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Prospective Science Teachers' Perception of Local Resources based Curriculum for Learning Science Concepts

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Abstract. A community-based curriculum emphasizes the utilization of local community resources to enrich science learning. Garut, situated in west Indonesia, boasts abundant local resources that can serve as valuable curricular materials for science instruction. This study delves into the perceptions of secondary prospective science teachers regarding the local community resources vis-à-vis science concepts. Thirty-four aspiring secondary science educators from a university in Garut participated in the investigation. The locale features several noteworthy resources, including the Kamojang geothermal field, the leather tanning industry, and Garut sheep. Data collection involved surveys and interviews, with analysis conducted through descriptive statistics and constant comparative methods. Overall, prospective teachers exhibited awareness of Garut's three primary local resources—namely, the Kamojang geothermal field (70.6%), the leather tanning industry (88.2%), and Garut sheep (67.6%). However, they lacked direct engagement with these resources, whether through site visits, ownership, maintenance, or comprehensive knowledge of their developmental processes. Furthermore, participants displayed varying levels of understanding regarding concepts related to geothermal science (31.63%), Garut sheep (52%), and the leather tanning industry (24.6%). Interviews depicted a growing inclination toward leveraging local resources in future science instruction. The findings underscore the imperative for prospective teachers to enhance their understanding of science concepts linked to each of Garut's community resources.
Keywords: Community resources; prospective teacher; science learning

Introduction

Science education has transitioned from a theory-centric approach to a student-centered paradigm anchored in real-world contexts, individual needs, academic readiness, and career education (Eilks & Hofstein, 2013). This shift traces its roots back to the emergence of science in the community as a pioneering science reform curriculum in the mid-1990s (Park et al. 2005). The integration of authentic contexts and community resources stands as a pivotal aspect of science education, accentuating the interconnectedness between real-life contexts and the science concepts under study (Kuhn & Müller, 2014). These real-life contexts and community resources in scientific concepts can be linked to various aspects of students' lives, including their families, local environment, and the interface between technology and society (Eilks et al. 2018). Moreover, the scientific literacy framework outlined in PISA 2021 underscores the importance of context in learning, particularly in the context of life situations involving science and technology at personal, local, and global levels (OECD 2021).

The incorporation of authentic contexts into science education is encapsulated in the concept of context-based science education (CBSE). CBSE represents a pedagogical approach that emphasizes the utilization of concepts and procedural skills within genuine contexts that resonate with students of diverse backgrounds (Kuhn & Müller, 2014). Another perspective on CBSE highlights the notion that employing real-world contexts serves as the foundation for cultivating scientific understanding during the learning process (Mustafaoglu, 2022). Moreover, the use of genuine contexts should entail students engaging in experiential or practical activities within real-life settings, thereby influencing their ability to navigate real-world situations (OECD, 2019). These perspectives collectively emphasize the aim of employing real-world contexts in science education: to furnish students with experiential learning opportunities and to serve as a catalyst for conceptual development.

Community resources offer a tangible context closely intertwined with students' daily lives, making them ripe for integration into science education within the classroom. Moreover, these resources facilitate the direct application of scientific concepts in students' learning endeavors (Eilks et al., 2018). Utilizing community resources in science education enables students to acquire knowledge and immediately put it into practice (Noor & Purnamasari, 2019). Furthermore, such utilization affords students firsthand experience with local resources, encompassing both natural elements and cultural assets (Engels et al., 2019).

Employing local community contexts in education fosters more meaningful learning experiences, encouraging students to grapple with authentic issues and refine their critical thinking skills in the process (Eilks et al., 2018; Hayati et al., 2020). Additionally, integrating local community contexts into learning endeavors enhances students' comprehension of the applicability of scientific concepts to real-world scenarios (Bølling et al., 2017; Littrell et al, 2020; Ramos de Robles & Gallard-Martinex, 2022; Zimmerman & Weible, 2017). Consequently, science education rooted in local community contexts not only imbues learning with greater significance but also deepens understanding of scientific concepts and the communities in which they are embedded.

