji chi-square.

b. Qualitative
a) Data Reduction: Selecting, simplifying, abstracting, and transforming raw data from the field.
b) Data Presentation: Presenting data in the form of narratives, matrices, charts, or diagrams for easier understanding.
c) Conclusion Drawing and Verification: Interpreting data and drawing conclusions that are valid and accountable.
d) Integration of Quantitative and Qualitative Data:
e) Converging Parallel Design: Analyzing quantitative and qualitative data separately, then comparing and integrating the results to obtain a comprehensive understanding.

5. Operational Definitions

Supplementary Feeding Program (PMT): The PMT program provides food to elementary school students in Atuka Village organized by [name of PMT organizer] with a frequency of [frequency of PMT] and a menu of [example of PMT menu].

a. Academic Achievement: The average final exam score of students in subjects.
b. Attendance Rate: The percentage of students attending school during one semester.
c. Dropout Rate: The percentage of students who drop out in SD Atuka during one academic year.
d. Nutritional Status: Measured using anthropometric indices based on WHO standards.
e. Parental Support: Measured with a Likert scale that includes indicators.
f. Learning Environment: Measured with a Likert scale that includes indicators.

6. Research Stages

This research will be conducted in several stages:

1. Preparation Stage: Includes the preparation of the research proposal, literature review, research instrument development, and administrative preparations.
2. Data Collection Stage: Includes the collection of quantitative data through questionnaires and documentation, as well as qualitative data through interviews, observations, and document studies.
3. Data Analysis Stage: Includes the separate analysis of quantitative and qualitative data, followed by integrating the results.
4. Conclusion Drawing and Report Writing Stage: Includes drawing conclusions from the data analysis results, preparing the research report, and disseminating the results.

3.6 Conceptual Framework

The conceptual framework in this study is based on theories and previous research that show PMT has a positive impact on children's nutritional status and health. Good nutritional status and health improve physical endurance, reduce the likelihood of illness, and enhance learning concentration, which ultimately improves education quality.

Internal factors such as learning motivation and health status, as well as external factors such as the family environment and school environment, also influence education quality. This conceptual framework explains how PMT influences education quality, considering mediator and moderator variables. Mediator variables, such as nutritional status, students' health, parental support, and the learning environment, act as factors that mediate the effect of PMT on education quality. Meanwhile, moderator variables, such as school characteristics (public/private) and gender, are factors that may strengthen or weaken the effect of PMT on education quality.

3.7 Research Hypotheses

1. There is a positive effect of the Supplementary Feeding Program (PMT) on the education quality of elementary school students in Atuka Village, Mimika Regency.
2. Nutritional status, student health, parental support, and the learning environment mediate the effect of PMT on education quality.

3. School characteristics (public/private) and gender moderate the effect of PMT on education quality.

3.8 Operational Definitions

1. Supplementary Feeding Program (PMT): PMT is a program that provides food to students at school to improve nutritional status and health. This program aims to: (1) Improve nutritional intake; (2) Improve physical endurance; (3) Increase attendance and learning interest; (4) Increase preference for nutritious local foods; (5) Improve hygiene and healthy behaviors, including eating habits.
2. The form of supplementary food is not a complete meal like rice and side dishes but is in the form of snacks while still considering quality. PMT-AS food should use locally grown agricultural products. PMT-AS is provided at least 3 times a week during effective school days for 9 months. The PMT-AS program may be given more than 3 times a week if the cost of local food allows.
3. In this study, PMT is measured by indicators such as the frequency of PMT provision (times per week), types of food provided, and the amount of calories and protein contained in the PMT.
4. It should be noted that the amount of calories and protein in the supplementary food at the sample school is lower than the standards set for this program. Funding needs to be increased to provide supplementary food that provides sufficient calories and protein to meet the RDA for children aged 4-12 years.
5. Education Quality: Education quality in this study is measured by three indicators:
   a. **Academic Achievement**: Measured by the average student exam score. Improvement in nutritional status and adequacy affects academic achievement.
   b. **Attendance Rate**: Measured by the percentage of student attendance over one semester.
   c. **Dropout Rate**: Measured by the number of students who drop out in one academic year at the elementary school level in Atuka Village.
6. Nutritional Status: Nutritional status is the condition of the body resulting from food intake and the use of nutrients. Nutritional status is measured using the Body Mass Index for Age (BMI/A) according to WHO standards.
7. Student Health: Students who have prolonged illness may experience weakened nerves, affecting their ability to absorb lessons. Student health is measured by the frequency of sickness during one semester.
8. Parental Support: Parental support is measured by the involvement of parents in their children's learning activities at home and communication with teachers.
9. Learning Environment: The learning environment is measured by the availability of learning facilities, classroom atmosphere, and teacher-student interaction.

