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Training in Local Food Calorific Value Analysis Using Environment-Based Learning Media to Improve Students' Scientific Literacy and Numeracy at SMAK Sint. Carolus, Kupang

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ABSTRACT

Indonesian students' science literacy and numeracy skills remain relatively low a condition linked to rote-oriented instruction and a shortage of contextual learning materials. The Kupang region, however, holds abundant local food resources that can serve as authentic learning material. This community service activity trained one teacher and fifteen students of SMAK Sint. Carolus, Kota Kupang, in environment-based media centered on caloric value analysis of local food. The program ran weekly on Fridays from April to early May 2026 at the partner school and the Physics Laboratory of FKIP Universitas Katolik Widya Mandira Kupang, following seven stages: preparation, media design, pretest, implementation, posttest and evaluation, data analysis, and follow-up planning. Data were collected with a nine-item literacy-numeracy test built around the caloric value of coconut, candlenut, and peanut, then analyzed using the N-gain equation and a paired-samples t-test. The average score rose from the low category of 37.4 on the pretest to the very good category of 91.8 on the posttest, a difference confirmed by a paired t-test, $t(14) = 13.67$, $p < .001$, with an N-gain of 0.87 in the high category. Beyond this quantitative gain, the activity strengthened students' critical thinking, data evaluation, and mathematical reasoning skills, and left the partner teacher with a reusable calorimetry-based instructional model that connects local wisdom to the science curriculum.

INTRODUCTION

Science education at the secondary-school level plays an important role in developing students' critical-thinking and problem-solving skills and in strengthening scientific literacy and numeracy. However, Indonesian students' scientific literacy remains relatively low (Fuadi et al., 2020), particularly in connecting scientific concepts with everyday life. This condition is associated with instruction that still emphasizes memorization, limited use of contextual learning media, and insufficient use of the surrounding environment as a learning resource. Consequently, students often find it difficult to relate scientific concepts to real phenomena in their environment. Kupang City and East Nusa Tenggara have diverse local food resources that can be used as science learning media, particularly for analyzing the calorific value of food.

Coconut, candlenut, and peanuts, for example, provide relevant and contextual materials that are familiar to students.

Environment-based learning uses the surrounding environment as a learning resource to develop students' science process skills and cognitive achievement (Alali, 2024). Through this approach, students not only learn concepts theoretically but also conduct observations, take measurements, analyze data, and interpret results directly. In physics and chemistry, scientific literacy and numeracy are essential because students need to interpret data, calculate calorific values, understand energy units, and draw conclusions from experimental evidence. Environment-based learning media help students connect the concept of heat with everyday energy needs, making learning more applicable. Research on locally grounded learning also shows that integrating local resources can strengthen students' scientific literacy and environmental awareness because concepts are learned through authentic experiences in their immediate surroundings (Putra et al., 2023).

The use of environment-based learning media and contextual approaches has been examined in both research and community service programs. Previous studies indicate that connecting scientific concepts with real-life contexts can enhance student engagement, conceptual understanding, and scientific-thinking skills. Learning media drawn from students' surroundings can provide more concrete learning experiences and strengthen critical-thinking and problem-solving skills (Wariani et al., 2025). This approach can bridge abstract scientific concepts and the real phenomena students encounter in daily life.

Research on contextual learning based on the local culture of East Nusa Tenggara indicates that integrating local culture and the surrounding environment into instruction can make learning materials more relevant to students' lives and, therefore, more meaningful. The findings show that the local context can serve as an effective learning resource for strengthening students' understanding of scientific concepts and their engagement in learning (Hayon et al., 2025).

Wariani et al. (2026) developed ethnoscience-based instructional materials in the form of student worksheets on redox reactions, voltaic cells, and electrolysis. Their findings showed that integrating local cultural and environmental elements into instructional materials can increase students' learning activity and understanding of chemical concepts. These findings further support the potential of locally contextualized learning to improve the quality of science education.

In community service settings, Mukin et al. (2025) implemented a program to improve students' learning outcomes and interest through virtual laboratories and hands-on science experiments at SDN Takolah Indah in Kupang. The program showed that laboratory and experiment-based learning can increase students' interest and scientific skills. Naen et al. (2025) also conducted training on interactive learning media for teachers and students at SDN Takolah Indah, Kupang Regency. Their program indicated that interactive media can support teacher creativity and active student participation in learning.

