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The Urgency of Transforming Indigenous Knowledge into Contextual Science Practicum: A Preliminary Study among Preservice and In-Service Science Teachers

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Abstract: This preliminary study aimed to examine the need for validated instructional support in transforming Sasambo indigenous knowledge into contextual science practicum activities for preservice and in-service science teachers. A descriptive survey design was employed involving 100 respondents, consisting of 76 preservice science teachers from Biology, Physics, and Chemistry Education programs and 24 in-service science teachers. These groups were selected to obtain complementary perspectives: preservice teachers represent future science educators who require contextual pedagogical preparation, whereas in-service teachers provide practical insights from classroom practice. Data were collected using an online questionnaire comprising nine closed-ended items related to the availability of science learning resources, the integration of Sasambo local wisdom into science learning, and the need for validated instructional support. The questionnaire was reviewed by experts to ensure content validity and tested for internal consistency to confirm instrument reliability. Descriptive statistics, including frequencies and percentages, were used to analyze the data. The findings revealed substantial gaps in current science learning support. Most respondents perceived science learning resources and portals as limited (82%), reported difficulty finding complete instructional materials (83%), and experienced challenges in accessing reliable and expert-validated resources (87%). The integration of Sasambo local wisdom into science learning was also limited, as 81% of respondents had never connected Sasambo local wisdom with science learning, 82% had difficulty integrating it into science content, and 87% had never implemented Sasambo-based ethno-practicum activities. In contrast, respondents expressed strong support for the development of an integrated learning platform: 98% indicated the need for a portal providing complete and validated instructional materials, 93% agreed that a Sasambo ethno-practicum portal would support innovative learning design, and 96% emphasized the need for reconstructed ethno-Sasambo data. These findings highlight the urgent need to develop validated, contextual, and accessible ethno-practicum learning support to facilitate the transformation of indigenous knowledge into meaningful science practicum activities.
Keywords: Indigenous knowledge; contextual science learning; science practicum activities; preservice science teachers; science educators

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INTRODUCTION

Practicum is an essential component of science learning because it provides students with opportunities to observe phenomena, manipulate objects, collect data, and construct relationships between empirical evidence and scientific concepts. Recent studies emphasize that practical work can support students' hands-on and minds-on engagement when it is designed to promote conceptual understanding, scientific inquiry, and science process skills (Oliveira & Bonito, 2023; Gericke et al., 2023; Shana & Abulibdeh, 2020). However, the effectiveness of practicum does not occur automatically. Practical activities may become merely procedural or descriptive when they are not supported by clear epistemic goals, coherent instructional design,

and meaningful opportunities for students to interpret their observations through scientific ideas (Gericke et al., 2023; Oliveira & Bonito, 2023; Spaan et al., 2025).

In contemporary science education, learning is no longer considered sufficient if it only presents abstract concepts detached from students' lives. Context-based science learning requires instructional materials that connect scientific concepts with authentic phenomena, students' experiences, and real-life problems. Recent studies show that context-based teaching materials can improve scientific literacy, strengthen student engagement, and support meaningful conceptual understanding when they are valid, practical, and pedagogically structured (Dori et al., 2018; Prins et al., 2018; Hadiprayitno et al., 2024). Therefore, contextual science practicum should not merely function as a means of verifying theory but should also serve as an investigative space for exploring phenomena embedded in students' social, cultural, and environmental contexts.

One highly potential yet underutilized source of context in science learning is indigenous knowledge. Indigenous knowledge reflects local communities' long-term interactions with nature, cultural practices, values, and environmental adaptation. In science education, indigenous knowledge should not be treated merely as a cultural illustration, but as a knowledge system that can productively interact with school science and enrich students' understanding of the relationships among science, culture, and sustainability (Zidny et al., 2020; Druker-Ibáñez & Cáceres-Jensen, 2022; Latip et al., 2024; Ijatuyi et al., 2025). Recent reviews also indicate that integrating local and indigenous knowledge into science learning can strengthen cultural identity, contextual understanding, sustainability awareness, and students' engagement with scientific concepts (Ogegbo & Ramnarain, 2024; El Yazidi & Rijal, 2024; Sihombing et al., 2025).