Understanding the local community context can profoundly influence an individual's actions and attitudes in both real-life and social settings. According to Flanagan et al. (2019), students who grasp the local community context tend to exhibit heightened environmental and nature conservation awareness. Moreover, familiarity with the local community context enhances students' engagement with real-world scenarios by establishing connections between scientific concepts and environmental conditions (Littrell et al., 2020). Consequently, a nuanced understanding of the local community context aids in the development of decision-making skills applicable to real-life situations, empowering individuals to actively participate in socio-scientific issues (Holmes et al., 2021). These studies collectively suggest that incorporating the local community context into science education fosters a more favorable perception of science among students. This positive shift arises from heightened awareness of the interplay between science and the environment, bolstering students' confidence in applying scientific concepts in everyday situations (Engels et al., 2019). Additionally, research indicates that student engagement in direct investigations of local community resources enhances their experimental skills and scientific comprehension (Tobin, 2008; Parmin et al., 2022). Furthermore, utilizing community contexts as learning aids enables students to reconfigure scientific material and innovate teaching resources (Parmin et al., 2019).

Garut stands out among Indonesian cities due to its abundant local community potential across various sectors, including natural resources like agriculture, plantations, and its distinctive geographical features. Renowned as a culinary hub, Garut boasts unique delicacies like Garut lamb, Garut dodol, and specialties such as the leather tanning industry, kejek tea, and vetiver oil, which are recognized locally, nationally, and globally. Additionally, Garut hosts sites of strategic importance to human life, such as the Kamojang geothermal area. These local resources in Garut hold significant potential as educational materials for classroom learning. Imtihana & Djukri (2021) assert that natural resources like coastal areas, mountains, and other environmental assets can serve as valuable educational tools in science instruction, offering direct experiential learning opportunities beyond the confines of the classroom.

Each of the local community resources in Garut is intertwined with scientific concepts; for instance, in the geothermal field, concepts like energy, heat, and temperature are prevalent (Nasrudin et al., 2019). Similarly, other Garut contexts also bear relevance to the scientific concepts explored in science subjects. However, there is a dearth of research examining the correlation between Garut's local community context and scientific concepts. Consequently, the potential of local community resources remains untapped in K-12 science education in the Garut community.

Methods

In this study, a descriptive quantitative-qualitative design was employed, utilizing surveys and focus group interviews as the primary data collection techniques. Although initially inspired by the explanatory sequential mixed-method framework (Creswell & Clark, 2017; Shiyanbola et al., 2021), the study did not fully adopt the rigorous integration procedures typically found in mixed-method research. Instead, the quantitative and qualitative phases were conducted sequentially to complement each other in describing and understanding prospective teachers' perceptions and experiences. Quantitative data were collected through an initial and follow-up survey, while qualitative insights were obtained through a focus group interview to further elaborate the survey findings. This design allowed for a more comprehensive portrayal of how local resources in Garut were perceived and planned for integration into science instruction.

This study utilized a purposeful sampling strategy to carefully select participants, resulting in a nonrandom convenience sample (Patton, 2014). Thirty-four prospective teachers (N=34) were selected from 108 prospective teachers in a private university situated in Garut, Java Island, Indonesia. These individuals were enrolled in a secondary science methods course. Participants willingly volunteered to participate in the study, indicating their readiness and availability (Patton, 2014). The sample was proportionally drawn to represent each semester level, ensuring varied academic backgrounds among participants.

The initial survey was administered at the outset of the study with the aim of gathering insights into prospective teachers' perceptions and experiences regarding their community's resources for teaching science in Garut. Following this survey, all prospective teacher participants were tasked with writing a science lesson plan utilizing local resources as part of their coursework. Subsequently, they engaged in discussions on how to integrate Garut's resources into their instructions. A follow-up survey, built upon the key ideas identified in the initial survey, was conducted two months later, following four weeks of classes and discussions. The primary objective of the follow-up survey was to assess any enhancements in participants' perceptions and understanding of science-related local resources, as well as to explore their plans for utilizing community resources. Both surveys aimed to gather information on prospective science teachers' comprehension of three local community resources in Garut: Kamojang geothermal field, Garut sheep, and Leather Tanning Industry. Additionally, the surveys sought to gauge participants' awareness of local resources, understanding of their benefits and development processes, and grasp of the relationship between the local context and science concepts.