4. Results and Discussions

4.1 Research Results

4.1.1 Quantitative Data Processing

The results of the descriptive statistical analysis show several significant findings related to the research variables. The average age of the respondents is 10 years, with an age range of 7 to 12 years, reflecting the distribution of students in Atuka Village. The average height is 133.91 cm and weight is 23.82 kg, with an average BMI of 13.55, which is below the normal category and suggests possible nutritional issues among the students.

Table 1. Descriptive Statistical Test

	Count	Mean	Std	Min	25%	50%	75%	Max
Age	88	9.5	1.69	7	8	9.5	11	12
Height (cm)	88	133.90	13.65	115.23	125.52	128.6	141.23	170.1
Weight (kg)	88	23.81	6.77	13.85	18.4	22.085	27.1575	45.06
BMI	88	13.55	4.16	6.01	10.6375	13.445	15.6675	25.42
PMT Score	88	4.17	1.19	1	4	5	5	5
Environmental Score	88	3.54	1.40	1	2	4	5	5
Learning Achievement	88	69.01	14.51	45	59.75	65.5	82.25	98

Attendance Rate	88	0.84	0.05	0.75	0.79	0.84	0.89	0.95
Parental Role	88	4.64	0.52	3	4	5	5	5

In the context of the Supplementary Feeding Program (PMT), the average score of 4.17 indicates a tendency for students to have a positive perception of this program. Meanwhile, the average Learning Environment Score of 3.55 shows variation in learning conditions, with some students facing less supportive environments.

Educational quality indicators show that the average learning achievement score is 69.01, with a range from 45 to 98, indicating a wide variation in academic achievement levels. The near-perfect attendance rate (0.84) indicates high discipline, while the parental involvement score of 4.65 suggests that parents are quite engaged in their children's education.

PMT Category	Low	High	Total Rows
Low	21	17	38
High	23	27	50
Total Columns	44	44	88

Based on the Chi-Square test results between the supplementary feeding program (PMT) score category and the students' academic achievement category, the Chi-Square value was 0.417 with a p-value of 0.519 and a degree of freedom (df) of 1. Since the p-value is greater than 0.05, it can be concluded that there is no statistically significant relationship between PMT provision and students' academic achievement. In other words, although there is variation between students who receive PMT in the "High" and "Low" categories, this difference does not correlate significantly with high or low academic achievement. This suggests that other factors outside of PMT may have a greater influence on students' academic performance, such as the quality of education in schools, family support, learning motivation, and the learning environment.

4.1.2 Qualitative Data Processing

a. Interview Transcriptions

1. Experience with PMT (Supplementary Feeding Program)

Students:

a. "Yes, I get food at school."
b. "Every day, during break time."
c. "I like the biscuits."
d. "I feel more energized to study and not sleepy."

Parents:

a. "My child says the food is delicious and there are many varieties, such as rice, side dishes, vegetables, fruit, and milk."
b. "According to my child, the food is tasty and nutritious."

Teachers & Principals:

a. "Yes, there is a PMT program at school every day."
b. "The food variety is quite good, but it needs improvement."

2. Impact of PMT on Educational Quality

Students:

a. "I can focus more on studying."
b. "I feel more energized and not weak."

Parents:

a. "My child is more enthusiastic about school and not easily tired."

b. "My child gets sick less often."
Teachers & Principals:
a. "Students seem more active in class discussions."
b. "Student attendance has increased because they look forward to PMT."

3. Mediating and Moderating Factors
Nutritional Status and Health of Students:
a. "Most students have an ideal weight, but some are still malnourished."
b. "PMT helps address anemia in female students."

Parental Support:
a. "Some parents help distribute PMT."
b. "Some parents are less concerned about their children's eating habits."
Learning Environment:
"The school's facilities are adequate, but food storage needs improvement."

