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Teacher Experience of Ethnoscience: Local Wisdom in Independent Curriculum Implementation

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Abstract: It is expected of teachers to be able to design and manage the instruction effectively. Learning will become meaningful if local wisdom and indigenous knowledge are presented in the science classes in accordance with the current curriculum through ethnoscience. This research was to explore the science teacher experiences about ethnoscience implementation in independent curriculum framework at junior high school level. This research uses a qualitative method known as phenomenology to explore participants' experiences. Four science teachers were involved as participants in this research through in-depth interviews and questionnaires. Science teacher experiences in designing and manage ethnoscience learning according to the independent curriculum is the primary data which is analysed with ATLAS.ti software. The connection between four themes, i.e. differentiated instruction, Pancasila student profile, local wisdom and contextual teaching and learning is the main finding in this research. Science teachers have carried out these key themes not only in the preparation but also in the process in order of gaining mastery earning.

Keywords: Ethnoscience; Independent curriculum; Indigenous knowledge; Local wisdom

Introduction

Improving education quality through globalization competencies and 21st-century skills is urged as the world develops and becomes a more engaged network (Anagün, 2018). As the advanced changes in science, technology, and information, local wisdom and cultural values may be lost (Sari et al., 2023). One main issue in modern and mainstream education is the threatness of indigenous knowledge (Idul et al., 2023). Learning challenges, a loss of respect for tradition and heritage, low self-esteem, a sense of shame, and a loss of indigenous identity are some effects of mainstream education. Indigenous knowledge reveals the distinctive worldviews of indigenous peoples (Zidny et al., 2020).

Indigenous knowledge integration in learning has the potential to facilitate the SDGs (sustainability development goals) (Demssie et al., 2020). Science learning becomes meaningful through indigenous knowledge presence in the classroom thus bridging the gap between science education in schools and community (Handayani et al., 2018). Indigenous knowledge such as heritage and culture could be elaborated with STEM (science, technology, engineering, and math) methods in science teaching and learning processes (Sumarni et al., 2022). Many studies across the world have revealed regarding cultural or historical identity of ethnic community connected to learning, for example indigenous knowledge of traditional foods in rural Nepal (Gartaula et al., 2020); indigenous microbiome in Maori, New Zealand (Warbrick et al., 2023), *Heteropyxis natalensis* the lightning tree in South Africa (Cameron, 2019); learning about botanical pesticide as green chemistry that is used by the Baduy tribe in Western Java, Indonesia (Zidny & Eilks, 2022).

The contextual-related term of indigenous knowledge or ethnic groups knowledge in science learning is ethnoscience (Asmaningrum et al., 2023; Efendi & Muliadi, 2023; Fasasi, 2017). In the framework of socioeconomic development processes, ethnoscience examines local perceptions, practices, skills, and ideas as well as the cosmologies that underlie them. Thus, the word "ethnoscience" is used to describe the often

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distinctive indigenous knowledge (IK) and indigenous technology (IT) systems that are characteristic of local populations or groups in the third world as well as of similar communities in the western nations (Okechukwu et al., 2014). Presenting contextual learning, providing regional uniqueness, and avoiding the loss of cultural identity, are the main goals of ethnoscience integrated into science education (Efendi & Muliadi, 2023; Handayani et al., 2018). However, to prepare youth with their cultural identity in the globalization era, rethinking and redesign the curriculum is crucial suggestion (Ningsih & Jha, 2021; Suprapto et al., 2021). Several nations, including those in Africa, the United States, New Zealand, Australia, China, Taiwan and Canada, have included local wisdom into their curricula (Asmaningrum et al., 2023; Suprapto et al., 2021). Taiwan's new educational initiatives are modelled from an exemplar that combines the concepts of globalization and localization (Suprapto et al., 2021).

