Macrothink Institute™

International Journal of Education
ISSN 1948-5476
2023, Vol. 15, No. 2

Funds of Knowledge of the Semai Orang Asli Children in Science Learning: A Needs Analysis

Azizah Osman[1], Lilia Halim[1] & Nurazidawati Mohamad Arsad[1,*]

[1]Faculty of Education, Universiti Kebangsaan Malaysia, Malaysia

*Corresponding author: Faculty of Education, Universiti Kebangsaan Malaysia, Malaysia. E-mail: azidarsad@ukm.edu.my

Received: April 18, 2023 Accepted: June 7, 2023 Published: June 20, 2023

doi:10.5296/ije.v15i2.20915 URL: https://doi.org/10.5296/ije.v15i2.20915

Abstract

Malaysia always strives to provide high-performance education for its citizens by emphasising on the principle of equality that prioritises quality education for every child. However, the performance of Orang Asli (indigenous) children in science education is still lagging far behind as a result of their difficulty in understanding scientific concepts of science which they feel are foreign to their culture. Thus, a needs analysis study was conducted to identify the science topics that are the most difficult for primary school year five Semai Orang Asli children to understand and the elements of funds of knowledge (FOK) that can be applied in science teaching for these difficult topics. This needs analysis was conducted using survey research design with interview method. The study sample comprised three students and four teachers in an Orang Asli school in the district of Slim River, Perak. The needs analysis found that Electricity is the most difficult topic to be taught to and understood by the Orang Asli children. In addition, the findings also showed that the elements of FOK of the Orang Asli such as family values, hobbies, parents' occupation, language, religion, tradition and school's co-curricular activities can be applied in science teaching to bring the science concepts that are considered difficult into their lives. In conclusion, the FOK elements identified from the needs analysis are expected to be able to help educators and researchers design science teaching that is more equitable in upholding the principles of equity in education in Malaysia.

Keywords: electricity, equity, funds of knowledge, indigenous, science education

1. Introduction

Science education is important to understand the modern world (DeBoer,1991) and is the trigger of technological development as well as human civilisation. However, the mastery of school students in the subject of science is still seen as unsatisfactory (Nasip & Ong, 2021). This situation is also happening among students from the minority groups (Cooper & Berry, 2020), namely the subgroups of the population with social, religious, ethnic, racial and other characteristics that are unique and different from the characteristics of the majority groups (Perkins & Willey, 2014). Dropout from STEM education among the students from the minority groups is higher compared to non-minority students (Van den Hurk et al., 2019), and this phenomenon is happening globally.

Sawalludin et al. (2020) emphasised that Orang Asli (indigenous people) who are the largest representative of Malaysia's minority groups show low performance and high dropout rates in school compared to the majority groups. This situation is also happening in the aboriginal minority groups in Canada, Alaska, Australia, America (Wood et al., 2017; Barret, 2017) and all over the world (Wilson, 2014; Johnston-Goodstar & Roholt, 2017). In Malaysia, many studies have argued that the lack of interest in continuing their education is the factor that contributes the most to the dropout of Orang Asli children (Singar & Zainudin, 2017; Rahman et al., 2021). From the cognitive perspective, Malaysian Orang Asli children find it difficult to understand teachers' teaching which causes them to be unenthusiastic about learning and do not attend school (Zainal et al., 2022). This explains that Orang Asli children have low performance and participate less in STEM because of their low level of mastery in STEM literacy (McKinley, 2016; Olszewski-Kubilius et al., 2017).

Renganathan (2021) argued that one of the perceptions that was raised based on the analysis of her study is that the representation of the problem relating to the Orang Asli and their education is the perception towards the Orang Asli's culture. Their culture, identity and traditions are often seen as incompatible with the mainstream education. Therefore, the competency and knowledge of educators about the culture and practices of Orang Asli need to be improved in the effort to apply the culture and practices of Orang Asli in teaching and learning in school (Zidny et al., 2020; Harrison & Skrebneva, 2020; Smith et al., 2021). This is in line with the views of previous researchers who found that culture can shape learning (Ladson‐Billings, 2006), motives and interests of students (Llopart & Esteban-Guitart, 2016).