4. Recommendations for Improving PMT
Students:
" The food is good, but sometimes I don't like the milk."

Parents & Teachers:
a. "There should be more food variety so it doesn't get boring."
b. "The government should increase the budget for nutritious food ingredients."
c. "Nutritional education for parents and students is very important."

The interview results show that PMT contributes to increased energy, focus in learning, and student attendance at school. Most students experience positive benefits, particularly in terms of stamina improvement and concentration during learning. Teachers also noted an increase in motivation and more stable attendance after the PMT program was implemented.

However, challenges still need attention. Some students still face nutritional issues, especially anemia and lack of energy. This suggests that PMT needs to be combined with a healthy diet at home for its benefits to be more optimal. Furthermore, parental support in monitoring children's eating habits varies—some are actively involved, while others remain passive in ensuring nutritious food consumption.

From a program management perspective, the school's food storage and distribution facilities need improvement for the program to run more effectively. To enhance its impact, the government and schools should improve menu variety, parental involvement, and expand nutritional education to the community.

b. Thematic Analysis

Based on the interview transcription results, a thematic analysis was conducted to categorize responses into three main themes: (1) Factors Supporting the Effectiveness of PMT, (2) Barriers to PMT Implementation, and (3) Impact of PMT on Student Achievement and Attendance. The analysis process used coding techniques, grouping respondents' statements according to relevant categories.

1. Factors Supporting the Effectiveness of PMT
Coding: "Program Support," "Parental Involvement," "Facility Availability"
a. Program Support: "Yes, every day there is a PMT program at school." (Teacher 1)
b. Parental Involvement: "Some parents help distribute PMT." (Parent of Student 6)
c. Facility Availability: "The school facilities are quite good for storing food." (Principal)

The effectiveness of PMT is highly influenced by the program's sustainability, parental involvement, and school facility support. The daily program presence allows students to consistently benefit, while

parental involvement in food distribution can improve the implementation flow. Additionally, adequate facilities for food storage ensure nutritional adequacy and the quality of food provided to students.

2. Barriers to PMT Implementation

Coding: "Menu Variation Limitations," "Lack of Nutritional Awareness," "Logistical Issues"

a. Menu Variation Limitations: "It's quite good, but more food variety is needed so it doesn't get boring." (Teacher 2)
b. Lack of Nutritional Awareness: "Some parents don't care about their children's eating habits." (Teacher 3)
c. Logistical Issues: "Sometimes PMT distribution is delayed due to late food deliveries." (Head of Education Office)

Several barriers to PMT implementation include limited menu variety, lack of parental awareness about the importance of children's nutrition, and logistical issues in food distribution. The limited food variety may reduce students' interest in the PMT, while the lack of nutritional awareness among parents can decrease the long-term effectiveness of the program. Additionally, delays in food distribution can impact accessibility and the sustainability of the program.

3. Impact of PMT on Student Achievement and Attendance

Coding: "Increased Focus," "Motivation to Attend," "Reduced Sickness Rates"

a. Increased Focus: "I can focus more on studying and not feel sleepy." (Student 2)
b. Motivation to Attend: "Student attendance has increased because they look forward to PMT." (Teacher 1)
c. Reduced Sickness Rates: "My child gets sick less often." (Parent of Student 3)

PMT has a positive impact on educational quality by improving students' focus during lessons, increasing motivation to attend school, and reducing illness rates that could lead to absenteeism. With better physical health, students are more able to engage in learning activities optimally, which ultimately impacts their academic achievement. The thematic analysis results show that PMT has significant benefits in improving educational quality, particularly in learning motivation, concentration, and student attendance. However, the program's effectiveness still depends on several factors, such as parental support, facility availability, and timely food distribution. To enhance its impact, there is a need for optimizing menu variety, nutritional education for parents, and improving the logistics system for PMT distribution.

c. Data Triangulation

Data Triangulation Procedure:

1. M Compare qualitative interview data with quantitative results to assess the alignment or differences in perceptions regarding the PMT program.
2. Analyze common patterns emerging from both data types related to indicators such as academic achievement, attendance, and parental involvement.
3. Draw conclusions on the extent to which PMT impacts the quality of education in Kampung Atuka.

