STRENGTHENING MATHEMATICS AND NATURAL SCIENCES EDUCATION BASED ON THE LOCAL WISDOM OF SOUTH NIAS: INTEGRATION OF TRADITIONAL CONCEPTS IN MODERN EDUCATION

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Abstract

This community service aims to strengthen the teaching of mathematics and natural sciences (Science) in schools in South Nias through the integration of local wisdom values. With a cultural-based approach, this service focuses on developing teaching methods that not only introduce scientific concepts but also connect the lessons to students' experiences, traditions, and local customs. The activities involve teachers and students in the development of learning media based on local wisdom, teacher training, and the implementation of project-based learning models. The results of this service show that the integration of local wisdom in teaching enhances students' understanding of mathematical and science concepts, strengthens their motivation to learn, and preserves local cultural values. Additionally, teachers acquired new skills in developing contextual and creative teaching methods. This service makes a positive contribution to both the preservation of culture and the development of education that is more relevant to the local context.
Keywords: *Community service; mathematics education; natural sciences; local wisdom; South Nias; cultural integration; culture-based education; cultural preservation.*

Abstrak

Pengabdian ini bertujuan untuk menguatkan pembelajaran matematika dan ilmu pengetahuan alam (IPA) di sekolah-sekolah di Nias Selatan melalui integrasi nilai-nilai kearifan lokal. Dengan pendekatan berbasis budaya, pengabdian ini menyasar pengembangan metode pembelajaran yang tidak hanya memperkenalkan konsep-konsep ilmiah, tetapi juga mengaitkan materi pelajaran dengan pengalaman, tradisi, dan kebiasaan lokal siswa. Kegiatan pengabdian ini melibatkan guru dan siswa dalam pengembangan media pembelajaran berbasis kearifan lokal, pelatihan guru, serta penerapan model pembelajaran yang berbasis proyek. Hasil dari pengabdian ini menunjukkan bahwa integrasi kearifan lokal dalam pembelajaran meningkatkan kualitas pemahaman siswa terhadap konsep matematika dan IPA, memperkuat motivasi belajar, serta melestarikan nilai-nilai budaya setempat. Selain itu, para guru juga memperoleh keterampilan baru dalam mengembangkan pembelajaran yang kontekstual dan kreatif. Pengabdian ini memberikan

kontribusi positif terhadap pelestarian budaya dan pengembangan pendidikan yang lebih relevan dengan konteks lokal.

Kata Kunci: *Pengabdian; pembelajaran matematika; ilmu pengetahuan alam; kearifan lokal; Nias Selatan; integrasi budaya; pendidikan berbasis budaya, pelestarian budaya.*

A. Introduction

Education is one of the main pillars of national development (Agusmina, Duha, & Darmawan Harefa, 2024). In the context of Indonesia, a nation rich in cultural diversity and local wisdom, it is important to recognize that learning should not only focus on the advancement of modern science and technology but also value and integrate the local wisdom possessed by each region (Kurniawan, D., 2017). One such region with a rich cultural heritage and local wisdom that needs to be preserved is South Nias, located in the Province of North Sumatra (Hidayati, N., & Hasan, M., 2020).

South Nias, with all its cultural potential and traditions, possesses a value system that is deeply rooted in the lives of its people. However, in the current era of globalization and technological advancement, a major challenge arises in preserving these values to prevent them from being eroded by the forces of modernization. According to Ardian, A. (2018), one way to preserve and strengthen local wisdom values is by integrating them into the educational system, particularly in the teaching of mathematics and natural sciences (Science). These two fields are often viewed as separate from local culture, yet many concepts within mathematics and science can be combined with local wisdom to create a more relevant and contextual approach for students (Dewi, S. M., 2019).

Mathematics and science education in schools in South Nias, as in many other regions, often appears rigid and theoretical, with little or no connection to the daily lives of the community. Therefore, there is a need to develop a curriculum that not only emphasizes theoretical mastery of the subject matter but also considers the local cultural context, which can enrich students' understanding (Dewi, S. M., 2019). Strengthening mathematics and science education based on the local wisdom of South Nias is expected to provide a more vibrant, meaningful, and relevant learning experience for students (Mulyasa, E., 2021).