The survey instrument comprised indicators across three key aspects: (1) awareness of the existence of local science-related resources, (2) understanding of the benefits, functions, and development processes of those resources, and (3) the ability to connect local contexts with science concepts in instructional planning. Instrument validity was established through expert judgment involving science education and curriculum specialists, while reliability was examined through a pilot test involving a group of non-participant prospective teachers, yielding a Cronbach's alpha of 0.82, indicating good internal consistency.

Following the follow-up survey, a semi-structured interview was conducted with prospective science teachers. The focus group interview aimed to gather insights on how they intend to integrate Garut community resources into their future science instruction. The focus group interview sessions were audio-recorded, professionally transcribed, and analyzed by two science educators with expertise in qualitative methods. The transcripts were subjected to deductive analysis to identify and categorize key ideas, forming patterns that were then validated through member checks for reliability. This explanatory sequential mixed method design, combining surveys and focus group interviews, enhanced the validity and reliability of the data. It ensured content validity by cross-checking the survey content through two phases and evaluated congruence between the survey and interview responses (Shiyanbola et al., 2021).

Results and Discussion

The main objective of this study is to collect data on prospective science teachers' comprehension of the local Garut context and its correlation with scientific concepts. As part of this investigation, prospective science teachers participated in a survey regarding their grasp of the local Garut context and its connection to scientific principles. The unearthed local context in Garut included the Kamojang geothermal area, Garut sheep, and the leather tanning industry.

The first exploration in this study aims to understand the awareness of prospective science teachers regarding the local Garut context. Understanding the presence of this local context among students is crucial because it serves as a valuable source of information for learning (Noor, 2019). Table 1 are the survey findings concerning the awareness of the three local Garut contexts examined in this research.

Table 1. Prospective science teachers' awareness of local community resources in Garut

Local Community Resources	Prospective Science Teachers' Responses (%)	
	Being Aware	Not Aware
Kamojang Geothermal Field	70.6	29.4
Garut Sheep	88.2	11.8
Leather Tanning Industry	67.6	32.4

The findings indicate that the majority of prospective science teachers are aware of the local Garut contexts studied, including the Kamojang geothermal area, Garut sheep, and the leather tanning industry. A higher percentage of prospective teachers demonstrate knowledge of these local contexts compared to those who do not. Specifically, 70.6% are familiar with the Kamojang geothermal context, suggesting that this location may have stronger public exposure or has been more frequently associated with science and environmental education. Meanwhile, 88.2% of participants are familiar with the Garut sheep context, which indicates a close cultural and economic connection between this local resource and the community, possibly due to its prominence in local traditions and livelihoods. In contrast, only 62.6% are aware of the leather tanning industry, pointing to a potential gap in exposure or integration of this industrial context in educational discourse. These differences suggest the need for curriculum designers to intentionally broaden the inclusion of diverse local contexts particularly underrepresented ones—into science learning to ensure equitable cultural relevance and engagement.

The Garut sheep context is recognized to a greater extent by prospective science teachers compared to the geothermal and leather tanning industry contexts. This heightened awareness can be attributed to the Garut sheep's familiarity relative to other local contexts. Moreover, the Garut sheep serves as an emblem of Garut city, renowned both locally and globally. These observations align with the insights of Asfestani, et al (2021), who suggest that familiarity with a context independently influences memory performance, alongside the learning process.

Garut sheep stands out as a primary commodity consistently highlighted by stakeholders (Firman et al., 2018), thereby ensuring its widespread recognition among the public through various media channels and activities. Understanding of local contexts can be cultivated through ongoing interactions and daily engagements within the community (Sotero et al., 2020). The prospective science teachers' awareness of the Garut local context prompted further inquiries into their firsthand experiences, comprehension of processes and advantages, and grasp of the interconnection between natural science concepts and Garut's local context.

The Direct Experience in Local Context

Direct engagement with the local Garut context pertains to the actions of prospective science teachers who visit and interact firsthand with it. The survey findings concerning students' direct experiences visiting the local Garut context are outlined in Table 2.

Table 2. Prospective science teachers' experience of local community resources in Garut

Local Community Resources	Prospective Science Teachers' Responses (%)	
	Direct visiting experience	No Direct Visiting Experience
Kamojang Geothermal Field	14.7	85.3
Garut Sheep	44.1	55.9
Leather Tanning Industry	11.8	88.2

The findings indicate that the majority of prospective science teachers need to acquire firsthand experience by visiting the Kamojang geothermal area and the leather tanning industry. However, in the case of the Garut sheep context, a higher percentage of students have direct visiting experience, totaling 44.1%. This greater accessibility to Garut sheep farms, without the need for permits, facilitates easier visits for students. Moreover, the presence of numerous Garut sheep within the community enhances opportunities for direct interaction with this context compared to the Kamojang geothermal area and the leather tanning industry.