Nevertheless, integrating indigenous knowledge into science learning is not sufficient if it is done only by mentioning cultural examples descriptively. Local knowledge needs to be reconstructed and transformed into learning experiences that can be observed, compared, tested, and analyzed scientifically (Druker-Ibáñez & Cáceres-Jensen, 2022; Zidny et al., 2020; Chibuye & Singh, 2024). In chemistry and sustainability education, the integration of indigenous knowledge with modern science has been shown to broaden students' perspectives, contextualize abstract concepts, and promote more holistic science learning (Zidny & Eilks, 2020; Sumarni et al., 2022). Thus, the current need is not merely to introduce local wisdom into learning, but to transform it into contextual, investigative, and pedagogically meaningful science practicum activities.

The urgency of this transformation is also closely related to pedagogical dimensions and educator readiness. Culturally relevant, responsive, and sustaining science pedagogies emphasize the importance of connecting scientific knowledge with students' cultural backgrounds, lived experiences, and social realities (Dodo Seriki, 2018; Smith et al., 2022; Wallace, 2022). However, recent studies indicate that teachers still face limitations in understanding, awareness, practical guidance, and instructional resources when integrating indigenous knowledge into science learning (Photo & McKnight, 2024; Ogegbo & Ramnarain, 2024). In the context of practicum, these challenges become even more apparent because teachers require activity models, instructional materials, and operational guidelines that enable local knowledge to be transformed into structured experiments or inquiry-based activities (Mlotshwa & Tsakeni, 2024; Seehawer, 2018).

In science teacher education, this need becomes even more critical because preservice science teachers are expected not only to understand scientific concepts, but also to develop the ability to reconstruct local knowledge into valid and usable learning resources. Parmin et al. (2016) showed that the systematic integration of indigenous

knowledge into the curriculum for preparing prospective science teachers can strengthen their ability to connect indigenous knowledge with NGSS-oriented science learning. Similarly, Parmin et al. (2022) revealed that preservice science teachers have the potential to develop skills in reconstructing local indigenous knowledge into relevant science learning materials. These findings suggest that transforming indigenous knowledge into science practicum is possible, but it requires intentional pedagogical design, adequate instructional support, and structured learning experiences that provide opportunities for preservice teachers to practice such reconstruction.

This urgency is further reinforced by the results of the present preliminary study involving 100 preservice science teachers and in-service science teachers. The findings indicate a clear gap between the potential of Sasambo indigenous knowledge as a contextual learning resource and the readiness of pedagogical tools to transform it into structured science practicum activities. Respondents reported limited access to complete and expert-validated instructional resources, limited experience in integrating Sasambo local wisdom into science learning, and a strong need for a validated ethno-practicum portal containing reconstructed ethno-Sasambo data, instructional materials, and practicum guidelines. This pattern is consistent with recent studies emphasizing that the integration of indigenous knowledge into science learning is often constrained by the lack of practical guidelines, models, and ready-to-use instructional resources for both teachers and preservice teachers (Photo & McKnight, 2024; Mlotshwa & Tsakeni, 2024; Ogegbo & Ramnarain, 2024).

Based on the foregoing discussion, transforming indigenous knowledge into contextual science practicum activities is an urgent need in the education of preservice science teachers and in-service science teachers. This need is not only related to improving the relevance of science learning, but also to positioning local knowledge as a valid, investigable, and meaningful learning resource. However, such transformation requires empirical evidence regarding the perceived availability of validated learning resources, the challenges of integrating Sasambo indigenous knowledge into science learning, and the instructional support needed to develop contextual practicum activities. Therefore, this preliminary study aims to identify the needs and challenges related to transforming Sasambo indigenous knowledge into contextual science practicum activities among preservice science teachers and in-service science teachers. Specifically, this study focuses on examining preservice science teachers' and in-service science teachers' perceived needs, challenges, and required instructional support in transforming Sasambo indigenous knowledge into contextual science practicum activities.

METHOD

Research Design

This study employed a descriptive preliminary study design using a survey approach. The study aimed to identify the urgency and initial needs for transforming indigenous knowledge into contextual science practicum activities, particularly in relation to the availability of learning resources, the integration of Sasambo local wisdom into science learning, and the need for validated instructional materials. As a preliminary study, this research was not intended to examine causal relationships among variables, but rather to map respondents' perceptions and needs as a basis for the development of learning tools or instructional models in subsequent stages.