Therefore, based on the principle of equity in the Malaysian education system, the teachers at Orang Asli schools need to be given the opportunity to develop knowledge and skills related to the approach that is based on the life and culture of the students, and subsequently include it in their teaching (Moll, 2019; Ramos & Kiyama, 2021). Even though the Science curriculum has been designed well and carefully, science education has often been said to be unrelated and distinct or foreign from the lives of the students, especially rural students, which ultimately makes them less interested and become low achievers in Science (Sabudin & Halim, 2020). Various approaches are taken to increase the interests of Orang Asli children towards science. Among these include using simple Malay language and simple sentences in

the teaching and learning of science. However, this method makes the Orang Asli low achieving students (Meerah & Halim, 2012). A better approach to bind Science in the Orang Asli children is by including FOK in Science learning where the teachers can take advantage of knowledge and experience by bringing in their lives into the classroom to make the learning more meaningful.

Thus, the aim of this study to carried out a needs analysis to answer the following research questions:

(i) What are the most difficult Science topics for year five Orang Asli children to learn?

(ii) What are the elements of Orang Asli FOK that can be integrated into the teaching and learning Science for the topic identified as difficult for year five Orang Asli children?

In general, needs analysis is the activities involved in the gathering of information that will be the basis for developing a curriculum that will fulfil the needs of a specific group (Singhori, 2008) and to refine the intervention and evaluate its acceptability and feasibility (Smith et al., 2022). Using the Pedagogical Needs Analysis model proposed by West (1994), the weaknesses found in the target group obtained from the needs analysis should be balanced and compensated for by collecting data about the learners and the learning environment.

2. Literature Review

2.1 Science Education of Indigenous People

Indigenous people all around the world face multiple threats to their ancestral territories, their cultures, beliefs and languages. These threats include agro-industrial development, extractive industries and rapid infrastructure development (Cosentino, 2016). Education is needed to ensure the survival and delivery of knowledge while simultaneously reflecting their ongoing struggle for equality and respecting their rights as citizens and individuals (Matengu at al., 2018). Therefore, UN's Declaration on the Rights of Indigenous Article 14 that states indigenous people have the right to establish and manage educational institution systems that provide education in their own language, in a manner that is appropriate to their culture (Rosnon & Talib 2019; Oxtero, 2022).

In the context of Malaysia, the Education of Orang Asli is an agenda that is always emphasised by several parties particularly the government (Nordin & Wahab, 2021). Nevertheless, based on the Twelfth Malaysia Plan, 2021-2025 (RMK-12), it was found that the number of Orang Asli children and students who live in remote areas who have completed their schooling and furthered their education at the tertiary level is low. Several factors contribute to the Orang Asli to not fully accept the changes that are happening in the context of education in this country. Among these are their shy nature that makes the process of teaching and learning difficult (Abdullah et al., 2013), lack of motivation to excel and ease to forget (Shaari et al., 2011), not take education as a serious matter and having the tendency to skip school to the effect that they fail to master the 3R (reading, 'riting and 'rithmetic)

skills which in turn inhibits their interests in other subjects (Talib & Muslim, 2007), having a care-free lifestyle without rules and regulations as well as having no time management skills (Yusof & Tahir, 2017), parents not spending enough time to show concern about their children's education, and only expecting that their children are able to read and having a little bit higher education than them (Awang et al., 2022; Baxter & Meyers, 2021).

Additionally, study by Nordin et al. (2020) found that the government's efforts through the Ministry of Education (MOE) and the Department of Orang Asli Development (JAKOA) namely the Aboriginal Education Transformation Plan (PTPOA) that was conducted from 2013 to 2017 have failed to achieve its goals in terms of mastery of literacy and numeracy as well as the formation of positive attitudes towards lifelong education. Among the factors of this failure is the recognition of culture, knowledge, language, and history of the Orang Asli which was not stated explicitly and was not highlighted when developing the existing syllabus. This resulted in the mainstream education system to become isolated from the real life of the Orang Asli. Therefore, education system that is more friendly and in line with the lives of the Orang Asli should be develop. This is because the potential of the Orang Asli in education is closely related to their ability to learn in a culturally and linguistically friendly environment that is under their own control and free from discrimination. This finding is supported by Jin (2021) who asserted that even though the Science curriculum has been well and carefully designed, Science education is often said to be out of sync with the lives of the Orang Asli and makes them feel isolated, which further diminishes their interest in science.