Naen et al. (2025) also examined the development of ethnoscience-based worksheets on the nature of physics and scientific methods. Their findings showed that ethnoscience-based learning can improve students' science process skills. Integrating local phenomena and regional culture into physics instruction helps students understand scientific concepts through experiences that are closely connected to their daily lives.

Other community service programs have shown that environment- and local-wisdom-based approaches can strengthen students' literacy and numeracy. A program in Nagari Pagaruyung demonstrated that integrating local wisdom into instruction can improve teachers' ability to design literacy and numeracy lessons grounded in local culture (Amalia et al., 2025). Another program used environmental exploration to strengthen literacy and numeracy through contextual activities based on the surrounding environment (Luthfi et al., 2025). In addition, a program involving simple chemistry experiments at SMAN 30 Garut showed that contextual experiments can significantly increase students' enthusiasm for learning and scientific literacy (Thoriq et al., 2024).

Although previous studies and community service programs have addressed scientific literacy, numeracy, environment-based learning, and the use of local resources, few have specifically integrated the analysis of local food calorific values to strengthen high-school students' scientific literacy and numeracy. Most earlier programs focused on general literacy, simple experiments, or environmental awareness without connecting thermal-energy concepts with local foods that are familiar to students. Community service programs that combine local food calorimetry experiments with an integrated scientific literacy and numeracy approach also remain limited in Kupang City. The novelty of this program lies in using environment-based learning media and local food calorific-value analysis as a contextual approach to strengthen high-school students' scientific literacy and numeracy.

The main contributions of this community service program comprise three tangible outputs: a simple calorimeter made from locally available materials, a scientific literacy and numeracy module focused on local food calorific-value analysis, and a teacher-support model that can be replicated in other schools. The program used the environment as a learning resource and selected familiar local foods, including coconut, candlenut, and peanuts, as objects of scientific investigation. This approach provided authentic learning experiences through direct observation, measurement, calculation, and data interpretation, enabling students to examine the relationships among heat, food energy, and the body's energy needs. The learning media and module were designed for reuse by the partner teacher on other science topics without continuous dependence on the community service team, thereby supporting program sustainability. The activity also strengthened students' awareness of the potential of East Nusa Tenggara's local foods as resources for contextual science learning.

Initial observations and brief discussions with the partner teacher during the preparation phase confirmed that students had difficulty explaining thermal-energy transfer scientifically and often made errors in unit conversion when solving numeracy problems. The program was therefore based on field evidence rather than on assumptions by the community service team. To address students limited scientific literacy and numeracy, the program implemented environment-based learning media through experiments on the calorific values of local foods using simple tools and materials available in the students' surroundings. The activities included an introduction to heat and food-energy concepts, hands-on experiments to measure the calorific values of local foods, numerical data analysis, and scientific discussion of the results. Through these activities, students were expected to improve their ability to read data, calculate thermal energy, interpret experimental results, and connect scientific concepts with everyday life. This active and experiential approach was also intended to strengthen students' motivation to learn.
Accordingly, this community service program aimed to describe the implementation of environment-based learning media in analyzing the calorific values of local foods to strengthen students' scientific literacy and numeracy at SMAK Sint. Carolus, Kupang.

IMPLEMENTATION METHODS

This community service program used a Participatory Action Learning approach, which emphasizes active engagement between the community service team and its partners throughout the program (Askahar & Akbar, 2025). The approach was selected because it supports participatory and collaborative learning through participants' direct involvement in identifying problems, implementing instruction, conducting experiments, and evaluating activities. Operationally, the community service team acted as facilitators who designed the learning media and instruments. The partner teacher acted as a co-facilitator who supported students during laboratory sessions and provided feedback on the alignment of the materials with the school curriculum. Students participated actively by formulating questions, conducting measurements, and interpreting data independently in small groups. During the preparation and evaluation phases, the partner teacher joined reflective discussions to assess the suitability of the learning media for classroom needs. This feedback informed revisions to the module before implementation. With this division of roles, the teacher and students were not merely participants but active contributors to the process of strengthening scientific literacy and numeracy through environment-based learning media.