Participants

The participants of this study consisted of 100 respondents selected through purposive sampling. They were chosen because they were considered relevant to the

focus of the study, namely the integration of local wisdom into science learning and practicum activities. The respondents comprised 76 preservice science teachers from Biology Education, Physics Education, and Chemistry Education programs, and 24 in-service science teachers. The preservice science teachers were included because they represent future science educators who need pedagogical preparation for integrating indigenous knowledge into science learning. Meanwhile, the in-service science teachers were involved because they had practical experience in implementing science instruction at schools. Therefore, the inclusion of both groups was expected to provide complementary perspectives on the needs and challenges of transforming Sasambo indigenous knowledge into contextual science practicum activities.

Instrument

Data were collected using an online questionnaire developed by the researchers. The questionnaire was administered in early 2026. The instrument consisted of two sections. The first section gathered respondents' demographic information, including name, respondent category, and institutional affiliation. The second section contained nine close-ended statements designed to explore respondents' perceptions regarding: (1) the limited availability of science learning resources or learning portals; (2) difficulty in finding portals that provide complete instructional materials; (3) difficulty in finding reliable and expert-validated learning resources; (4) experience in linking Sasambo local wisdom to learning; (5) difficulty in integrating Sasambo local wisdom into science content; (6) experience in implementing Sasambo-based practicum; (7) the need for a portal providing complete validated instructional materials; (8) perceptions of the usefulness of an integrated Sasambo ethno-practicum science learning portal; and (9) the need for reconstructed ethno-Sasambo data to be integrated into learning content.
The questionnaire was validated through expert judgment using Aiken's V to assess the content validity of each item. The validation process focused on the clarity, relevance, and appropriateness of the items in relation to the objectives of the preliminary study. The results of the Aiken's V analysis indicated that the questionnaire items met the validity criteria and were therefore considered appropriate for data collection. Each item employed a four-point scale, ranging from 1 to 4, in which higher scores indicated a stronger level of agreement with the given statement. The use of a four-point scale was intended to encourage respondents to provide more definite responses.

Data Collection Procedure

Data was collected through the online distribution of the questionnaire to science teachers and preservice science teachers. Prior to completing the questionnaire, respondents were informed about the purpose of the study. Participation was voluntary. All collected data were then compiled in spreadsheet format for further analysis. Since this study was a preliminary investigation, the data collection process focused on obtaining a comprehensive initial picture of respondents' needs.

Data Analysis

The data were analyzed using descriptive statistics. Respondents' answers were first compiled, coded, and grouped according to each questionnaire item. The data were then presented in the form of frequencies and percentages to describe response tendencies for each aspect under investigation. The results were subsequently interpreted descriptively to identify the level of urgency and respondents' needs regarding the transformation of indigenous knowledge into contextual science practicum activities. These findings served as the empirical basis for formulating directions for the development of ethno-practicum science learning tools or portals.

RESULTS AND DISCUSSION

This section reports the results of the preliminary study and discusses them in relation to previous research on contextual science learning, indigenous knowledge integration, and practicum-based instruction. The presentation begins with a description of the respondent profile, followed by the main findings concerning the limited availability of science learning resources, the low integration of Sasambo local wisdom into science learning and practicum, and the strong need for validated instructional materials and reconstructed ethno-sasambo data. These findings provide an empirical basis for explaining the urgency of developing a contextual ethno-practicum learning portal for preservice science teachers and science teachers.