Indonesia as a develop country, has strong potential to redesign the curriculum and include the sociocultural aspects because of a considerable diversity of local wisdom in the form of arts, ethnic, and culture (Widiyawati et al., 2022). The presence of ethnoscience combines with several learning strategy in Indonesian's science classroom was show in the previous studies, e.g: project based learning with ethnoscience learning towards conceptual understanding (Ardianti & Raida, 2022); Pendap as an integrated science learning media from Lembak Tribe, Bengkulu (Walid et al., 2022); exploration of the process of making Batik Sendang Duwur (Nikmah et al., 2023); Nyadran Sruwen Hamlet as ethnoscience and environmental ethics (Amidi et al., 2023); and ethnoscience based on Sasak Ethnic culture (Efendi & Muliadi, 2023).

In 2022, the Ministry of Education and Culture's launched Independent Curriculum includes differentiation as a topic and a new challenge for educators (Hasanah et al., 2022; Jatmiko & Putra, 2022). "Independent" means freedom according to the ideals of Ki Hajar Dewantara which focuses on independency and independent characters to explore students abilities in learning (Ardianti & Amalia, 2022). The application of ethnoscience learning in the 2013 curriculum has been widely discussed in previous studies (Dewi et al., 2019). Ethnoscience learning can improve scientific literacy (Perwitasari et al., 2021), critical thinking skills (Arfianawati et al., 2016). However, research to explore the relationship between ethnoscience and independent curriculum in science learning is still rarely conducted. Thus, this research aimed to explore the science teacher experiences with ethnoscience implementation in an independent curriculum framework at the junior high school level.

Method

Research Design

Based on a literature review, this study use a qualitative method known as phenomenology. Husserl first proposed this kind of phenomenological inquiry in 1931 as a means of elucidating a person's "life experience" and the significance of that experience (Williams, 2021). Phenomenology is a well-established tradition in qualitative research and is widely used by many researchers (Alase, 2017; Neubauer et al., 2019).

Participant

The criteria for choosing participants included science instructors with at least three years of experience teaching at the junior high school level; as well as a school that has adopted the Independent Curriculum and has the willingness to participate. Hence, participants were assigned a P1–P4 code.

Data Collection: Unstructured Interview Guide

Two methods, questionnaires and in-depth interviews, were used to collect the data. During one-on-one interviews, the responses provided by participants on the questionnaire were then cross-checked. There are four key research questions in the unstructured interview guide, i.e: independent curriculum; science learning; ethnoscience urgency; and teacher challenges.

Data Analysis

The accumulation of a great deal of information is one of the traits of qualitative research, making the coding and interpretation process is fundamental (Souto-Seijo et al., 2021) . ATLAS.ti 9, a program for analyzing qualitative data, was used to aid in the analytic process (Paulus et al., 2019). The data analysis process is supported by this software's components, such as query tools, codes, and network views, which also make it simpler to check codes and create categories to handle qualitative techniques (Ronzani et al., 2020; Scales, 2013). The findings from unstructured interviews served as the source of the data. The Miles, Huberman, and Saldana (2014) methodology is then used to process the data. This model entails three steps: data condensation, data display, and drawing and verifying conclusions. To do content analysis in the first stage, information transcripts must first be carefully coded and decoded. An Atlas.ti network map is constructed to show the relationship between various types of codes and the key codes from each participant that is pertinent to the study issue. This diagram will ultimately be used in drawing and verifying conclusion. The research flowchart served in Figure 1.