In this regard, the education of the minority groups and the Orang Asli needs to emphasise a curriculum that is relevant with the context of their real life in order to ensure a high level of learning motivation (Sarimin & Rahman, 2018). In addition, other researchers also argued that educators need to apply culture and FOK in the education of minority groups and the Orang Asli (Upadhyay et al., 2020; Zidny et al., 2021) because Science education cannot be separated from history, culture and the world view of a society (Handayani et al., 2019). In conclusion, FOK facilitates minority and Orang Asli children to go through a more meaningful learning process because their culture and way of life are different from the community.

2.2 Science Education of Indigenous People

Funds of Knowledge (FOK) have been defined as a collection of bodies of knowledge and skills that is accumulated and developed from history and culture that are essential for the wellbeing of the household or individual functioning (Moll et al., 1992; Wilson-Lopez et al., 2016). In short, FOK is a knowledge and skills that are developed from daily life experience.

Previous studies have found that indigenous people are more appreciative of Science curriculum integrated with FOK and are motivated to expand knowledge and enjoy science learning from the perspective of the indigenous culture (Fakoyede & Otulaja, 2020; Ricci & Riggs, 2019; Mills et al., 2019). Additionally, science learning that is based on culture has also enhanced the confidence and self-efficacy of indigenous students in learning and applying science in their life as well as expanding their involvement in science and STEM (Miller & Roehrig, 2018). At the same time, McKnight (2016) argues that in an effort to

embed the indigenous people's perspective in the curriculum, academics need to therefore apply the FOK of indigenous people. This is supported by a five-year study conducted between 1999 to 2004 by Richards et al., (2008), involving 366 public schools in 43 districts in British Columbia, Canada which found that indigenous students increased their achievements when the content and context of indigenous people are implemented in the policy design, followed by the implementation of the curriculum and performance measurement.

Additionally, the study by Borgerding (2017) as well as Irish and Kang (2018) found that teachers apply FOK in teaching by building opportunities for students to discuss topics related to their interests and creating space for the students to share their FOK. The 16-day case study by Borgerding (2017) on the teaching of the topic of Evolution in the subject of Biology involved a science teacher and high school students had found that the teacher used three FOK approaches. First, the teacher strategically placed himself among the students with their beliefs, where he constantly mentioned "scientists say that" in teaching the concept of evolution. Second, the teacher provided the students opportunities to share their views about the concept of evolution based on their religious knowledge. Third, the teacher served as a "guide" who connects the students' religious knowledge with the concept of evolution in the biology class at school.

Meanwhile, Ali and Hashim (2023) have listed a few strategies to take advantage of students' FOK in Science education. Among these include teachers interacting with students and their family or organising trips to learn more about the students' home life and interests. Teachers also need to be open minded by giving opportunities for students to share their cultural experience. By doing so, the students in minority groups who are often marginalised will have the opportunity to showcase themselves by sharing their special skills and abilities with their peers and teachers which will in turn develop the students' scientific communication skills and self-confidence.

As a conclusion, the education of indigenous people requires an approach that is more friendly towards their life, culture and environment. This is also surmised by Morrison et al. (2019) in their study where they asserted that the education of indigenous people requires teachers who integrate knowledge about teaching strategies that are responsive to the learning strengths and needs of students from various linguistic, cultural, religious and socioeconomic background. Thus, this needs analysis was conducted to help educators design Science teaching that applies the FOK of Orang Asli children.

3. Method

This needs analysis study was carried out using qualitative research based on an ethnographic research design. The data were collected through interview and document analysis (ranking form) to explore life experience and cultural identity related to funds of knowledge (FoK) and science difficulties in teaching and learning from informants (teachers) and respondents (Semai Orang Asli children).