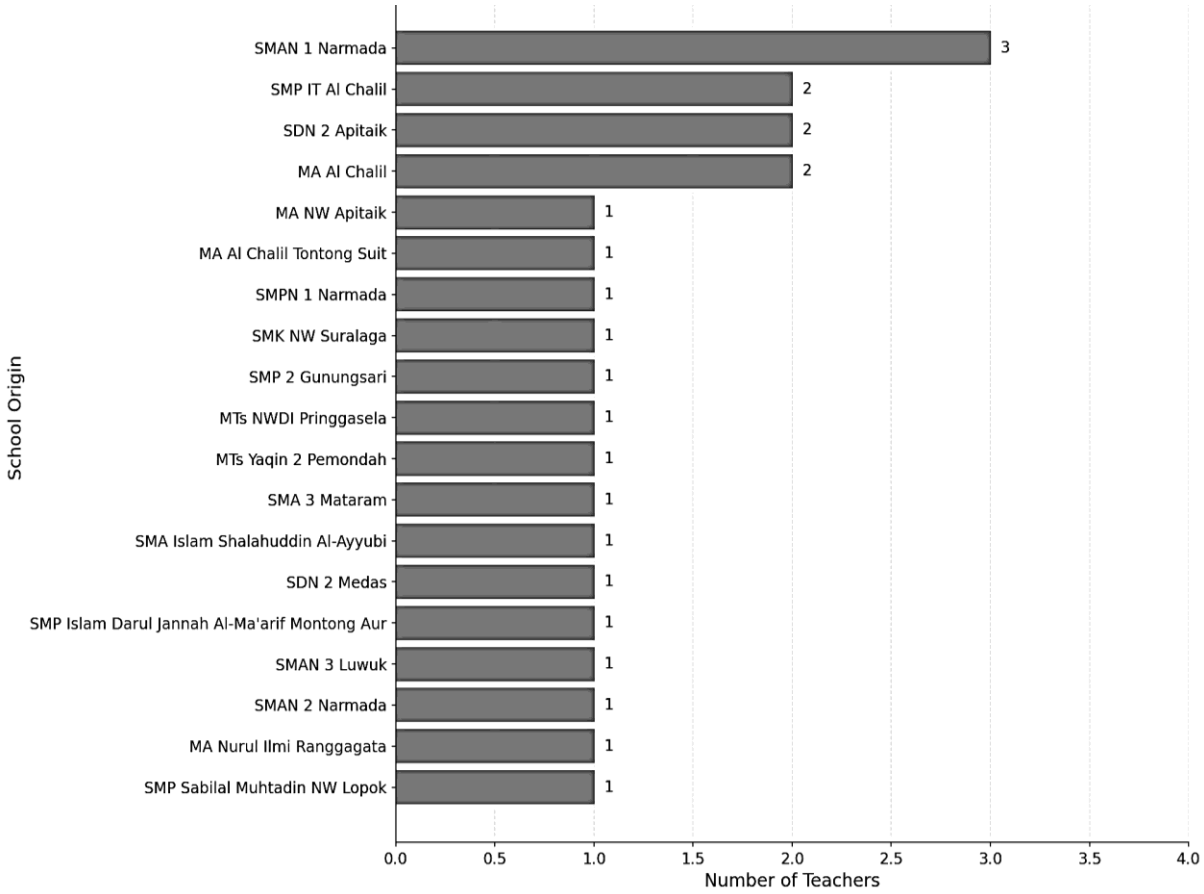

Figure 1. Distribution of in-service teachers by school origin (n=24).

Figure 1 illustrates that the 24 in-service teacher respondents were drawn from a wide variety of school origins, reflecting diverse institutional representation in the preliminary study. SMAN 1 Narmada contributed the highest number of respondents with 3 teachers, while SMP IT Al Chalil, SDN 2 Apitaik, and MA Al Chalil each contributed 2 teachers. The remaining schools each contributed 1 teacher, namely MA NW Apitaik, MA Al Chalil Tontong Suit, SMPN 1 Narmada, SMK NW Suralaga, SMP 2 Gunungsari, MTs NWDI Pringgasela, MTs Yaqin 2 Pemondah, SMA 3 Mataram, SMA Islam Shalahuddin Al-Ayyubi, SDN 2 Medas, SMP Islam Darul Jannah Al-Ma'arif Montong Aur, SMAN 3 Luwuk, SMAN 2 Narmada, MA Nurul Ilmi Ranggagata, and SMP Sabilal Muhtadin NW Lopok. Overall, this distribution indicates that the participating teachers came from multiple school types and locations, which supports the representativeness of the needs analysis for portal development across different educational contexts.