The Garut sheep industry represents a burgeoning aspect of the local community, fostering a sense of pride and exerting a direct influence on community members. Contexts cultivated within local communities are readily acknowledged by residents and offer a broader array of resources compared to more professionally developed contexts (South et al. 2020). The Kamojang geothermal area and leather tanning industry were established with a professional focus that often excludeds involvement from the local community, resulting in limited accessibility for the broader community, and including students.

Understanding of the Process and Benefits of Garut's Local Context

Understanding the processes within the local Garut context pertains to prospective teachers' grasp of the activities and developmental procedures inherent in Garut's local context. This encompasses various processes such as maintenance, production, and others directly associated with the local Garut context. The prospective teachers' understanding of these processes within the local Garut context is detailed in Table 3.

Table 3. Prospective science teachers' understanding about the development processes of local resources in Garut

Local Community Resources	Prospective Science Teachers' Responses	
	Understand (%)	No Understand (%)
Kamojang Geothermal Field	17.6	82.4
Garut Sheep	20.6	79.4
Leather Tanning Industry	14.7	85.3

The results reveal that the majority of prospective science teachers require further learning and comprehension of the processes occurring within the local Garut context, encompassing the Kamojang geothermal area, Garut sheep, and leather tanning industry. These findings underscore the ongoing need for prospective science teachers to establish connections between the scientific concepts they have studied and the local context within their environment. Regarding Garut sheep, the relevant processes involve the breeding, starting from the selection of superior breeds, crossbreeding, and care for the Garut sheep. This shared understanding of the Garut sheep processes extends beyond students, as many breeders in rural areas also seek to comprehend the nuances of raising Garut sheep, particularly the cultivation process (Dudi et al., 2021).

In the context of geothermal energy, understanding the processes pertains to the steps involved in generating steam from geothermal sources and subsequently converting it into electricity. The prevailing comprehension among students regarding processes within the Kamojang geothermal context aligns with research findings indicating a generally low understanding of geothermal energy and its associated processes (Wahyudi et al., 2019). Moreover, a shared understanding of geothermal processes may lead to potential resistance towards geothermal energy. Conversely, a comprehensive grasp of geothermal processes has the potential to enhance awareness and accountability among stakeholders, fostering a more favorable societal perception of geothermal energy (Nasrudin et al., 2019).

Within the context of the leather tanning industry, prospective science teachers exhibit a lower level of understanding of its processes compared to other contexts. The leather tanning industry is undergoing continuous development, and some individuals are only acquainted with its industrial procedures. This lack of understanding is primarily why many students need to familiarize themselves with the processes involved in the tanning industry. The leather tanning process comprises three stages: pre-tanning, tanning, and post-tanning (Kuncoro & Soedjono, 2022). The widespread lack of knowledge and awareness of these processes in the leather tanning industry contributes to environmental pollution (Hutagalung, 2010). Consequently, there is a pressing need to enhance public and student awareness and comprehension of the leather tanning process.

Prospective science teachers' collective understanding of the processes within the local Garut context is shaped by various factors, including the necessity for greater direct experience with the surrounding local environment. The integration of the local context into school curricula remains inadequate, reflecting a limited awareness of its significance as an educational resource. Interviews emphasize the need for courses to integrate the local Garut context more comprehensively into their content. Currently, the introduction of the Garut context into lectures serves primarily as an initial stimulus, lacking depth and relevance to students' daily lives. Despite the potential for the surrounding context to offer direct experiences and knowledge, the presented context has yet to align closely with students' lived experiences. Engaging prospective science teachers in studying their local context can provide valuable firsthand experiences and deepen their understanding of the concepts under study (Parmin et al., 2019).

In addition to examining the processes within the local Garut context, this study delves into prospective science teachers' comprehension of the advantages associated with it. Survey findings regarding the understanding of the benefits of the local Garut context are presented in the Table 4.