The participants were one teacher and 15 eleventh-grade students at SMAK Sint. Carolus, Kupang. Eleventh-grade students were selected because they had studied heat and energy transfer in physics, allowing the program to deepen their understanding of these concepts through the context of local foods. The 15 students were selected based on the subject teacher's recommendations, their willingness to participate in additional activities on Fridays, and representation of varied academic abilities. The subject teacher served as the main partner, supported implementation at the school, and facilitated communication between the community service team and school administrators. The limited number of participants was consistent with an intensive mentoring-based program. Therefore, the results represent this specific classroom context and should not be generalized to all high-school students in Kupang. SMAK Sint. Carolus has strong potential for environment-based science learning through the use of local resources. Initial observations identified several challenges, including students limited scientific literacy in explaining energy transfer and combustion processes, difficulty converting units, limited skill in processing experimental data, and difficulty interpreting thermodynamic graphs and tables. The school also lacked environment-based learning media that connected thermodynamic concepts with students' daily lives, so instruction tended to remain abstract and insufficiently contextualized.

The program was conducted at SMAK Sint. Carolus and the Physics Laboratory of the Faculty of Teacher Training and Education at Unika Widya Mandira, Kupang. It comprised five 90-minute sessions held every Friday from April to early May 2026. The first session introduced heat and food-energy concepts and administered the pretest. The second to fourth sessions involved rotating calorimetry experiments using three local food materials. The fifth session included the posttest, a reflective discussion, and presentation of the follow-up plan to the partner teacher. The schedule was developed collaboratively with the partner teacher to avoid disrupting the students' regular classes.

The materials included candlenuts, coconut, and peanuts as test samples for calorific-value analysis. The equipment consisted of a simple calorimeter assembled from a recycled can containing 100 mL of water, a thermometer with a range of 0 to 100°C, a support stand, a digital scale with a precision of 0.1 g, and a spirit burner as the heat source. Each group weighed 1 g of a food sample, burned it beneath the calorimeter, and recorded the initial and final water temperatures after combustion. The heat transferred to the water was calculated using the calorimetry equation $Q = m_w \times c_w \times \Delta T$, where m_w is the mass of water in grams, c_w is the specific heat capacity of water (1 cal/g°C), and ΔT is the difference between the final and initial water temperatures. Measurements were repeated three times for each food type, and the mean values were used to calculate the specific energy in calories per gram of sample. These values provided the basis for comparing the energy content of the local foods. Student worksheets served as laboratory guides and data-analysis sheets throughout the activity.

The program was implemented in seven stages, as shown in Figure 1: (1) Preparation, involving coordination with the partner school, SMAK Sint. Carolus; (2) Media Design, involving the design of the MBL calorimeter and development of the scientific literacy and numeracy module; (3) Pretest, involving the collection of baseline data on students' scientific literacy and numeracy; and (4) Implementation, involving concept reinforcement and laboratory experiments on the heat of combustion of local foods.

The remaining stages were (5) Posttest and Evaluation, involving measurement of changes in students' competencies and collection of partner feedback; (6) Data Analysis, involving statistical analysis of changes in scientific literacy and numeracy outcomes; and (7) Follow-Up Planning, involving continued support on other topics and training the teacher to develop scientific literacy and numeracy assessment items.