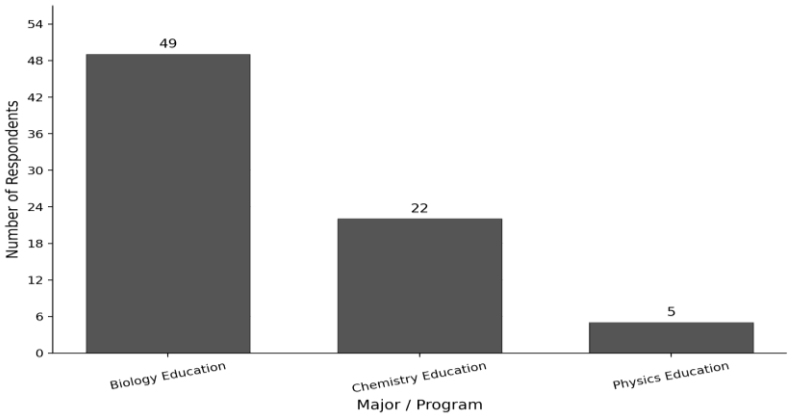

Figure 2. Distribution of pre-service teachers by major/program (n=76).

Figure 2 shows that the 76 pre-service teacher respondents were predominantly drawn from the Biology Education program, which contributed 49 respondents, making it the largest group by a substantial margin. This was followed by Chemistry Education with 22 respondents, while Physics Education contributed the smallest number, with 5 respondents. The distribution indicates that the preliminary study was mainly represented by students from Biology Education, with moderate participation from Chemistry Education and relatively limited representation from Physics Education. Overall, these results suggest that the needs analysis for the development of the PESaLeR portal was informed primarily by the perspectives of biology preservice teachers, while still incorporating input from chemistry and physics education students.

Table 1. Survey tabulation by item

Item	Survey Statement	(1)	(2)	(3)	(4)	Agree (%)
Q1	Science learning resources/portals (physics, chemistry, and biology) are still very limited.	2	16	41	41	82%
Q2	I have difficulty finding portals that provide complete instructional materials (ATP, teaching modules, e-modules, e-LKPD, and assessment instruments), especially those relevant to the Merdeka Curriculum and a deep learning approach.	1	16	45	38	83%
Q3	I have difficulty finding reliable and expert-validated instructional materials relevant to the Merdeka Curriculum and a deep learning approach.	2	11	45	42	87%
Q4	I have never linked Sasambo local wisdom to science learning.	4	15	37	44	81%
Q5	I have difficulty integrating Sasambo local wisdom into science content.	2	16	37	45	82%
Q6	I have never implemented Sasambo-based ethno-practicum.	2	11	30	57	87%
Q7	I need a portal that provides complete expert-validated instructional materials (ATP, teaching modules, e-modules, e-LKPD, and assessment instruments), especially those relevant to the Merdeka Curriculum and a deep learning approach.	1	1	37	61	98%
Q8	A science learning portal that provides integrated Sasambo ethno-practicum instructional materials would help me design innovative learning activities.	0	7	38	55	93%
Q9	I need reconstructed ethno-Sasambo data to integrate with science learning content.	1	3	42	54	96%