Table 4. Prospective science teachers’ understanding about the benefits of local community resources in Garut

Local Community Resources	Prospective Science Teachers’ Responses (%)	
	Understand the Benefits of Local Resources	Do not Understand the Benefits of Local Resources
Kamojang Geothermal Field	47.1	52.9
Garut Sheep	88.2	11.8
Leather Tanning Industry	32.4	67.6

Table 4 indicates that the majority of prospective science teachers are aware of the benefits associated with the Garut sheep context, particularly in its practical application in daily life, which they frequently encounter. In contrast, understanding of the benefits related to the Kamojang geothermal context and the leather tanning industry is lower among students compared to the Garut sheep context. These findings resonate with research conducted in Turkey, which demonstrates that students possess limited knowledge about the benefits of geothermal energy and lack sufficient understanding of its environmental impact (Çetiner et al. 2016). Additionally, other studies have observed a negative inclination among local communities toward the presence of geothermal energy in their vicinity compared to communities situated farther from geothermal sites (Baek et al. 2021).

Prospective Science Teacher's Understanding of the Relation of Science Concepts to Local Contexts

In order to assess the comprehension of prospective science teachers concerning the correlation between scientific concepts and the local context, open-ended questions were employed to inquire about the concepts that can be gleaned from the local Garut context. The responses of prospective science teachers regarding the science concepts associated with the local Garut context are presented in Table 5.

Table 5. Prospective science teachers' understanding of the relationship between science concepts and local resources in Garut

Local Community Resources	Science Concept	Prospective Science Teachers’ Responses (%)	Average Responses in Local Resources (%)
Kamojang Geothermal Field	Energy change	82.40	31.63
	Earth structure	23.50	
	fluid	14.70	
	Rock Type	5.90	
Garut sheep	Diversity and classification of living things	8.53	52
	hybridization concept	64.7	
	Biotechnology	32.4	
	Motion System	25.6	
Leather Tanning Industry	Environmental pollution	42.8	24.6
	Ecosystem	16.4	

As depicted in Table 5, most of the prospective science teachers involved in the study recognized energy change as a relevant science concept that can be derived from the Kamojang geothermal context. Furthermore, prospective teachers also referenced other science concepts such as earth structure, fluids, and rock types in connection with the Kamojang geothermal context. These discoveries align with research suggesting that geothermal energy can provide a framework for comprehending natural science concepts such as energy changes, heat, and temperature (Nasrudin et al., 2019). Overall, prospective teachers exhibit an understanding of how scientific concepts relate to the geothermal context, which supports previous research emphasizing the interplay between scientific principles and the processes inherent in geothermal systems (Forissier et al., 2019). Furthermore, prospective teachers also referenced other science concepts such as earth structure, fluids, and rock types in connection with the Kamojang geothermal context. These findings align with research suggesting that geothermal energy can provide a framework for comprehending natural science concepts such as energy changes, heat, and temperature (Nasrudin et al., 2019). Overall, prospective teachers exhibit an understanding of how scientific concepts relate to the geothermal context, which supports previous research emphasizing the interplay between scientific principles and the processes inherent in geothermal systems (Forissier et al., 2019).

Within the context of the leather tanning industry, prospective teachers exhibit the lowest percentage of understanding regarding the relationship between science concepts and the local Garut context compared to other contexts. Moreover, fewer natural science concepts are evident in this context compared to others, with only the concept of environmental pollution and ecosystems being identified. However, insights gleaned from interviews with the participants regarding leather tanning indicate their comprehensions about the potential environmental pollution resulting from tanning activities. Despite these concerns, they have yet to provide scientific justifications for their understandings. This finding is consistent with research indicating that while students possess a heightened interest in environmental pollution, educational curricula primarily emphasize theoretical aspects rather than practical applications (Al-Maliki et al., 2021).

Findings of Follow-up Survey and Interview

Using follow-up surveys, the subsequent investigation in this study aims to ascertain the strategies prospective science teachers intend to employ in incorporating the local Garut context into their upcoming science instruction when they become a full-time teacher. The follow-up survey asked two questions of (a) how often they would plan to use and (b) in what way they plan to use in their future science instruction. The follow-up results of question (a) are presented in Table 6.