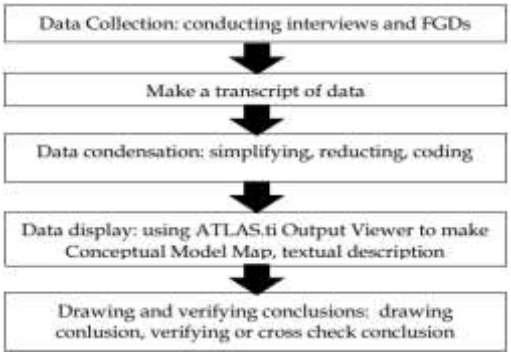

Figure 1. Research flowchart

Result and Discussion

This research was to explore the science teacher experiences about ethnoscience implementation in independent curriculum framework at junior high school level. Based on in-depth interviews with participants, individually or FGD, certain statements are considered to be the main themes for ethnoscience implementation in independent curriculum. These themes are based on coding analysis with ATLAS.ti which is relevant to the research questions, including: differentiated instruction, Pancasila Student Profile, local wisdom, contextual teaching and learning. Figure 2 illustrates how the conceptual model for this study was created.

Differentiated Instruction

Based on the literature review and participation statements, the implementation of the independent curriculum in schools uses a differentiated instruction approach. The science efforts to provide differentiated instruction as best as they can obtain. However, not all teachers are able to carry out differentiated instruction in their classes even though the independent curriculum instructs them to do so. The following are some relevant statements about the differentiation instruction implementation:

> So in the independent curriculum there must be differentiated lesson plans, although not all. Not all teachers carry out differentiated learning, but they have been asked to do so. Even in grade 8, which still uses K-13, some have been asked to use a differentiated instruction approach. (P3)

The differentiation includes three mandatory concepts, i.e.: content, process, and product (Tomlinson & Moon, 2013). Some of participants stated that they have use the differentiated instruction for one year in any techniques and activity. The following are some relevant statements regarding the differentiation in science learning:

> Yesterday in 7th grade I used a lot of product differentiation because it was easier than content and process. I don't like pencil and paper tests so I choose to assess the science Projects. Children do some projects in groups but the theme will be about what they learned during one TP (learning objective). For example, in the interactions between living things topics, the third learning objective was to learn about food chains, food webs, symbiosis and so on. I compiled 3 worksheets. In the second activity, I provide the tools and materials. I asked them to assemble it into a kind of macket of a small garden diorama, but some children were creative. One of them asked me "Ma'am, is it okay if I change the materials with plasticine or use small miniature animals", I answered, "Yes, that's fine, that's fine." So the children made a small garden diorama of their ecosystem, and some also made a small aquarium ecosystem. (P1)

Students are unique individuals with diverse learning styles, motivations, abilities, needs and interests (Suprayogi et al., 2017). According to Smale-Jacobse et al. (2019) and Tomlinson et al. (2013), differentiated learning is an active pedagogical method that can inform teachers about the varied. Differentiated learning is considered a practical approach to respond to the diverse needs of students (Pozas et al., 2020) as proven by many studies. Participants stated that they used diagnostic or initial assessments in the beginning of learning to find out the needs of each student. Initial assessments can provide information about students' talents, interests, learning styles and academic abilities so that teachers can carry out the treatment according to their needs. The following are supporting statements regarding the student needs:

> Yes, I have implemented the independent curriculum. Since the implementation of the independent curriculum, teachers have received provision and training from supervisors, departments or science teacher associations. We were taught how to create differentiated teaching modules. Usually, this differentiation begins with a diagnostic test, but when the lesson starts, the initial test aims to group students into good, middle *and low groups. So that the differentiation is adjusted to the learning material. (P4)*

Valiandes, (2015) for example proves that students show better performance when teachers implement differentiated learning compared to those who do not. Educators' beliefs in teaching of course guide their pedagogical actions and decisions (Suprayogi et al., 2017).