Through this community service, we aim to design and implement a mathematics and science learning approach that integrates the local wisdom values of South Nias. This approach is expected to not only enhance the quality of education but also introduce traditional concepts rich in life philosophies, such as harmony with nature, cooperation within the community, and the use of sustainable traditional tools and methods (Foahonoa Zisokhi Nehe, 2024). Thus, education that integrates local wisdom will prepare the

younger generation to face the challenges of the modern world while still appreciating and preserving their cultural heritage (Ardian, A., 2018).

Through this community service, we also hope to strengthen the relationship between education and the people of South Nias, so that the learning process takes place not only in the classroom but also incorporates the broader values and practices of daily life.

B. Implementation Method

In order to implement the strengthening of mathematics and natural sciences (Science) education based on the local wisdom of South Nias, we will use a participatory, interactive, and contextual approach. The methods employed aim to integrate local wisdom concepts into the learning materials in a way that is accessible, understandable, and enjoyable for students, while being relevant to their lives (Sugiyono, S., 2018). Below are the steps that will be taken in the implementation of this community service:

1. **Identification and Inventory of Local Wisdom in South Nias**

   As an initial step, we will conduct an identification and inventory of the local wisdom values present in the South Nias community, particularly those related to daily life, nature, and local culture. This process will involve:

   a. Interviews with Community Leaders and Cultural Experts: To explore cultural values that can be applied in teaching.
   b. Observation of Community Practices: Observing how the people of South Nias interact with nature and apply principles of mathematics and science in their daily activities.
   c. Documentation of Local Traditions: Collecting folklore, customs, and traditional knowledge related to environmental management and resource use.

2. **Designing a Local Wisdom-Based Curriculum**

   Based on the results of the identification of local wisdom, the community service team will design learning modules that integrate these local values into the mathematics and science curriculum. This adjustment will be made through:

   a. **Integration of Traditional Concepts with Curriculum Content**: For example, in mathematics, geometric concepts can be integrated with traditional Nias architecture that uses symmetrical patterns. In science, it could involve observing the local environment, which has already become part of the daily life of the community, such as understanding the local ecosystem or how the people of Nias manage agriculture and fishing practices.

b. **Development of Teaching Aids and Learning Media with a Local Flavor**: For example, using models of traditional tools, such as farming implements or ceremonial equipment, to illustrate scientific concepts.
c. **Development of Teaching Guidebooks**: This guidebook will provide teachers with a framework for teaching subjects by incorporating local cultural values into each lesson topic.

3. **Teacher Training**

To ensure that this approach can be applied effectively, we will conduct training sessions for teachers in the schools involved in this community service. The training will cover:

a. **Introduction to Local Wisdom-Based Learning Concepts**: Teachers will be trained to understand the importance of integrating local values into the teaching of mathematics and science.
b. **Contextual Teaching Techniques**: Teachers will be equipped with skills to adapt lesson materials with a local wisdom-based approach, both in terms of content and teaching methods.
c. **Use of Local Learning Media**: Teachers will also be taught how to create and utilize learning media that reflect local culture, such as teaching aids based on natural resources or traditional objects.

4. **Implementation of Classroom Learning**

After the teachers have been trained, the next step is to implement the developed curriculum in classroom teaching activities. In this phase:

a. **Project-Based Learning**: Students will be engaged in projects that connect mathematics and science concepts to their everyday lives. For example, they could create models of traditional Nias buildings based on geometric principles or study local sustainable farming systems using scientific approaches.
b. **Collaborative Learning**: Cooperative learning methods will be used, where students work in groups to solve problems related to local wisdom, such as finding solutions to environmental issues in their community.
c. **Field Trips and Nature Experiments**: Students will participate in field activities, such as observing biodiversity or traditional farming and fishing practices, which will then be linked to science lessons.