3.1 Sample

Four teachers who were working at Orang Asli elementary school at Slim River, Perak Malaysia were selected as the informants. Meanwhile three Orang Asli children Year Five from Semai ethnic group were selected as a respondent.

3.2 Instrument

This needs analysis employed two types of instruments: (i) ranking form document, and (ii) semi-structured interviews.

3.2.1 Ranking Form

The ranking form is a question response format that is used to identify the level arrangement of difficulty of topics in science either in teaching or learning. In this study, the ranking form was forwarded to all teachers and students during the interview session. This ranking form contained two questions, namely:

(i) Which year five science topics are the most difficult for teachers to teach?

(ii) Which year five science topics are the most difficult for students to understand?

3.2.2 Semi-structured Interviews

Semi-structured interview was implemented to give freedom to the informants and respondents in exploring their understanding and experience about science topics and identify the FoK elements of Orang Asli children. To obtain detailed information, the researcher elicited data from the participants using interview's skills and techniques such as inquiry, interpretation and stimulation. The protocol interview was divided into two sections namely: (i) chidren profile related to their attendance to explore any hard-core truancy, involvement of students in co-curricular activities and family background, (ii) Children FoK such a language, traditional games, festivals celebrated, religion and belief and other possible FoK elements.

3.3 Method of Data Collection and Analysis

The process of data collection began with applying for permission to do the research from the Education Policy Planning and Research Division (BPPDP), Ministry of Education and Perak State Education Department. After received the approval letter, researcher contact the headmaster of a selected school to get the agreement to do the research. After obtaining positive feedback, researchers interviewed the teachers and children based on the interview protocol that had been verified by experts. Before the interview, a consent note was given to the participants. Finally, the audio data from the interviews and ranking form responses were transcribed and analysed thematically to answer the research questions.

4. Results and Discussion

This section presents the results and discussion of the needs analysis study from the ranking forms responses and interviews to answer the following research questions.

4.1 Research Question 1: Which science topics (year five) are the most difficult for teachers to teach and most difficult for children to understand?

Based on the ranking result in Table 1, the topic that was the most difficult to teach by teachers and the most difficult for students to learn is Electricity.

Table 1. Ranking of Year Five Science Topics Based on Level of Difficulty

Topics in Year Five Science	Question 1 The following topics are the most difficult for teachers to teach	Question 2 The following topics are the most difficult for students to understand
Electricity	1	1
Phases of the Moon and Constellations	2	2
Matter	3	3
Machines	4	4
Heat	5	5
Rusting	6	6
Humans	7	7
Scientific Skills	8	8
Plants	9	9
Animals	10	10

Initially, the teachers thought that all the topics were difficult for the students to understand except for the topic on animals. In the end, the teachers selected Electricity as the most difficult topic for the students to understand.

"*If considered, for these students, all topics are difficult. It's just that the most difficult would be the topics on Moon and Constellation, Electricity, Density...maybe because these things are too remote from their lives, they do not see often*." (Teacher Syed)

"*The ones seen as easy for them to understand, topic on animals. Other topics definitely difficult for them to understand. But if the researcher wants to help, I ask please refer to the topic on Electricity...indeed really difficult to make them understand series and parallel circuits*." (Teacher Hafiz)

"*...the most difficult, the one that has calculations, Moon and Constellations. Electricity is difficult too...*" (Teacher Zul)

The results of the analysis on the questionnaire and interview data clearly show that the most difficult topic is Electricity. The topic is difficult to the Orang Asli children to understand perhaps due to the factor of the students' family background as they have minimal electrical appliances at home. Although the findings showed two most difficult topics were Electricity and Phases of the Moon and Constellations, the participant stills select the topic of electricity

as the highest difficulties ranking. This is consistent with Nasip & Ong (2021) who found that elementary science teachers believe that third to sixth grade topics, which include electricity, are difficult to teach. This is confirmed by Preston et al. (2022), who discovered that challenging science topics for T&L in elementary school are related to abstract concepts such as electricity, and this concept was included in the Malaysian elementary school science curriculum. Preston et al. (2022) also reported that learning activities for fundamental electrical concepts, such as building circuits, appear uncomplicated but are difficult for children to grasp. Gill et al. (2011) and Rosnon et al. (2019) reported that Orang Asli children find it difficult to comprehend the topic of electricity, which may be due to the fact that their families have few electrical appliances.