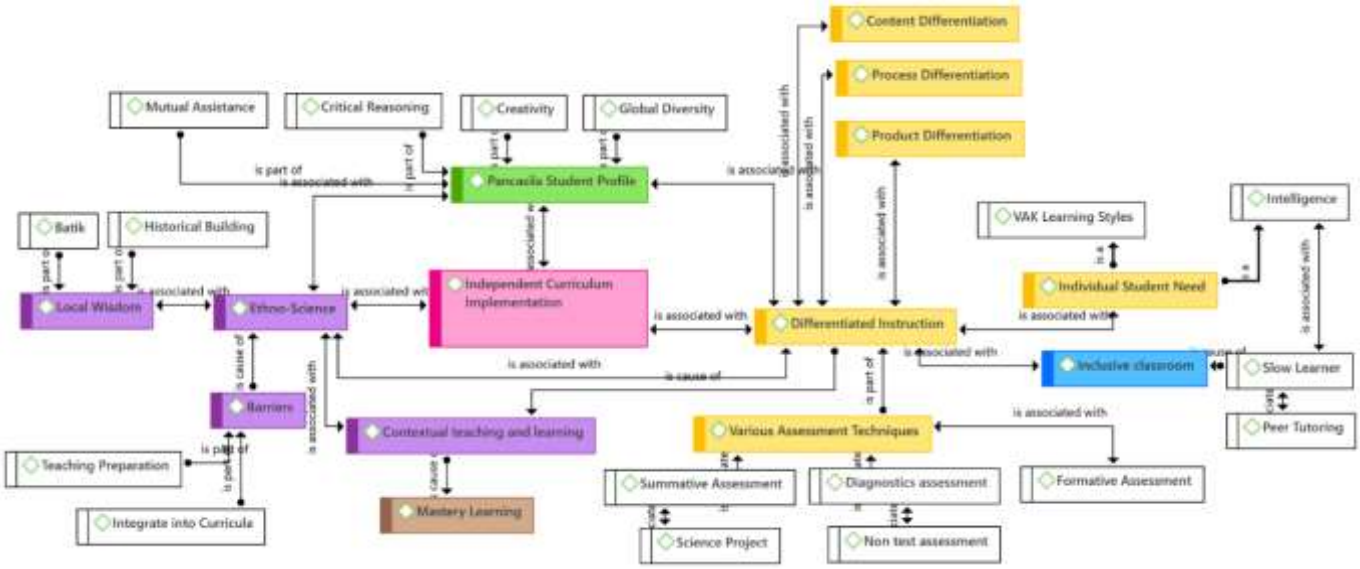

Figure 2. ATLAS.ti output viewer: conceptual model map

Pancasila Student Profile

The main goal of the Independent Curriculum in Indonesia is the Pancasila Student Profile, as the core value of Indonesian ideology, including six dimensions i.e: faith, fear of God, and noble character; independency; mutual assistance; global diversity; critical reasoning, and creativity (Rusnaini et al., 2021). One of the participants shared how the Pancasila Student Profile had been used in science learning in a variety of ways, such as integrating local wisdom and teamwork. Incorporating student into playing an educational game improve students' concentration on the information and foster a pleasant learning environment as well as prevent saturation (Zein & Rahayu, 2022). Since it can greatly enhance learning outcome, teacher should aim to incorporate educational games into their teaching methods (Yu et al., 2021). The following are some relevant statements regarding providing Pancasila student profiles in science classrooms:

> Learning is connected with local wisdom, mutual assistance and student collaboration. Because they work in groups, it means mutual assistance. Creativity and global diversity are directed at jumputan batik. If it's a game, it means arranging the game in every learning material taught. When introducing the structure and function of cells, children have already learned about that. During the assessment, I made a game like "finding a partner". So some kids got the "organelle" part and some got the "function" part. Later they look for their partner by shouting, for example, "vacuola vacuola" then the partner of the "function" will come. (P1)

Another participant stated that Pancasila Student Profile must be included in the teacher preparation and hopefully can be assessed in an effective way. The complete lesson plan in the Independent curriculum context namely "teaching module". Pancasila Student Profile is the goal of learning, which the dimension, element and sub element of it stated in the Decision Head of Educational Standards, Curriculum and Assessment Agency, Ministry of Education, Culture, Research and Technology Number 009/H/Kr/2022. But this participant find a problem related to teaching module implementation especially to integrate and assess Pancasila Student Profile. This statement is in line with previous studies (Kurniati & Kusumawati, 2023; Rizal et al., 2022) that teachers at the Driving School were having problems in teaching module preparation. The following are participation statement about Pancasila Student Profile in teaching preparation:

> In science learning, the Pancasila Student Profile is only included in the teaching module because it is the target. However, during learning it is more likely to reach the teaching module but it is not optimal. So, for example, in the current material, the scientific method has dimensions that I take, for example critical reasoning and creative thinking. Regarding assessment issues, I am still having problems. So I'm not optimal for implementing it. There are targets that have been written in the teaching module, there are dimensions and elements of the Pencasila student profile that have not been implemented as well as possible. It is possible that if the teaching module is implemented well, it is hoped that it can achieve the Learning Outcomes and Pancasila Student Profile. (P2)

These dimensions are also provided through Project for Strengthening Pancasila Student Profiles or Project Penguatan Profil Pelajar Pancasila (P5). It is a new issues in Indonesian curriculum and each educational institution has the independency to choose the theme and how to implement P5 as well as select significant concerns to address. (Asrifan et al., 2023). As stated by another participant, her school has implemented P5 for the last two years by selecting various themes to accommodate the Pancasila Student Profile; e.e.: bullying, plant cultivation and sustainable living. The following is according to the participant statement about P5 in her educational unit:

> So yesterday we were still testing, but thank God we won 1st place in Semarang City. We choose a theme and elements that will be included in the student's report card. Like yesterday. We chose the entrepreneurial theme, namely cultivating orange plants. So children plant from small seeds, care for them until they harvest the results and process them. The element chosen is morals towards plants, faith and fear to God, it seems they really care for them. Then they get mutual cooperation, if they are individualistic their group doesn't work. We took 3 themes yesterday, namely bullying, plant cultivation, and sustainable living, namely regarding waste management. So three more will be in grade 8, the rest will be in grade 9. Next year everyone will be in P5. (P3)

Local Wisdom

Each region in Indonesia has their culture, ethnic and local wisdom (Jufrida et al., 2021; Widiyawati et al., 2022). By using an ethnoscientific approach, local culture and knowledge can be converted into scientific knowledge. Ethnoscience is the practice of fusing scientific knowledge with societal understanding (Jufrida et al., 2021; Sumarni et al., 2016). Local wisdom integration through ethnoscience in science learning has many benefits, e.g: increasing students learning outcome (Ramdiah et al., 2020), conceptual understanding (Ardianti & Raida, 2022; Lubis et al., 2022), improve critical thinking skills (Ramdani et al., 2021). One of research participant said that her school was integrated local wisdom into P5 to promote Pancasila Student Profile as follows:

> The theme that we took or raised in the first year was our local wisdom in using the "toga plant" at school. So, on the theme of local wisdom, we make use of the many banana leaves that are available. In our school there are lots of banana trees, mango trees and then aloe vera, well, with Mrs. Heru's guidance, one of the products is shampoo from mango and banana blossoms. It turned out that there was 1 student whose talent was extraordinary, and then it was facilitated by the Principal, so he took part in various events, including yesterday's P5 work title and then at the museum, this child also had a talent for making puppets from banana leaves. So we've been flooded with orders. Then it's development. The intention is local wisdom related to the toga plant, then because we are an adiwiyata school, the environment will be empowered for the environment. (P4)

According to the P4 statement, students' creativity, independency and entrepreneur skill was equipped through the P5. This P5 theme was also in line with science learning goals, that is scientific literacy. Scientific literacy is the way students use their scientific knowledge to solve the problem in real-world situations (Dewi et al., 2021; Yasir et al., 2022). Students were guided to make various products from the local plant, e.g. banana blossom and mango to make a natural shampoo is an example of an activity which has applied scientific concepts to the real-world problems to train Pancasila Student Profile (Yasir et al., 2022). It is hoped that local wisdom used in P5 can increase the Indonesian scientific literacy index in the upcoming Programme of International Student Assessment (PISA). Using local plants as P4 said can also engaged student in the activity to nurture environmental awareness.