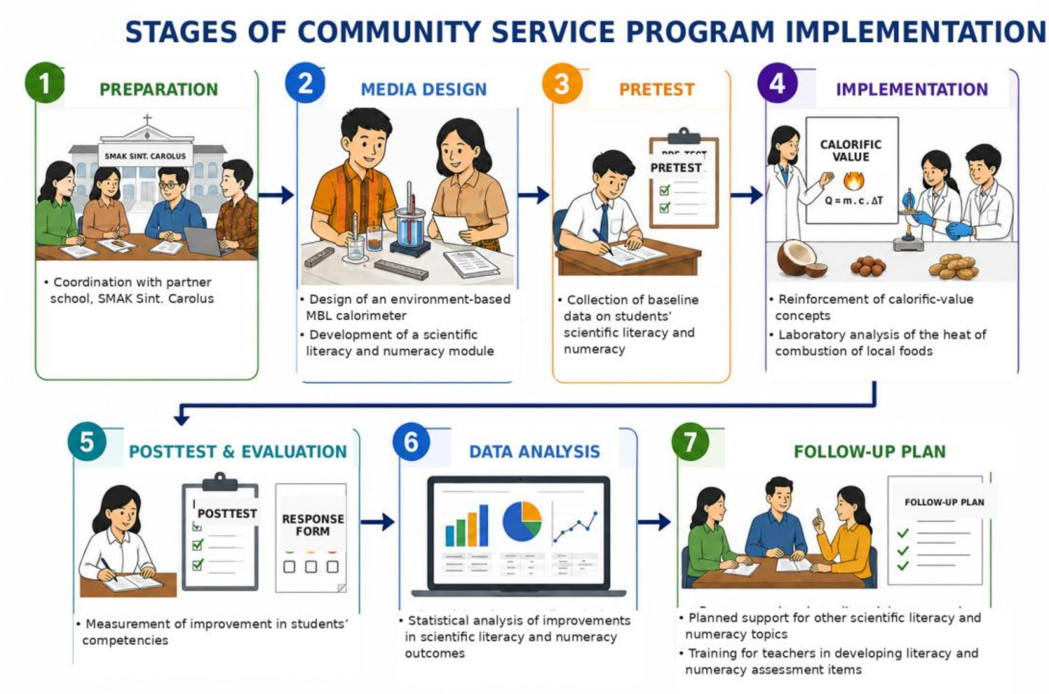

Figure 1. Stages of Program Implementation.

Data on students' scientific literacy and numeracy were collected using the Local Food Calorific Value Scientific Literacy and Numeracy Learning Outcomes Test, which was developed by the community service team. The instrument covered nine indicators grouped into three competency domains: scientific literacy (identification of scientific issues, explanation of phenomena, use of scientific evidence, and analysis of variables), numeracy in science (extraction of numerical information, mathematical operations in physics, and ratio-and-proportion reasoning), and integrated scientific literacy and numeracy (critical evaluation and data-based decision making). The instrument comprised nine essay items and generated a maximum score of 100 for each aspect. The same form was used in the pretest and posttest to maintain measurement equivalence. The relevance of the instrument content was reviewed by the partner physics teacher before use. Scoring consistency was supported by a detailed rubric containing achievement criteria for each indicator, including the ability to explain the principle of calorimetry orally and in writing, calculate temperature differences accurately, and convert joules to kilocalories. Achievement was categorized as low (below 40), moderate (40-69), high (70-89), or excellent (90-100). The data were analyzed using N-gain to compare students' pretest and posttest scores, followed by a normality test and a paired-samples t test to examine the statistical significance of the difference.

RESULTS AND DISCUSSION

1) Preparation Phase

The preparation phase began with coordination between the community service team and SMAK Sint. Carolus to align the objectives, implementation procedures, and schedule. Discussions with the principal and the subject teacher identified aspects of scientific literacy and numeracy that required strengthening. The discussions showed that students had difficulty understanding heat in context and relating scientific concepts to everyday life. The teacher also emphasized the need for more interactive learning media connected to students' surroundings.

Based on these findings, the program focused on strengthening scientific literacy and numeracy through calorimetry experiments using local materials. This approach was selected because hands-on learning can help students understand concepts more concretely and meaningfully (Kadir, 2013). The use of local materials also made learning more contextual and enabled students to relate scientific concepts to situations in their immediate environment. This rationale is consistent with Bruner's view that learning becomes more effective when students actively discover concepts through authentic experiences.

2) Media Design Phase

During the media design phase, the community service team developed a simple calorimeter using materials that were readily available around the school. The device was designed for practical use in teaching heat and energy concepts. The team also developed a scientific literacy and numeracy module containing laboratory instructions, exploratory questions, observation sheets, and simple data-analysis exercises. This phase produced a teaching aid that was simple, affordable, and easy for students to use.

The media design phase showed that a simple calorimeter made from locally available materials can serve as an alternative learning tool for contextual science instruction. Because the device used materials that were easy to obtain, it was affordable, practical, and suitable for classroom activities. The accompanying scientific literacy and numeracy module guided students through laboratory procedures, exploratory questions, observations, and data analysis, helping them participate in learning in a more focused and active manner. The use of simple laboratory media emphasized students' direct involvement in discovering concepts through authentic learning experiences. According to Bruner, learning is more meaningful when students have opportunities to explore and discover ideas independently (Syafila & A'yun, 2024). Environment-based learning media also increased the relevance of instruction to students' daily lives, making heat and energy concepts easier to understand.