Therefore, Van Leeuwen (2005) suggested that a different approach must be used to explain something that is not visible to the naked eye in order to promote understanding of science concept such as electricity (Jusoh & Ishak, 2022). Therefore, science teachers need to enlist the help of experts to find the appropriate method or approach for teaching and learning about electricity for elementary students (Summers et al., 1998). In addition, students' science knowledge needs to be reinforced in their own environment and culture in elementary school (OECD, 2012).

4.2 Research Question 2: What are the FOK elements of Orang Asli children that can be applied in science teaching and learning?

Based on the interviews conducted, there are six elements of Orang Asli children FOK that could be applied in science teaching and learning which were family values, language, hobbies and interests, parents' occupation, religion and tradition as well as co-curricular activities in school. These findings are consistent with previous research in identifying FOK elements (Llopart & Estaban-Guitart, 2016).

4.2.1 Family Value

The Semai Orang Asli children in the study location have close relationship with their family members and have been raised to help their parents in daily activities at home such as taking care of their younger siblings or accompanying their parents at work.

"*The boys who are older, like five to six years old always follow their father to climb the petai (stink bean) trees, catch fish.*" (Teacher Da'an)

"*Mother does not allow bathing in the river...catch fever. Mother told me to stay at home, do schoolwork, take care of younger siblings*." (Student: Marta)

"*Play slingshot, ball, 'kelereng'...but must bring little brother along*." (Student: Yok Lenes)

4.2.2 Language

The Semai Orang Asli children at this study location use the Semai language at home or when interacting with their friends at school. They only speak in the Malay language when communicating with their teachers. They love it and are excited when the teachers try to use a few Semai language while teaching them.

"*...sometimes we just use a few Semai words when teaching Science, they like it...like very proud when we try to teach them in the Semai language*." (Teacher Syed)

"*They understand Malay language, but sometimes they like it when we try to speak in Semai while teaching*." (Teacher Hafiz)

"*Like it...sometimes the teachers do ask me, what is tiger in the Semai language? What is durian in the Semai language? I like it...I feel if I learn Science in the Semai language perhaps I would understand faster*." (Student: Marta)

4.2.3 Hobby and Interest

From the interviews it was also found that there is a house near the study location that provides musical instruments like guitar, bass guitar, and drums for use of the teenagers and youths during their free time.

"*They're not so traditional anymore. Even the music no longer played with those from bamboos. They have a band...in the evening, the youths here play music at this one house, the owner of the house provides and let them play every day*." (Teacher Syed)

"*For entertainment, they really love to dance, sing. If there is a wedding ceremony, they dance from night until morning...small, big, old, young people, everybody joins. A band comes to play music, if there is no band, they use the PA System like karaoke, they dance, not 'sewang'. Here, sewang is only used for medicinal purposes. If a VIP comes, haa... that's when they'll dance the 'sewang'*." (Teacher Da'an)

Apart from singing and dancing, the students also love playing in the evenings after school hours, similar to other children in general. The only difference is that the Orang Asli children here are inclined towards traditional games like swimming in the river, *kelereng*, slingshots, and guns made from wood as well as playing tag.

"*After school, the students they play. Bathing in the river, swimming. The Semai people have no special games. Play like normal village children. Slingshots, wooden guns with pellets made from pea eggplant, after that play tag, play kelereng where they push the wheels, boys, girls, all the same*." (Teacher Hafiz)

"...bathing and swimming in the river. Not deep, until here only (while pointing to chest level)." (Students: Yok Lenes and Raslan)

Based on this findings, Orang Asli Children prefer to learn in a stress-free atmosphere and enjoy entertainment-based activities. This is in line with McGee (2020) who stated that most Orang Asli have a free lifestyle without the constraints of rules however lacking in time management skills related to education.