5. **Evaluation and Reflection**

Each community service activity will be concluded with an evaluation to measure the effectiveness of

implementing local wisdom-based learning. The evaluation will be conducted through:

a. **Exams and Project-Based Assessments**: Assessing how well students can connect mathematics and science concepts with the local wisdom values they have learned.
b. **Reflection with Teachers and Students**: Holding discussion and reflection sessions to understand the impact and challenges faced in applying this approach. This reflection will also serve to gather constructive feedback from both teachers and students for future improvements.
c. **Observation and Documentation of Learning Activities**: Observing the teaching and learning process to see how local wisdom-based learning is received by students and how it influences their motivation and understanding.

6. Dissemination of Community Service Results

After the completion of this community service activity, the results will be published in the form of reports, articles, or seminars to introduce the local wisdom-based learning approach to other educational institutions. In addition, we will also develop learning materials that can be accessed by other schools in South Nias and other regions with similar cultural contexts.

C. Results and Discussion of Community Service

Results

The implementation of the community service titled "Strengthening Mathematics and Natural Sciences Education Based on the Local Wisdom of South Nias: Integrating Traditional Concepts into Modern Education" is expected to produce various positive impacts. These outcomes will not only enrich classroom learning but also contribute to the preservation of local wisdom values and enhance the relevance of education for students in South Nias. Below are the expected results from this community service:

1. Improvement in Learning Quality

One of the main outcomes expected from this community service is the enhancement of the quality of mathematics and science education in the schools involved. By integrating the local wisdom of South Nias, the learning process becomes more contextual and relevant to students' daily lives. The visible outcomes of this improvement in learning quality include:

a. **Increased Student Engagement and Participation**: Students show greater interest and become more active in lessons because the learning material is closer to their own experiences.
b. **Deeper Understanding of Concepts**: Students develop a more profound understanding of concepts, particularly in mathematics and

science, as these are presented through the lens of local cultural contexts that students are already familiar with.

c. **Development of Critical and Creative Problem-Solving Skills**: Students enhance their critical thinking and creativity in solving problems related to their local environment, making the learning experience more meaningful and applicable to real-life situations.

2. **Improvement in Teacher Competence**

Through the training and mentoring provided during the community service, there has been a significant enhancement in teachers' competencies in teaching mathematics and science based on local wisdom. The expected outcomes from this aspect include:

a. **Improved Ability to Design Curriculum and Teaching Materials**: Teachers are better equipped to design curricula and teaching materials that integrate local wisdom without compromising the academic substance of the subjects.

b. **Application of More Creative and Contextual Teaching Methods**: Teachers implement more innovative teaching strategies, such as project-based learning, collaborative learning, and the use of learning media that involve local culture.

c. **Strengthened Teacher-Student Relationships**: Teachers play a more active role as facilitators, not only delivering content but also connecting formal knowledge with students' lived experiences, fostering deeper engagement and understanding.

3. Student Engagement in Local Wisdom-Based Learning

One of the main objectives of this community service is to involve students in learning that values and integrates local wisdom. The expected outcomes related to student engagement include:

a. **Increased Interest and Motivation in Learning**: Students show stronger interest and motivation in mathematics and science because the learning material is easier to understand and directly relates to their everyday lives.

b. **Strengthened Pride in Local Culture**: Students develop a greater sense of pride in their local culture, as they learn not only academic knowledge but also the traditions and wisdom that are part of their community.

c. **Application of Knowledge in Daily Life**: Students apply the knowledge they acquire in real-world contexts, such as using geometric principles in building traditional houses or understanding local ecosystems in managing natural resources.

4. Development of Local Wisdom-Based Learning Media

As part of this community service, learning media that integrate local cultural elements will be developed. The media developed include:

a. **Traditional Teaching Aids**: Models of traditional buildings or farming tools

that can be used to explain mathematical concepts (e.g., symmetry, measurement, and ratios) and science concepts (e.g., ecosystems, natural resources).

b. **Learning Guidebooks**: These will contain methods and teaching techniques based on local wisdom that teachers can apply in various schools.
c. **Documentary Videos and Digital Learning Materials**: These will showcase how the people of South Nias apply mathematical and scientific principles in their daily lives, providing students with visual and interactive learning experiences.