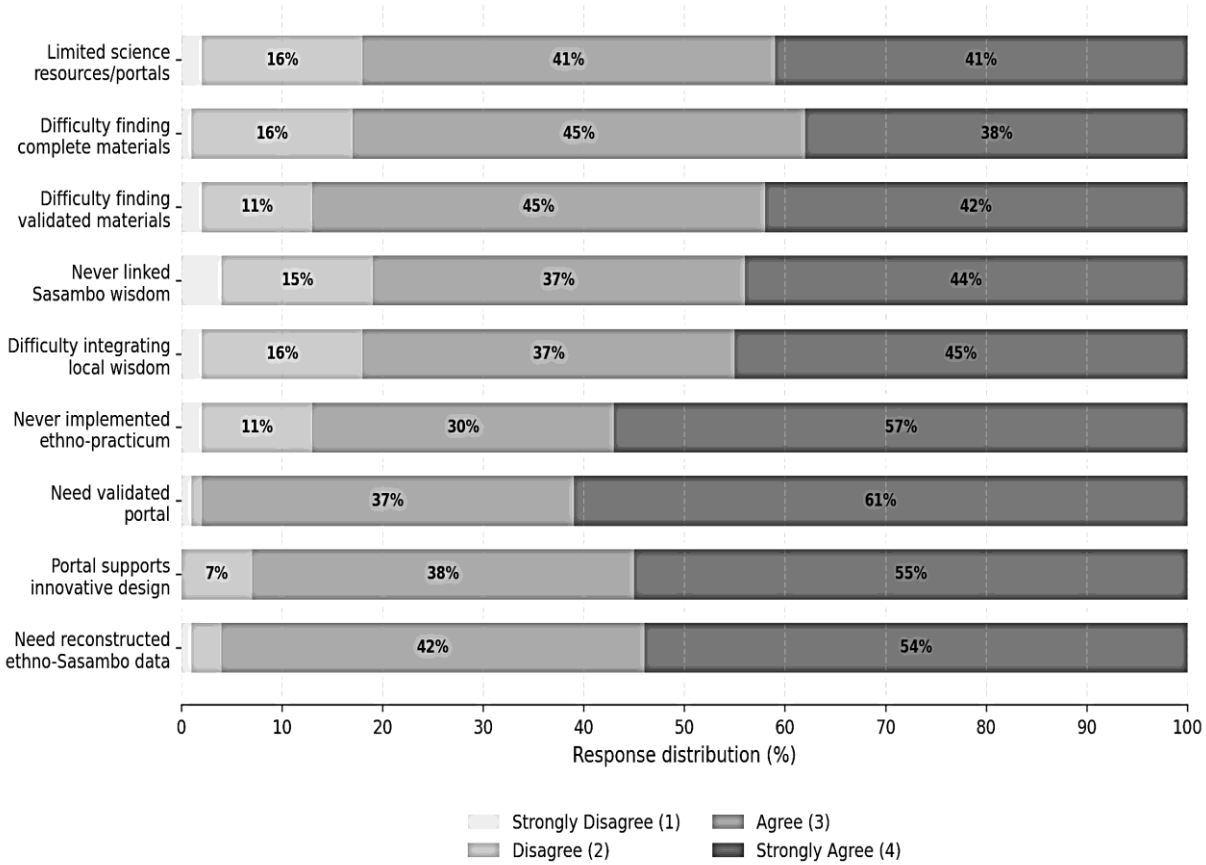

Figure 3. Likert response distribution by survey item

Table 1 and Figure 3 indicate that respondents faced considerable challenges while also expressing strong needs related to contextual science learning based on Sasambo local wisdom. Most respondents perceived science learning resources and portals as limited (Q1 = 82%), and reported difficulty finding complete instructional materials (Q2 = 83%) and reliable expert-validated resources (Q3 = 87%). The table also shows limited integration of Sasambo local wisdom into science learning, as 81% had never linked it to instruction (Q4), 82% had difficulty integrating it into science content (Q5), and 87% had never implemented Sasambo-based ethno-practicum (Q6). At the same time, respondents showed very strong support for future instructional development, with 98% needing a portal with complete validated materials (Q7), 93% agreeing that an integrated ethno-practicum portal would support innovative learning design (Q8), and 96% requiring reconstructed ethno-Sasambo data for science learning integration (Q9). Overall, the findings suggest that the current integration of local wisdom remains limited, while the need for structured, validated, and contextual instructional support is very high.

Building on the findings presented in Table 1 and Figure 3, the results reveal three interconnected issues: limited access to complete and validated science learning resources, low integration of Sasambo local wisdom into science learning and practicum activities, and a strong demand for a validated ethno-practicum learning portal supported by reconstructed ethno-Sasambo data. These patterns indicate that the challenge faced by preservice and in-service science teachers is not limited to the availability of learning resources, but also concerns the pedagogical transformation of local knowledge into structured, reliable, and implementable science learning experiences.

Limited Access to Science Learning Resources and Validated Materials

The findings show that respondents experienced substantial limitations in accessing science learning resources and validated instructional materials. Across the first three questionnaire items, a large proportion of respondents reported limited availability of science learning portals, difficulty finding complete instructional materials such as ATP, teaching modules, e-modules, e-LKPD, and assessment instruments, as well as difficulty accessing reliable and expert-validated resources relevant to the Merdeka Curriculum and deep learning approach. These findings indicate that the main issue is not merely the limited number of available learning resources, but the lack of instructional materials that are complete, pedagogically structured, quality-assured, and ready to be implemented in science teaching and practicum activities.