4.2.4 Family's Economic Situation and Parents' Occupation

In terms of family economics, it was found that most of the parents of the students in this study location work as farmers either at their own farm or working for wage at other people's farm. However, during certain seasons, they still continue with their traditional work such as collecting forest produce (*petai* and rattan) as well as catching fish and other animals for food.

Nearly all of them get supplies of clean water supply and electricity at home, either from the electrical substation or solar panel or generator. The electrical appliances at each home are limited to the basic needs only which are fans and lights. In addition, basic need of food is limited to the sources that are available in their surroundings. Nonetheless, the younger generation of the Orang Asli already know about searching for their needs outside their area such as at the night market, grocery stores or the towns nearby.

"*Most of their parents work cutting palm trees, some also take care of durian farms or chilli farms...*" (Teacher Syed)

"*Their jobs are not permanent. When it is the durian, they work for a wage taking care of the durian farm. When the petai season comes, they look for petai*." (Teacher Da'an)

"*These students are all B40. They get RMT. Water supply, electricity are available for those living near the main road only, like us...they get their electricity supply from TNB. The ones further inland, they use solar panels or generators. Coming to school with wrinkled clothes is normal...because they do not have irons at home. Only basic electrical appliances are available at home, like fans, lights...If TV only two or three people have it. Other electrical items, even though they do not have it at home, but they have seen them...at big towns or night markets. They do go to night markets...buy ice-blended, pizza...so they see the sellers using blenders, ovens. At the grocery store, when buying ice-cream, it's common opening and closing the fridge. Most electrical appliances they see at school. Projector, TV laptop, microphone, speakers. They know that they shouldn't turn on the appliances with wet fingers, shouldn't put many plugs in one socket...We teach them when leaving the classroom, they must turn off all lights, fans*." (Teacher Hafiz)

"*My mother doesn't work. My father works at tauke's durian farm. Sometimes my brother follows my father to take care of the durian farm. If they river water dries, they go and catch fish. Even vegetables my mother picks from around the house...tapioca leaves*." (Student: Marta)

"*At home, we use the generator. Only have fans and lights, but no TV, no iron*."

(Student: Raslan)

The FOK elements from this finding commonly describe the lives of Orang Asli children, and they are consistent with the findings of Bedggood et al. (2017), who discovered that most indigenous people have only basic electrical appliances such as bulbs, and other appliances such as stoves and refrigerators are limited. However, children are accustomed to seeing and utilising them without completely comprehending the importance of safety and energy conservation (Molina et al., 2018). The element of FoK can be used by the teacher to explain the topic of electricity. For example, the electricity sources in some students' homes are solar panels and generators, which gives them prior knowledge that there are many other sources of electricity that do not only come from electrical substations. Furthermore, students learn how to operate electrical appliances at home, school, the supermarket, and the night market, as well as certain safety considerations, such as not touching the switch with damp hands and not connecting too many cords to one outlet.

4.2.5 Religion and Tradition

Genggulang Day but prefers to like to celebrate Christmas despite not professing the religion and there are a few who are Muslims. They greatly respect their village chief who is the *Tok Batin* and their shaman known as *Tok Dalaq*. Dark magic (*sewang gelap*) is still practised to cure illnesses. Additionally, they also celebrate the *genggulang* festival at the beginning of every year which starts with a feast during the day and ends with singing and dancing throughout the night until dawn. The same things take place when there is a wedding ceremony.

"*Most of them have no religion. At this school, there are only three students who are Muslims. But even though they have no religion, they like to celebrate Christmas, put on fairy lights, Christmas tree but they don't even go to church*." (Teacher Syed)

"*They celebrate the 'Genggulang' Day, eating, dancing. They really respect the 'Tok Batin' and 'Tok Dalaq'. It's like whatever the 'Tok Batin' or 'Tok Dalaq' say, they follow*." (Teacher Da'an)

Religion? Emm...(shaking her head indicating not knowing)." (Student: Marta)

The element of custom and culture in this finding does not seem to be related to the scientific topic being taught, electricity. However, it can be used to create hybrid spaces in learning activities that help students better understand scientific concepts. This is consistent with Zhou (2012) who found that using Buddhist beliefs about ghost and rebirth in creating a hybrid space in science teaching and learning resulted in students better understanding the science concepts presented by the teacher.