Another participant experience of integrating local wisdom in P5 which is cultivate the local species of orange, Calamansi orange, *Citrus microcarpa*. This citrus species is one of the local plants in the Bengkulu area which contains potential phytochemical compounds to be antioxidants and antibacterials (Lestari, 2023). Beginning with this project, she claimed that her school became the 1st winner, invited to collaborate with the Ministry of Education and famous. This school has the ability to use the potential local wisdom optimally and combine it into educational unit curricula. This project of course in line with science conceptual knowledge. The following is P3 statement which is related to the local wisdom in the school:

> Our school was originally an Adiwiyata school so it was full of orange trees. Then we use the oranges for P5 with an entrepreneurship theme. It turns out that through this program, thank God, yesterday we were able to win 1st place in Semarang City for P5, by selecting the orange cultivation theme. Students start planting until harvesting in one year. And our oranges are also different, namely small Calamansi oranges. Yesterday we were invited to collaborate by the Ministry of Education, and we have participated

> in the exhibition 3 times. The Mayor has also brought our products to the Merdeka Palace. So our product from the P5 results can be introduced to the public. Coincidentally, our school was visited by teachers who were actually driving schools in Kudus. (P3)

One of the other participants stated how she had blended science learning with indigenous knowledge by creating jumputan batik using natural dyes from various flowers or leaves e.g: suplir plant, purple cassava, butterfly pea flowers, and turmeric. According to the participant, this project refers to ecoprint, which uses a variety of natural dyes. Ecoprint is a product of modern society that is oriented towards sustainable development. Vesterinen et al. (2016) stated that giving students the chance to take action is just as important as teaching them social and scientific concepts in order to transform formal education into a game-changer for sustainable citizenship science. Considering that students will eventually make decisions, the role of formal education is critical in fostering socio-scientific connections (Gartaula et al., 2020).

Natural dyes were also used in food coloring techniques by Javanese ethnic to make traditional food. Originally, the natural dyes used in batik or food colouring techniques were indigenous knowledge. Today, the metabolite component in natural dyes is scientifically verified (Gartaula et al., 2020; Sudarmin et al., 2020; Wahyuni et al., 2020). One of the batik factories in Malon, Gunungpati, Semarang, also uses natural dyes (Sudarmin et al., 2020).

Students find it quite exciting, of course, because it allows them to put the scientific concept they have learned into real world practice through teamwork projects. Because of the connection and obligations that indigenous peoples have to the natural world, their wisdom is frequently founded on sacred regard for it (Knudtson & Suzuki, 1992). Therefore, teaching students about indigenous knowledge may enable them to recognize this close relationship between people and the natural world at the forefront of culture (Zidny et al., 2020). This strategy turns science education into a way to preserve the traditions and culture of a specific Indonesian ethnic (Rahmawati et al., 2020; Widiyawati et al., 2022). The following are relevant statement about providing natural dyes as an indigeneous knowledge in science classroom:

> Actually, this content is contextual because it is all around us. They will learn that there are natural dyes in addition to artificial ones. Natural colors are safer and the point is more about the types of dyes. For food coloring, we can make natural dyes from a variety of plants. There are those who bring what they call red flowers. I don't know what they are called. They have Suplir leaves, and there are all kinds of leaves because they bring them. Indeed, I give them independence, basically, they are allowed to bring any flowers in their house and also unique leaves. Then they try it, whether it is good or not. These leaves or flowers produce good colors on fabric, which means one group has many colors but the pattern (batik) is free, depending on their wishes. (P1)