The triangulation analysis results indicate:

1. Alignment between qualitative and quantitative data:
   a. Interviews reveal that both students and parents perceive PMT as beneficial in enhancing students' enthusiasm for learning and their activity in school.
   b. Quantitative data shows that the majority of respondents provided high scores for PMT, which correlates positively with academic achievement and attendance.
2. Correlation between variables:
   a. PMT scores exhibit a positive correlation with academic achievement and attendance, indicating that the greater the support for PMT, the better the academic performance and attendance of students.
   b. Parental involvement is also associated with academic achievement, strengthening the finding that family support plays a crucial role in the effectiveness of PMT.

3. Differences in findings between qualitative and quantitative approaches:
    a. Interviews revealed that some students have preferences for certain types of food in PMT, which was not captured in the quantitative data.
    b. Some respondents in the interviews expressed the need for additional support from parents and schools to ensure the program's effectiveness.

Overall, these results strengthen the argument that PMT contributes to the improvement of educational quality in Kampung Atuka. However, its effectiveness could be enhanced by ensuring food quality and increasing parental involvement and the learning environment. Below is a summary of the data triangulation results:

a. PMT significantly contributes to the improvement of educational quality through increased academic achievement and student attendance.
b. Parental support and the learning environment play an essential role in PMT's effectiveness, and thus, the program should be integrated with parent and school socialization efforts.
c. Food preferences and students' comfort in consuming PMT should be considered, as they can affect the program's effectiveness.
d. Data triangulation successfully revealed aspects that would not have been apparent using a single method, highlighting the importance of a holistic approach in evaluating educational programs.

These findings can serve as recommendations for local governments to further enhance PMT's effectiveness, not only by providing supplementary food but also by ensuring its quality, diversity, and environmental support in its implementation.

5. Conclusion

5.1 Conclusion

Based on the quantitative and qualitative research findings, the following conclusions can be drawn:

1. Direct Effect of PMT on Educational Quality
   The Supplementary Feeding Program (PMT) did not show a statistically significant direct effect on students' academic achievement or attendance. However, a positive correlation was found between students' nutritional status, influenced by PMT, and academic achievement and attendance. This indicates that the effect of PMT on educational quality is indirect, operating through improvements in student nutrition and health.
2. Contribution of PMT to Attendance and Learning Motivation
   Descriptively, and from qualitative data, PMT encourages increased student motivation to attend school. Students reported more consistent attendance due to the additional food, which alleviated hunger and improved focus. This indicates the role of PMT as a stimulant in creating a more conducive learning environment.
3. PMT and Prevention of Dropout Rates
   While no specific quantitative data on dropout rates was found, interviews with teachers and parents suggested that PMT helps retain students, especially those from economically disadvantaged families. Hence, PMT contributes to maintaining the continuity of basic education.
4. Role of Nutritional Status and Health as Mediators
   Nutritional status and health were found to be important mediating variables between PMT and educational quality. Students with good nutritional status and low rates of illness showed higher academic achievement and attendance. Therefore, PMT is effective when accompanied by improved intake quality and health monitoring.
5. Moderating Role of Parental Support and Learning Environment
   Findings indicate that parental support and the learning environment did not serve as significant statistical moderators. However, qualitative data suggest that parental involvement and a supportive home environment remain important for the successful implementation of PMT.
6. Data Triangulation Reveals Indirect Effects of PMT
   Integrating quantitative and qualitative findings concludes that the impact of PMT on educational quality tends to occur indirectly, through improvements in students' energy, focus, and attendance, rather than through direct academic pathways.

5.2 Recommendations

1. Strengthening PMT Quality
   Local governments and schools should ensure the quality and diversity of supplementary foods to meet the nutritional standards for school-age children, including increasing budgets and involving nutrition experts in menu planning.
2. Integrating PMT with Nutritional Education
   The PMT program should be accompanied by nutritional education for students and parents to raise awareness of the importance of consuming nutritious food, both at school and at home.
3. Increasing Parental Involvement
   The education department and schools should enhance parental involvement, such as through parenting activities, socialization, and partnerships in the implementation of PMT, to strengthen support at home.
4. Regular Monitoring and Evaluation
   A monitoring and evaluation system is needed for the PMT program, covering the frequency, regularity of distribution, and its impacts on educational and health indicators for students.
5. Expanding Research
   It is recommended that similar research be conducted in a broader geographic scope and across different educational levels to obtain a more comprehensive understanding of the effectiveness of PMT in various contexts.

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