3) Pretest Phase

The pretest produced an overall mean score of 37.4, with a standard deviation of 19.1, indicating considerable variation in the initial abilities of the 15 participants. The lowest-scoring aspects were Critical Evaluation (20) and Data-Based Decision Making (27). In these aspects, most students copied numbers from data tables without comparing them with reference values or explaining discrepancies, and many answered "I don't know" when asked to recommend an option based on the data. Identification of Scientific Issues, Extraction of Numerical Information, and Mathematical Operations in Physics recorded the highest pretest scores (47), although these scores remained in the low category. This pattern indicated that students had basic data-reading skills but were not yet accustomed to systematic interpretation and calculation. It was also consistent with the partner teacher's initial observation that students were better prepared in basic technical skills than in critical reasoning and evidence-based decision making.

4) Implementation Phase

The implementation phase used laboratory-based learning with the simple calorimeter developed during the previous phase. The 15 students were divided into five groups of three. Each group tested coconut, peanuts, and candlenuts in rotation so that all groups gained experience with the three samples and their results could be compared. A member of the community service team accompanied each group, guided the measurements, ensured that the triplicate procedure was followed, and facilitated discussion when students had difficulty interpreting the data. During the activity, students actively observed the experiments, recorded temperature changes, and discussed the results with their group members. The partner teacher and community service team helped students connect the laboratory findings with heat and energy concepts in everyday life.

Because the activity did not include a formal student-response questionnaire, increased interest in learning was reported as an observational finding based on the community service team's field notes rather than as measured survey data. Observed behaviors included more spontaneous questions during the laboratory sessions, students' initiative to repeat measurements when results appeared inconclusive, and enthusiasm while waiting to use the equipment. The partner teacher confirmed these observations during the final reflective discussion. Environment-based learning media also appeared to help students understand heat more concretely, and students began to display critical-thinking skills through the questions and discussions that emerged during the activity. These observations are consistent with theories that emphasize active engagement, direct experience, and exploration in concept development. Bruner argues that learning is more meaningful when students actively participate in knowledge discovery, while Hosnan emphasizes that contextual learning can strengthen critical thinking and conceptual understanding.

5) Posttest and Evaluation Phase

The posttest and evaluation phase was conducted after all learning activities had been completed to assess changes in students' scientific literacy and numeracy. The posttest showed stronger understanding of heat, particularly in reading experimental data, performing simple calculations, and explaining the relationship between heat and energy. Students also appeared more confident when presenting observations and drawing conclusions from the laboratory activities. The evaluation with the partner teacher indicated that simple experiment-based learning was more engaging and easier for students to understand than conventional lecture-based instruction.

Table 1. Mean Pretest and Posttest Scores for Scientific Literacy and Numeracy

Scientific Literacy and Numeracy Aspect	Pretest	Posttest
Identification of Scientific Issues	47	100
Explanation of Phenomena	40	100
Use of Scientific Evidence	33	80
Analysis of Variables	33	93
Extraction of Numerical Information	47	87
Mathematical Operations in Physics	47	93
Ratio and Proportion Reasoning	33	100
Critical Evaluation	20	93
Data-Based Decision Making	27	80
Mean	37.4	91.8

The results showed substantial improvement in students' scientific literacy and numeracy after the implementation of environment-based learning. The overall mean increased from 37.4 (low category, SD = 19.1) on the pretest to 91.8 (excellent category, SD = 10.6) on the posttest. The smaller posttest standard deviation indicated reduced variation in students' performance after instruction. The Shapiro-Wilk test applied to the pretest-posttest difference scores showed no significant departure from normality ($W = 0.942$; $p = 0.402$), so a paired-samples t test was used. The test showed a statistically significant difference, $t(14) = 13.67$; $p < 0.001$, with Cohen's $d = 3.53$, indicating a very large standardized difference. The mean N-gain was 0.87, which was categorized as high. Because the program did not include a control group, these results demonstrate substantial improvement within this activity but do not isolate the contribution of the learning media from possible retesting or other influences. At the indicator level, all nine indicators achieved high N-gain values ranging from 0.70 to 1.00. Identification of Scientific Issues, Explanation of Phenomena, and Ratio and Proportion Reasoning each achieved an N-gain of 1.00. These findings are consistent with Zainuddin's (2024) view that learning contextualized through real-world problems can support deeper conceptual understanding. The substantial improvement suggests that the learning activities helped students address difficulties identified at the beginning of the program.