This finding is consistent with recent science education literature emphasizing that the effectiveness of practical and contextual learning depends strongly on the quality of instructional design, learning tasks, and supporting materials. Well-designed pre-laboratory and inquiry-based activities can help students prepare for laboratory learning, engage more deeply with experimental data, and connect observations with scientific reasoning (Agustian & Seery, 2017; van Brederode et al., 2020; Eymur & Çetin, 2024). In addition, context-based science teaching requires teachers to design learning activities that connect scientific concepts with students' real-life experiences and authentic phenomena, rather than presenting context as a superficial example (Mustafaoğlu & Yücel, 2022). The development and validation of science instructional materials also show that learning resources need to be evaluated in terms of content quality, organization, accuracy, and alignment with students' learning needs before they are implemented in classrooms (Macalikod & Simpal, 2025). Therefore, the high level of need identified in this study suggests that respondents require not only broader access to learning resources, but also complete, validated, and ready-to-use instructional materials that can support contextual science teaching and practicum design. This interpretation is also supported by recent studies showing that culturally responsive and socio-scientific issue-based learning tools can be valid and practical for promoting meaningful science learning (Arifin et al., 2024a).

Limited Integration of Sasambo Local Wisdom into Science Learning and Practicum

The second important pattern in this study concerns the still limited integration of Sasambo local wisdom into science learning. The survey results show that 81% of respondents stated that they had never linked Sasambo local wisdom to science learning (Q4), while 82% reported difficulty integrating Sasambo local wisdom into science content (Q5). Furthermore, 87% of respondents stated that they had never implemented Sasambo-based ethno-practicum activities (Q6). These findings indicate that Sasambo local wisdom is still largely present as cultural potential but has not yet been systematically transformed into actual science learning experiences or practicum activities.

This result aligns with recent studies showing that indigenous and local knowledge has increasingly been recognized as a meaningful source for science learning, but its integration requires careful pedagogical reconstruction rather than simple inclusion as cultural examples. Latip et al. (2024), in a systematic literature review of 52 articles, showed that local and indigenous knowledge in science learning is commonly connected to ecology, medicinal plants, astronomy, climate, and community practices, and that its implementation requires strategies such as place-based learning, community-based learning, curriculum integration, and practicum development. Similarly, Blackie (2024) emphasized that the inclusion of Indigenous Knowledge Systems in science education should be carried out carefully because different knowledge systems need to be meaningfully connected to science concepts rather than inserted superficially. Ogegbo &

Ramnarain (2024) also showed that integrating Indigenous Knowledge Systems into science classrooms requires appropriate pedagogical practices that enable indigenous knowledge to become part of meaningful science learning. Therefore, the high percentages in Q4–Q6 suggest that the challenge is not the absence of Sasambo local wisdom, but the absence of pedagogical mechanisms that can transform it into contextual science content and practicum activities.

The finding that 87% of respondents had never implemented Sasambo-based ethno-practicum is particularly important. It suggests that the gap lies not only at the conceptual level, but also at the practical level of teaching implementation. Science practicum requires activities that can be observed, tested, and connected to disciplinary concepts. Without a reconstruction process, local wisdom remains difficult to convert into inquiry-based or experiment-based learning tasks. Recent studies support this interpretation by showing that indigenous knowledge can become pedagogically meaningful when it is translated into learning contexts, practical activities, and structured instructional designs. Photo & McKnight (2024) found that science teachers still need clearer guidance to integrate indigenous knowledge into science teaching, while Seehawer (2018) demonstrated that teachers require practical strategies to integrate indigenous and Western knowledge in classroom practice. These studies strengthen the present finding that the limited implementation of Sasambo-based ethno-practicum is closely related to the lack of reconstructed learning designs, practical guidelines, and operational models, rather than to a lack of local knowledge itself.

Need for a Validated Ethno-Practicum Portal and Reconstructed Sasambo Resources

The strongest pattern in the survey appears in the respondent's expressed needs for future instructional support. A total of 98% of respondents stated that they needed a portal that provides complete expert-validated instructional materials (Q7). In addition, 93% agreed that a science learning portal containing integrated Sasambo ethno-practicum instructional materials would help them design innovative learning activities (Q8). Furthermore, 96% reported that they needed reconstructed ethno-Sasambo data to integrate with science learning content (Q9). These percentages clearly show that respondents not only recognized the existing limitations but also pointed directly to the kind of solution they considered necessary.