Table 6. Prospective science teachers' plan for utilizing local Garut resources in instruction

Question	The prospective science teachers’ answer about utilizing local Garut culturals in instruction (%)			
	Not Likely use at all	Will use when needed	Will use occasionally	Will use frequently
How often would you plan to incorporate local Garut culture into science learning?	0	52.94	32.35	14.70

As shown in Table 6, 52.94% of prospective teachers expressed their intention to use resources as required, 32.35% mentioned they would use them occasionally, and 15%

expressed intentions to integrate them regularly. We further inquired about the participants' future strategies for incorporating local resources into their science instruction. The results of question b are depicted in Table 7.

Table 7. Prospective science teachers' strategies for integrating local garut resources into instruction

Question	Prospective science teachers' strategies for integrating local garut resources into instruction (%)				
	As an example of a scientific phenomenon	Primary content of the practicum	Engage students' attention	Frame them as local potentials linked to science	Not sure use local resources in learning
How do you plan to integrate Garut's local cultural and natural resources into science teaching?	61.76	5.88	8.82	5.88	17.64

As illustrated in Table 7, 61.76% of prospective teachers indicated their intention to utilize resources as examples of scientific phenomena, while 17.6% expressed uncertainty about their usage. Additionally, 15% conveyed intentions to incorporate them regularly. The remaining respondents outlined their intentions as follows: 5.9% planned to use them as the primary focus of teaching practicum activities, 8.8% intended to use them to capture students' attention, and 5.9% aimed to introduce them as local economic potentials and related scientific concepts.

Through the interviews, prospective science teachers revealed their intentions to utilize local Garut resources in science instruction, which can be grouped into several key thematic categories. The first theme pertains to instructional planning. For instance, one participant stated, *"Aspiring to become a science teacher, I aim to incorporate Garut's local resources into my teaching materials, especially during practicum sessions. Specifically, I intend to use dodol Garut as a tangible illustration to explain the concept of food additives."* This response indicates an awareness of how culturally familiar materials can make abstract science concepts more relatable. The second theme highlights the strategic use of local resources as learning tools to contextualize science. One participant explained, *"We plan to integrate Garut's local resources into initial learning activities to demonstrate scientific phenomena and illustrate science concepts directly related to Garut."* This suggests an emerging pedagogical approach where local examples are positioned not just as content, but as a starting point for scientific inquiry and relevance.

A third theme relates to student engagement. Participants noted that *"Garut's local resources can be used as examples to capture students' attention and increase their awareness of the rich local potential."* This illustrates their understanding that localized content can foster curiosity and emotional connection in learning, which is critical for meaningful science education. An additional theme that emerged emphasized the broader socio-economic and cultural functions of local resources. One participant stated, *"I will utilize local resources to introduce Garut's economic potential and cultural heritage."* This reflects a more integrated view of science learning that connects content with local identity and community development, aligning with the goals of culturally responsive pedagogy.

However, the interviews also revealed variability in participants' readiness. One prospective teacher admitted, *"I have yet to develop science learning activities* *incorporating Garut's local resources; I am still uncertain about the relationship between science concepts and the local resources."* This highlights a gap in pedagogical content knowledge and suggests that while the intention to use local contexts is present, further support is needed to build confidence and capacity in instructional design. Overall, these findings reflect a qualitative descriptive analysis that surfaces variations in awareness, readiness, and pedagogical planning among prospective science teachers. While not yet in-depth interpretive analysis, the themes indicate a spectrum of engagement and the need for targeted interventions in teacher education programs to strengthen the integration of local resources into science teaching.

Conclusion

The findings and subsequent discussion revealed that the majority of prospective teachers were familiar with certain aspects of the local Garut resources, such as Garut sheep, geothermal energy, and the leather tanning industry. However, most prospective teachers lacked direct experience with these local contexts, whether through visits, ownership, maintenance, or understanding of their development processes. Furthermore, it was observed that prospective teacher comprehension of the interconnectedness of scientific concepts within each Garut local resource needed improvement. The findings of this study indicate that the utilization of the local recourses in science education remains limited. Hence, there is a pressing need for a science learning strategy that embraces and incorporates the local resources into the educational process. This strategy involves developing learning approaches tailored to local potentials and contexts, along with creating teaching materials and educational media that embrace local resources. It also emphasizes enhancing prospective teachers understanding of local resources as valuable educational assets and teaching them how to integrate these effectively into science instruction.

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