5. Increased Awareness and Preservation of Local Wisdom

Through the integration of local wisdom values into education, this community service also aims to strengthen awareness of the importance of cultural preservation. Some of the expected outcomes in this regard include:

a. **Increased Awareness Among Students and the School Community**: Students and the broader school community become more aware of the importance of preserving local wisdom, both in the educational context and in daily life.
b. **Empowerment of the Local Community**: The local community is empowered by being involved in the educational process, such as through collaborations with community leaders, cultural experts, or traditional craftsmen in delivering culture-based learning materials.
c. **Enhanced Appreciation for Local Cultural Heritage**: Students develop a greater appreciation for local cultural heritage, seeing local wisdom not only as part of history but also as knowledge that can be applied in modern life.

6. Documentation and Dissemination of Community Service Results

The results of this community service will be documented in a comprehensive report that includes:

a. **Community Service Activity Report**: A detailed report describing the implementation process, the results achieved, and an analysis of the impact of the service on education and the community.
b. **Publications in the Form of Articles or Journals**: Articles or journals will be published and shared with the broader educational community to promote the local wisdom-based learning approach.
c. **Seminars or Workshops**: Organizing seminars or workshops to share the experiences and results of this community service with stakeholders such as the Department of Education, educational organizations, and cultural communities in other regions.

7. Feedback and Follow-Up Plans

Based on the evaluations and reflections conducted during and after the community service implementation,

the feedback obtained will be used to improve and further develop the program. The results of this evaluation are expected to serve as a foundation for:

a. **Development of a Local Wisdom-Based Learning Model**: Creating a learning model that can be implemented in other schools, both in South Nias and in other regions with similar cultural contexts.
b. **Improvement and Enhancement of Teacher Training Quality**: Refining and expanding the training for teachers to ensure that local wisdom-based teaching can be implemented more broadly and effectively.

Overall, the results of this community service are expected to create a more relevant and meaningful learning model for students, strengthen teachers' competencies, and preserve the local wisdom that is a valuable cultural heritage for the people of South Nias. Thus, education will not only serve as a means to acquire knowledge but also as a tool to strengthen cultural identity and enrich the social life of the community..

Discussion

This section will discuss the results achieved from the community service project titled *"Strengthening Mathematics and Natural Sciences Education Based on the Local Wisdom of South Nias: Integrating Traditional Concepts into Modern Education"*, as well as the challenges and lessons learned during the implementation of the program. The discussion will also reflect on the effectiveness of integrating local wisdom into mathematics and science education and its impact on students, teachers, and the community in South Nias.

1. Integration of Local Wisdom in Mathematics and Science Education

One of the main objectives of this community service project is to integrate the values of local wisdom from South Nias into mathematics and science education. This process not only introduces traditional concepts but also allows students to connect scientific knowledge with their everyday lives.

Several key points were observed during the implementation of the program:

a. **Deeper Understanding**: The integration of local wisdom into mathematics and science education has proven to help students understand the material more deeply and practically. For example, the concept of geometry, taught through symmetrical patterns in Nias traditional houses or measurements in traditional buildings, provided students with tangible examples connected to their own culture. In science, understanding concepts like ecosystems or energy flow became easier through hands-on activities, such as observing local plants or animals in their surroundings.
b. **More Engaging and Contextual Learning**: By using local wisdom as

the backdrop for learning, students felt more connected to the material being taught. They were not just studying abstract theories but also seeing how these concepts relate to local traditions and customs they already knew. This increased student engagement and made the learning experience more enjoyable and meaningful.