These results are strongly supported by the literature on teacher support, indigenous knowledge integration, and contextual learning design. Photo & McKnight (2024) found that science teachers need clearer guidance for integrating Indigenous Knowledge Systems into science classrooms, particularly in ways that connect familiar cultural knowledge with formal school science. Mlotshwa & Tsakeni (2024) reported that teachers encounter considerable challenges in translating indigenous knowledge into practical science work when operational support is absent. From another perspective, research on context-based science teaching has shown that teachers need carefully structured materials and models to transform authentic contexts into effective science learning tasks (Dori et al., 2018; Prins et al., 2018). Therefore, the respondents' demand for a validated portal should be interpreted not as a request for a simple digital repository, but as a request for a pedagogical system that integrates reconstructed local knowledge, curriculum-linked instructional materials, and implementable practicum designs. In line with this, the development of digital learning materials such as e-modules based on the CRTT model and socio-scientific issues has been shown to support interactive and contextually meaningful science learning (Ahmad et al., 2024; Arifin et al., 2024b; Arifin et al., 2025).

The need for reconstructed ethno-Sasambo data is also especially significant. This result indicates that respondents require not only teaching materials, but also an

epistemic bridge that connects local knowledge with science concepts. In this regard, reconstructed indigenous knowledge can function as the basis for designing contextual inquiry, observation, experimentation, and scientific reasoning. Parmin et al. (2016) showed that preservice teachers could be prepared to integrate science and local wisdom through open inquiry, enabling them to develop teaching materials and improve learning outcomes. In a more recent study, Parmin et al. (2022) found that preservice science teachers developed very good skills in reconstructing indigenous knowledge through local cultural studies when learning experiences were intentionally designed for this purpose. These studies support the idea that the high need for reconstructed ethno-Sasambo data in the present research is pedagogically reasonable, because reconstruction is a necessary step before local wisdom can become a contextual science practicum resource.

Implications for Preservice Teacher Education and Science Teaching Practice

The composition of respondents in this study also gives the findings an important educational meaning. Since 76% of the respondents were preservice science teachers and 24% were science teachers, the results suggest that the issue of transforming indigenous knowledge into contextual science practicum should be addressed both in teacher education and in school practice. The strong agreement across survey items indicates that future teachers and practicing teachers face a similar need for validated materials, contextualized practicum guidance, and reconstructed local knowledge resources.

This implication is supported by the literature on culturally responsive and context-based science education. Smith et al. (2022) argued that culturally relevant, responsive, and sustaining pedagogies are essential for making science education more equitable and meaningful, especially in contexts shaped by diverse cultural knowledge systems. The present findings suggest that such pedagogies cannot be implemented effectively without adequate resources and structured guidance. In the specific context of science teacher education, Parmin et al. (2016) and Parmin et al. (2022) showed that preservice teachers can be trained to reconstruct local wisdom and integrate it into science instruction. Therefore, the current survey results imply that the development of a validated ethno-practicum portal based on reconstructed Sasambo knowledge would be relevant not only as a classroom support tool, but also as a professional preparation resource for preservice science teachers. In this sense, the urgency identified in this study is both curricular and pedagogical: curricular because it relates to the integration of local wisdom into science content, and pedagogical because it concerns the practical ability of teachers to transform that knowledge into contextual science practicum activities.

CONCLUSION

Based on the research findings, it can be concluded that the transformation of Sasambo indigenous knowledge into contextual science practicum activities is needed through systematic pedagogical reconstruction. The main contribution of this study is that it provides empirical evidence that preservice science teachers and in-service science teachers require not only access to local wisdom-based learning resources, but also validated, complete, and ready-to-use instructional support for implementing ethno-practicum activities. These findings highlight the importance of developing a contextual ethno-practicum portal that integrates reconstructed ethno-Sasambo data, instructional materials, and practicum guidelines. As a follow-up direction, future research should focus on designing, validating, and testing the effectiveness of such a portal or instructional model in actual science learning contexts.

RECOMMENDATION

Based on these findings, it is recommended that a validated contextual ethno-practicum portal be developed to support the integration of Sasambo local wisdom into science learning and practicum. The portal should provide expert-validated instructional materials, reconstructed ethno-Sasambo resources linked to science concepts, and practical guidance for implementation in teacher education and school contexts. Further studies are also recommended to test the effectiveness of the portal in improving contextual understanding, pedagogical skills, and the ability to transform indigenous knowledge into meaningful science practicum activities.

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