4.2.6 Cocurricular Activities in School

The interviews revealed that the Orang Asli children in the study location are active in sports and enjoy school programmes in the form of entertainment or those that give presents or food.

"*They are very active in sports. They represent the state in rugby, but only among the Orang Asli schools. During the sports season, many of the school's teachers take the sports students out, in fact for almost a month*." (Teacher Hafiz)

"*If it's normal days, many students don't show up...If you want to see all of them come, it's during Eid celebration, if not during sports day...They will come for PTA meetings, but have to organise raffles, food, presents, entertainment because they have the concept of 'tenukar arap'...everything that they do, there must be a reward in the form of goods or food.*" (Teacher Da'an)

This FOK elements can be applied in teaching particularly in student activities like problem solving questions that provide situations related to FOK, as well as dialogues and instructions in the worksheet that create a hybrid space in the science classroom. For example, while teaching the topic of electricity, the teacher gives a problem situation by asking the students to help *Tok Batin* choose the most suitable light arrangement to be installed in *balei mondeq* (the dance hall) during the *Genggulang* festival. In this context, a hybrid space appears when

the teacher and students in the school environment create a new space that combines the science classroom space with the *balei mondeq* space. Thus, this new space is described as a hybrid space as it brings together the various prior knowledge of the student and generates new knowledge that breaks down misunderstanding towards a concept in learning.

Orang asli children show feelings of happiness and pride when the teachers ask them about their life or culture (Waddington, et al., 2021). Thus, FOK elements need to be integrated in Science T&L so that students are more attracted and actively involved in all the T&L activities carried out. This has been proven by Tzou et al. (2019) and Lleopart and Estaban-Guitart (2016) who found that the approach of including students' experience and culture in the classroom can help them to understand the concepts of science and enjoy the process of learning science.

5. Conclusion

Overall, this study provided input about difficult topics, as well as learning needs analysis that provided information about the FOK that can be applied in the teaching of science, giving a direct implication on the development of science teaching module on the topic of electricity. In addition, the findings of this study also have implications on the findings from previous FOK studies, where this study lists new ideas in FOK which are activities in school such as cocurricular activities that can help the teaching and learning of science. Even though the findings from this needs analysis are limited to the topic of electricity, however it can be benefited to the educators in developing the intervention based on this topic whereas culture can be utilised to bring science closer to Orang Asli children in helping them to understand the scientific concepts that engage with their life experience. Other limitation was this study was focus on *Semai* Orang Asli children in Perak state only. Future research in the area can be expanded by investigating the FOK of Orang Asli children from other *Senoi* sub-ethnicities such as the *Jahut, Che Wong, Mahmeri, Semoq Beri* and *Temiar* as well as two other Orang Asli ethnicities, namely the *Proto Malay* and *Negrito* who are scattered throughout the Peninsular Malaysia. Finally, this study hopefully can give advantages to the science curriculum developers to plan the best curriculum and pedagogic content for Orang Asli children to ensure equity in education for all Malaysian citizens.

Acknowledgments

This study was financially supported by STEM Enculturation Research Centre, UKM and the Program STEM dan Minda (GG-2022-004) under RMK-11 STEM Program fund.

References

Abdullah, R., Wan Mamat, W. H., Amir Zal, W. A., & Ibrahim, A. M. (2013). Teaching and Learning Problems of The Orang Asli Education: Student's Perspective. *Asian Social*

Science, *9*(12), 118-124. https://doi:10.5539/ass.v9n12p118

Ali, M. N., & Hashim, H. (2023). The Role of Funds of Knowledge in Culturally Responsive Science Pedagogy. In Lilia Halim, Murni Ramli & Mohd Norawi Ali (Eds.), *Culturally Responsive Science Pedagogy in Asia Status and Challenges for Malaysia*, Indonesia and Japan (pp.56-74). Routledge.