The largest improvement occurred in Critical Evaluation, which increased by 73 points, from 20 to 93. Before the activity, students had considerable difficulty assessing the accuracy and validity of scientific information. After the intervention, they were more able to examine data carefully and evaluate it logically. Critical-evaluation skills are important because critical thinking does not develop automatically; it requires repeated opportunities to analyze problems in the classroom (Azizah et al., 2018). The learning activities appeared to stimulate students' curiosity and encourage more active engagement with scientific information.

Three posttest aspects achieved a score of 100: Identification of Scientific Issues, Explanation of Phenomena, and Ratio and Proportion Reasoning. These perfect scores should be interpreted cautiously. The items in these areas required descriptive responses that may have been easier to score fully than the computational items in the numeracy domain. In addition, using a similar format for the pretest and posttest may have produced a practice effect alongside the actual learning effect. Nevertheless, the results indicate that students demonstrated stronger ability to identify scientific problems in their surroundings, explain natural phenomena, and calculate basic ratios. This pattern suggests better integration of scientific literacy and numeracy, enabling students to apply mathematical reasoning to scientific problems (Yayuk et al., 2023).

Analysis of Variables and Mathematical Operations in Physics also showed strong improvement, with each aspect reaching a score of 93. This finding suggests that students' persistent difficulty in connecting mathematical formulas with physics concepts was substantially reduced. Overall, the integration of literacy and numeracy in the program indicates a shift toward more connected scientific and mathematical reasoning (Aisyah et al., 2025).

Hands-on laboratory learning provides more concrete learning experiences and can help students understand scientific concepts more deeply and contextually than lecture-based instruction. This finding is consistent with Trianto's view that direct experience can strengthen conceptual understanding and active engagement in learning (Lovisia, 2018).

6) Data Analysis Phase

During the data analysis phase, the pretest and posttest results were processed to determine the extent of improvement after the learning activities. The analysis yielded a mean posttest score of 91.8 and an N-gain of 0.872, which was classified as high. These results indicate substantial improvement in students' scientific literacy and numeracy, particularly in relation to heat and energy concepts within the context of this program.

N-gain values above 0.70 across all aspects, together with the significant paired-samples t-test result, provide a strong indication that learning supported by environment-based media contributed to improved scientific literacy and numeracy in this activity. However, because no control group was included, a definitive causal conclusion requires further study using a comparative design. The consistent improvement across nearly all aspects is also compatible with student-centered learning, which gives students opportunities to construct new knowledge (Ramadani et al., 2025). The results further suggest that environment-based learning media can create active, contextual, and accessible learning experiences (Naen et al., 2025), thereby supporting the development of students' scientific literacy and numeracy.

7) Follow-Up Planning Phase

The follow-up planning phase was conducted to support program sustainability after the community service activities ended. The community service team and the partner teacher developed a plan consisting of one follow-up training session in the next semester. The subject teacher will facilitate the session with support from the community service team through monthly online or in-person consultations for one semester. The teacher received brief training in developing contextual scientific literacy and numeracy questions suited to students' characteristics, as well as a reusable module and simple calorimeter for teaching specific heat capacity and changes of state. As a sustainability indicator, the team and the teacher agreed to monitor whether the media and module are reused in the following semester. A brief telephone interview will be conducted three months after the program. The teacher expressed strong interest in continuing to use environment-based learning media, and the school plans to develop other simple experiments using local materials so that science learning remains closely connected to students' daily lives.

Overall, the program produced important findings regarding changes in students' scientific literacy and numeracy. The increase in the mean score from 37.4 to 91.8, supported by a high N-gain of 0.87, indicates substantial improvement in conceptual understanding. Interactive and student-centered learning was associated with higher academic performance and fewer learning difficulties among students with low initial proficiency. Within this group and activity context, the objective of strengthening students' scientific literacy and numeracy was achieved.

Several factors supported the implementation of the program. Students showed high enthusiasm and active involvement in each learning activity, while the school provided a supportive learning environment. Connecting the material with everyday contexts also helped students understand the relationship between physics concepts and real phenomena in their surroundings. This contextual approach supported conceptual understanding because students did not merely memorize formulas but also examined their application in real situations. The program nevertheless faced limitations in class time and substantial variation in students' prior knowledge, which affected the pace of learning. Intensive mentoring and group guidance helped manage these challenges during implementation.

The impact of the program was evident not only in knowledge but also in students' skills and attitudes. Students demonstrated stronger ability to analyze scientific data and apply mathematical reasoning to physics problems. They also appeared more independent and confident when discussing and solving problems collaboratively, and their responses reflected stronger critical thinking. For the partner school, the program strengthened institutional capacity to implement scientific literacy- and numeracy-based learning in line with current curriculum expectations.