2. Enhancement of Teacher Competence

This community service project also aims to enhance the competence of teachers in delivering lessons in a more creative and culturally contextual manner. Based on the training provided, the teachers involved in this program showed a significant improvement in their ability to:

a. **Adapting the Curriculum**: The teachers successfully adapted the mathematics and science curriculum by integrating local wisdom values. They learned to design learning activities that not only focused on achieving academic competencies but also emphasized understanding the social and cultural context of the students.
b. **Using Diverse Teaching Methods**: Project-based learning, collaborative learning, and the use of local wisdom-based media were methods effectively implemented by the teachers. These approaches allowed students to learn through hands-on experiences and collaborative group work, which strengthened their understanding of the concepts being taught.
c. **Applying Innovative Evaluation Techniques**: The evaluation process was not limited to written exams but also included project-based assessments and direct observation of students' field activities. This provided a more comprehensive view of students' understanding and their ability to apply the knowledge they had gained.

3. Impact on Students

One of the main goals of this community service project was to increase student interest and motivation in learning mathematics and science through a more contextual approach. The results observed during the implementation of the program show several positive impacts on the students:

a. **Increased Student Interest and Motivation**: Students showed greater enthusiasm for learning mathematics and science once the learning materials were linked to local wisdom. For example, students who previously struggled with geometry concepts found it easier to understand after being presented with real-life examples from traditional house structures or familiar traditional tools.

Additionally, projects that involved direct observation of the surrounding environment sparked their interest in science.

b. **Development of Practical and Creative Skills**: The project-based learning and hands-on experiments honed students' critical thinking and creative skills. Students not only learned theoretical concepts but also applied their knowledge to solve real-world problems, such as finding solutions to environmental issues or designing building models based on mathematical principles.

c. **Enhanced Pride in Local Culture**: Connecting learning with local wisdom also strengthened students' sense of identity and pride in their culture. They began to see that local wisdom is not only something to be preserved but also can make a significant contribution to education and knowledge development.

4. Challenges in Implementation

Although the community service project successfully achieved many of its objectives, several challenges were encountered during the implementation process, including:

a. **Lack of Resources and Adequate Teaching Materials**: Although we made efforts to develop learning materials based on local culture, there were still limitations in the availability of tools and resources that could be directly used by both teachers and students. For some concepts, procuring traditional teaching aids that align with the curriculum required additional time and financial investment.

b. **Limited Time and School Facilities**: The schools involved in this community service often faced challenges in terms of physical facilities and teaching time. For instance, conducting field activities or experiments requires extended time and appropriate facilities, which are sometimes difficult to provide.

c. **Resistance to Change**: Some teachers and students were still accustomed to conventional teaching approaches. Implementing new methods that integrate local culture requires patience and adaptation. This process did not always go smoothly, particularly during the initial phase of implementation.

5. Reflection and Recommendations

The experiences gained during the implementation of this community service project have provided valuable lessons and recommendations for further development:

a. **Enhancing Collaboration with the Local Community**: Integrating local wisdom into education requires deeper involvement from

the community. Collaboration with traditional leaders, cultural experts, and local residents can enrich the teaching materials and provide students with firsthand experiences. This partnership can also foster a greater sense of community ownership over the educational process, ensuring that cultural values are preserved and transmitted through future generations.

b. **Provision of More Adequate Resources**: To ensure the sustainability of this program, further development in the provision of resources is essential. This includes developing and providing culturally relevant teaching aids, local wisdom-based educational tools, digital learning media, and ongoing professional development programs for teachers. Investing in these resources will empower educators to continue delivering meaningful and contextually relevant education, even after the initial program concludes.

c. **Implementing the Local Wisdom-Based Teaching Model in Other Schools**: This teaching model can be further developed and implemented in other schools, both within Nias Selatan and in regions with similar cultural wisdom. A more in-depth evaluation is necessary to assess its long-term impact on educational outcomes and community engagement. Expanding this approach to other schools will require adapting the model to local contexts while maintaining the core principles of integrating local culture into formal education.

By acting on these reflections and recommendations, it is possible to create a more inclusive, sustainable, and culturally responsive education system that not only enhances students' academic learning but also strengthens their connection to local traditions and cultural heritage.

Overall, this community service demonstrates that the integration of local wisdom into mathematics and science education can have a significant positive impact on the quality of education, student engagement, and the preservation of local culture. Although there are challenges in its implementation, the success of this community service provides a solid foundation for the development of a broader and more sustainable local wisdom-based learning model.