Other participant claimed that she was integrate local wisdom in her classroom through instructional technology. Technology and media combination can be a useful tool to teach students how to handle conflict in real life (Lubis et al., 2022). Thus, Teachers should assign teamwork projects about local wisdom that involve digital technology to solve real-world issues (Widiyawati et al., 2022). Mobile Apps, for example, can be used as a medium to introduce culture or local heritage to students (Mustika et al., 2020). The following are relevant statement about providing digital technology use in science learning:

> At that time, when I was teaching in Solo, for the MCM (Math city map) application I applied local heritage in Solo, namely Kraton Kasunan Surakarta. So I made trails like in the Scout lesson where you look for tracks, for example there is post 1, there is post 2, there is post 3, there is post 4 and so on, so we make the trail like a GPS point. For example, the first trail I asked the students, at that time the science measurement material, was related to measuring how much floor area is in the front yard of the temple at the Surakarta Palace, so the students there learned to measure length times width then later the answers were entered into the MCM application so it was like a game between groups too. (P2)

Contextual Teaching and Learning

Presenting contextual learning, providing regional uniqueness, and avoiding the loss of cultural identity, are the main goals of ethnoscience integrated into science education (Efendi & Muliadi, 2023; Handayani et al., 2018). The P1 stated that local wisdom is able to make a meaningful and contextual teaching and learning. Integrate science projects with daily experiences in students' local community, will impact their critical thinking abilities and conceptual understanding (Idul et al., 2023). Students' conceptual discovery and ability to critically explain phenomena and events were also accommodated by ethnoscience (Amini et al., 2021). These are the P1 statements which are relevant with the contextual teaching and learning:

> Coincidentally, yesterday I tried it, the technique was not using a steamed technique but rather a

> beaten technique because you don't have to use a stove. Actually, this content is contextual because it is all around us. They will learn that there are natural dyes in addition to artificial ones. (P1)

According to Yulianto et al. (2019), contextual learning aims to provide students with knowledge that they can utilize in real-world scenarios and everyday settings. One of the recommended learning strategy to combine with ethnoscience is contextual collaboration learning (Dewi et al., 2021). Science learning is not only about remembering or acquiring content knowledge but also about procedural and cognitive understanding (Kind & Osborne, 2017; Maksić & Spasenović, 2018).

Hence, ethnoscience in the independent curriculum also provides the Pancasila Student Profile. P5 is the co-curricular programme in order to strengthen the Pancasila Student Profile through school projects. Each school have independency to select and design their P5. Each school is allowed to select project themes and activities, for example, integrate with local products or cultures. Science learning should be thaugt in both scientific and contextual in order to help students build their capacity for scientific thought, reasoning, and behavior as well as to provide them with hands-on, relevant experiences (Latifah et al., 2020). The following are participant relevant statements with P5 in contextual teaching and learning:

> So it was improved in the 3rd project, with the theme of a sustainable lifestyle. There were several activity topics, namely one child who made processed food from tofu waste, then made liquid fertilizer from liquid tofu waste and applied it to potted plants, and three children made media from liquid tofu fertilizer which was applied to hydroponics. Children can choose their own activities that suit their interests. Some of these dimensions have the same elements. And these same elements relate to the assessment. (P1)

Conclusion

After conducting in-depth interviews and analysis of the experiences of four science teachers who have implemented ethnoscience in the independent curriculum, it can be concluded that there are four main themes, namely: differentiated instruction, Pancasila Student Profile, Local Wisdom, and Contextual teaching and learning. Science teachers have carried out these key themes in the classroom not only in the learning preparation but also in the process in order of gaining mastery earning. Integrate science projects with daily experiences in students' local community, will impact their critical thinking abilities and conceptual understanding. Ethnoscience in independent curriculum provided through intracurricular nor extracurricular (P5). The relationship between these four themes can provide new information for further research. We recommend to integrate local wisdom and indigenous knowledge in science classes through a differentiated learning approach.

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Author Contributions

Y.W. conceptualization, methodology, writing original draft preparation. D.S.S. data collection, review and editing. I.S.W. validation and vizualitazion. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

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