Several limitations of this community service program should be acknowledged. The activity focused on a single topic, calorimetry, involved only 15 students, did not include a comparison group, and did not measure long-term retention after the program. Without a control group, part of the score increase may have resulted from repeated testing or students' natural development during the activity period. The reported effect size should therefore be interpreted as an upper-bound estimate of the isolated effect of the learning media. The small number of participants also prevents generalization to the broader population of high-school students in Kupang without further replication. Future programs should apply the model to other science topics, involve a comparison group or a multi-cycle design, extend the implementation period, and include a larger number of participants. These limitations do not reduce the practical value of the program for the partner school; instead, they provide a basis for developing broader and more rigorous community service initiatives.

CONCLUSION

This community service program trained one teacher and 15 eleventh-grade students at SMAK Sint. Carolus, Kupang, to use environment-based learning media for analyzing the calorific values of local foods. Students' scientific literacy and numeracy improved from the low category on the pretest to the excellent category on the posttest. The significant paired-samples t-test result and high N-gain indicate substantial improvement within the context of the program, although the design did not isolate the effect of the learning media from other possible influences. The practical benefits included stronger critical-thinking skills, improved ability to perform calculations based on physics principles, and greater awareness of local food resources. The partner school also gained an applicable science learning model that the teacher can reuse for other topics. Because the program involved a small group without a control group, the conclusions apply specifically to SMAK Sint. Carolus and require larger-scale replication before broader generalization.

As a practical implication, this environment- and local-food-based learning model can be considered for integration into other science topics at SMAK Sint. Carolus, Kupang. It also has potential for replication in other schools in the Kupang region, with adjustments to local food materials and further evaluation involving larger samples and comparison groups to strengthen evidence of effectiveness.

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REFERENCES

Aisyah, N., Firdaus, F., Prasetyo, N. D., Kristiningrum, K., Purba, C., Isnaeni, N., Susanti, S., & Damayanti, F. (2025). Integrasi Literasi Matematika dan Sains dalam Pendidikan Berbasis Teknologi Digital: Penelitian. Jurnal Pengabdian Masyarakat Dan Riset Pendidikan, 4(2), 9660–9670. https://doi.org/10.31004/jerkin.v4i2.3506

Amalia, I., Hakiki, R., & Murniati, S. (2025). Sosialisasi Media Pembelajaran Berbasis Kearifan Lokal untuk Penguatan Literasi dan Numerasi Guru Era Digital. JUPAMU: Jurnal

Pengabdian Masyarakat Multidisiplin, 1, 1–12. https://doi.org/10.66031/jupamu.v1i1.25

Alali, R. M. (2024). Assessing the effectiveness of environmental approach-based learning in developing science process skills and cognitive achievement in young children. Education Sciences, 14(11), 1269. https://doi.org/10.3390/educsci14111269

Askahar, A., & Akbar, M. (2025). Klinik Guru Digital: Pendekatan Inovatif Untuk Transformasi Kompetensi Guru Dalam Pembelajaran Abad 21. Jurnal Inovasi Penelitian Dan Pengabdian Masyarakat, 5(1), 67–76. https://doi.org/10.53621/jippmas.v5i1.490

Azizah, M., Sulianto, J., & Cintang, N. (2018). Analisis Keterampilan Berpikir Kritis Siswa Sekolah Dasar pada Pembelajaran Matematika Kurikulum 2013. Jurnal Penelitian Pendidikan, 35(1), 61–70. https://doi.org/10.15294/jpp.v35i1.13529

Hayon, V. H., Wariani, T., Tinenti, Y. R., Mukin, M. U. J., & Naen, A. B. (2025). Persepsi Calon Guru Kimia Terhadap Implementasi Pembelajaran Kontekstual Berbasis Budaya (Etnosains) NTT dalam Pembelajaran Kimia. *Jurnal Locus Penelitian Dan Pengabdian*, *4*(11), 10194-10208. https://doi.org/10.58344/locus.v4i11.4888

Kadir, A. (2013). Konsep Pembelajaran Kontekstual di Sekolah. Dinamika Ilmu, 13(1). https://doi.org/10.21093/di.v13i1.20