D. Conclusion

The community service project titled "Strengthening Mathematics and Science Education Based on the Values of Local Wisdom from South Nias: Integrating Traditional Concepts into Modern Education" has successfully

achieved its main objective of introducing and integrating the local wisdom values of South Nias into mathematics and science education. Below are several conclusions that can be drawn from the implementation of this community service project:

1. **Improvement in Learning Quality**

   The integration of local wisdom into mathematics and science education made the lesson material more contextual, relevant, and engaging for students. Students found it easier to understand academic concepts because the learning material was linked to their personal experiences and everyday life, such as geometric patterns in traditional architecture or understanding local ecosystems in science lessons.

2. **Improvement in Teacher Competence**

   Teachers involved in this community service demonstrated enhanced competence in designing and implementing culturally-based lessons. They became more creative in using contextual and project-based learning methods and were able to adapt the curriculum to include local cultural values without compromising its academic substance.

3. **Increased Student Interest and Motivation**

   Students showed higher enthusiasm and motivation in participating in mathematics and science lessons after the learning material was connected to their local culture. The more hands-on and experience-based learning process provided students with opportunities to apply knowledge in real-world contexts, which improved their understanding of the subject matter.

4. **Preservation of Local Wisdom**

   By linking education to local wisdom, this community service not only benefited the educational field but also contributed to the preservation of local culture. Students became more proud of their cultural heritage and realized the importance of preserving and developing local wisdom in modern life.

5. **Challenges in Implementation**

   Despite achieving many positive results, there were several challenges, such as limited resources, facilities, and time available in schools. Additionally, implementing a locally-based teaching method required adaptations that were not always easy for all teachers and students, especially during the initial stages of implementation.

Suggestions

Based on the results of this community service project, there are several recommendations for further development, both for schools, teachers, and other stakeholders:

1. **Strengthening Partnerships with the Local Community**

   To enrich the learning material and strengthen the connection with local culture, it is recommended to establish more intensive cooperation with community leaders, cultural figures, and traditional craftsmen. This collaboration could provide direct experiences for students, such as inviting resource persons to discuss local traditions or engaging students in cultural activities.
2. **Provision of More Adequate Resources and Facilities**

   One of the challenges encountered was the limited resources available for developing learning materials based on local culture. Therefore, schools and educational institutions should support the procurement of teaching aids, textbooks, and learning materials that are rooted in local wisdom and can be widely used. Additionally, physical facilities for project-based learning and experiments should be improved.
3. **Ongoing Training for Teachers**

   For the continued implementation of local wisdom-based learning, more routine and structured training should be provided to teachers in other schools. These training programs should not only focus on teaching techniques based on local culture but also on how to address challenges that arise when adapting the curriculum to local cultural contexts.
4. **Application of the Local Wisdom-Based Learning Model in Other Schools**

   The learning model developed in this community service project can be adapted and implemented in other schools with similar cultural contexts. Therefore, follow-up evaluations should be conducted to assess the success and challenges of applying this model in more schools, both in South Nias and in other regions of Indonesia with rich local cultural heritage.
5. **Development of Research and Publication**

   As a follow-up to this community service, it is important to document and disseminate the results through publications in educational journals or national/international seminars. This will not only raise awareness about the importance of integrating local wisdom into education but also serve as a reference for other schools and educational institutions wishing to implement similar approaches.
6. **Enhancing the Role of the Government in Supporting Local Wisdom-Based Education**

There is a need for further support from local governments in the form of educational policies that encourage the preservation of local wisdom through school-based learning. The government can provide incentives or assistance for the development of local culture-based learning materials and strengthen teacher training throughout the region.

Overall, this community service project shows that strengthening mathematics and science education based on the local wisdom of South Nias can improve the quality of education, enrich students' learning experiences, and preserve valuable local cultural values. With broader support from various stakeholders, this learning model is expected to develop further and be implemented in different regions across Indonesia.

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