Lovisia, E. (2018). Pengaruh Model Pembelajaran Inkuiri Terbimbing terhadap Hasil Belajar. Science and Physics Education Journal (SPEJ), 2(1), 1–10. https://doi.org/10.31539/spej.v2i1.333

Luthfi, A. K., Asriadi, Sartika, Wahyuni, S., & Rahmadania, L. (2025). Penguatan Literasi Anak Pesisir melalui Pendekatan Edukasi Kontekstual Berbasis Lingkungan. Daya Karya: Jurnal Pemberdayaan Masyarakat, 1(1), 54–64. https://doi.org/10.65508/3nz7ky13

Mukin, M., Naen, A., & Wariani, T. (2025). Peningkatan Hasil Belajar Dan Minat Siswa Melalui Penggunaan Laboratorium Virtual Dan Praktikum Ipa Di Sdn Takolah Indah, Kupang. Jurnal Abdimas Ilmiah Citra Bakti, 6, 1015–1028. https://doi.org/10.38048/jailcb.v6i3.5764

Naen, A. B., Wariani, T., & Mukin, M. U. J. (2025). Pelatihan Penggunaan Media Pembelajaran Interaktif Bagi Guru Dan Siswa Sdn Takolah Indah Kabupaten Kupang. Jurnal Abdimas Ilmiah Citra Bakti, 6(3), 1047–1062. https://doi.org/10.38048/jailcb.v6i3.5400

Fuadi, H., Robbia, A. Z., Jamaluddin, & Jufri, A. W. (2020). Analisis faktor penyebab rendahnya kemampuan literasi sains peserta didik. Jurnal Ilmiah Profesi Pendidikan, 5(2), 108–116.

Putra, E. P., Yanti, F. A., & Walid, A. (2023). Cultivating Scientific Literacy: Developing A Biodiversity E-Module Based on Socioscientific Issues and Local Potential. Edukasi Islami: Jurnal Pendidikan Islam, 12(001). https://jurnal.staialhidayahbogor.ac.id/index.php/ei/article/view/6381

Ramadani, A. R., Rohmaniah, H. F. R., Syafitri, D. L. S., Hermawan, C. H., & Mustikawati, A. M. (2025). Perspektif Guru Tentang Rancangan Pembelajaran yang Berpusat pada Siswa (Student Centered Learning): Teacher Perspectives on Student Centered Learning Design. Biologiei Educația, 5(1), 59–68. https://doi.org/10.62734/be.v5i1.406

Syafila, A. E., & A'yun, D. Q. (2024). Analisis Eksplorasi Konsep Pendidikan Konstruktivis Dalam Pembelajaran Berbasis Proyek. Jurnal Media Akademik (JMA), 2(12). https://doi.org/10.62281/v2i12.1175

Thoriq, T., Rahayu, R. S., Ramdhani, Z. F., Pramesthi, A. R. Y., & Azis, M. Y. (2024). Peningkatan Literasi Sains Melalui Pengabdian Masyarakat Berbasis Eksperimen Kimia Sederana di SMAN 30 Garut. Jurnal Pengabdian Masyarakat, 3(1), 189–200. https://doi.org/10.30640/abdimas45.v3i1.2426

Wariani, T., Hayon, V. H. B., Mukin, M. U. J., & Naen, A. B. (2025). Pengembangan Lembar Kerja Peserta Didik (LKPD) Berbasis Etnosains Materi Redoks, Sel Volta, dan Elektrolisis. Jurnal Locus: Penelitian Dan Pengabdian, 4(5), 2207. https://doi.org/10.58344/locus.v4i5.4092

Wariani, T., Naen, A. B., Hayon, V. H. B., Rozari, A. M. de, & Guterres, D. A. (2026). Metode dan Media Pembelajaran Método e Mídia de Aprendizagem. Omera Pustaka.

Yayuk, E., Restian, A., & Ekowati, D. W. (2023). Literasi Numerasi dalam Kerangka Kurikulum Merdeka Berbasis Art Education. International Journal of Community Service Learning, 7(2), 228–238. https://doi.org/10.23887/ijcsl.v7i2.56278

Zainuddin, M. (2024). Efektivitas Model Pembelajaran Problem-Based Learning Dalam Meningkatkan Pemahaman Konsep Kimia Di Sekolah Menengah Atas. Jurnal Ilmiah IPA Dan Matematika (JIIM), 2(1), 17–22. https://doi.org/10.61116/jiim.v2i1.468