Awang, M. A., Khairuddin, K. H., Ahmad, A. R., Ghani, S. A., Wahab, J. L. A., & Raja Mamat, R. M. S. R. (2022). School Absenteeism: Contributing Factors, Activities during Truancy and Learning Culture Aspiration among Native Pupils. *Malaysian Journal of Learning and Instruction*, *19*(1), 227-308. https://doi.org/10.32890/mjli2022.19.1.10

Bedggood, R., Perenyi, A., Meyer, D., Farquharson,K., Johansson,C., Bedggood, P. & Milgate,G. (2017). The Living Conditions Of Aboriginal People In Victoria. *International Conference on Improving Residental Energy Efficiency, IREE 2017, 121*. 278 – 283.

Borgerding, L. A. (2017). High school biology evolution learning experiences in a rural context: A case of and for cultural border crossing. *Cultural Studies of Science Education*, *12*(1), 53-79. https://doi.org/10.1007/s11422-016-9758-0

Cooper, G., & Berry, A. (2020). Demographic predictors of senior secondary participation in biology, physics, chemistry and earth/space sciences: students' access to cultural, social and science capital. *International Journal of Science Education, 42*(1), 151-166. https://doi.org/10.1080/09500693.2019.1708510

Cosentino, G. (2016, August 9). Indigenous peoples have a right to quality education. But so far, we've failed them. *World Economic Forum*. Retrieved from https://www.weforum.org/agenda/2016/08/indigenous-people-have-a-right-to-qualityeducation-but-so-far-we-ve-failed-them/

Deboer, E. G. (1991) *A History of Ideas in Science Education: Implication for Practice*. Teacher Collage Press, New York.

Fakoyede, S. J., & Otulaja, F. S. (2020). Beads And Beadwork as Cultural Artifacts Used In Mediating Learners' Agentic Constructs In Science Classrooms: A Case For Place-Based Learning. *Cultural Studies of Science Education*, *15*(1), 193-210. https://doi.org/10.1007/s11422-019-09911-4.

Gill, S. S., Rosnon, M. R., Redzuan. M., Abdullah, H., & Ahmad, N. (2021). Penggunaan Barangan Dan Perkhidmatan Mewah Serta Pengurusan Kewangan Dalam Kalangan Belia Orang Asli Di Semenanjung Malaysia. *Malaysian Journal of Youth Studies* (4), 126 - 132.

Handayani, R. D., Wilujeng, I., & Prasetyo, Z. K. (2018). Elaborating Indigenous Knowledge in the Science Curriculum for the Cultural Sustainability. *Journal of Teacher Education for Sustainability*, *20*(2), 74-88. https://doi.org/10.2478/jtes-2018-0016

Harrison, N., & Skrebneva, I. (2020). Country As Pedagogical: Enacting an Australian

Foundation for Culturally Responsive Pedagogy. *Journal Of Curriculum Studies*, *52*(1), 15-26. https://doi.org/10.1080/00220272.2019.1641843

Irish, T., & Kang, N.-H. (2018). Connecting classroom science with everyday life: Teachers' attempts and students' insights. *International Journal of Science and Mathematics Education, 16*(7), 1227-1245. https://doi.org/10.1007/ s10763-017-9836-0

Jin, Q. (2021). Supporting Indigenous Students in Science and STEM Education: A Systematic Review. *Education Science, 11*, 555-570. https://doi.org/10.3390/educsci11090555

Johnston-Goodstar, K., & Roholt, R.V. (2017). Our Kids Aren't Dropping Out; They're Being Pushed Out: Native American Students and Racial Microaggressions in Schools. *Journal of Ethnic & Cultural Diversity in Social Work*, *26*(1-2), 30-47. https://doi.org/10.1080/15313204.2016.1263818

Jusoh, M., & Ishak, N. (2022). Potensi Integrasi Model Pemikiran Reka Bentuk Bersama Terapi Tingkah Laku Kognitif Dalam Modul Intervensi Topik Elektrik Sekolah Rendah Di Pulau Pinang. *International Journal of Education, Islamic Studies And Social Science Research, 7*(1), 31-42.

Ladson-Billings, G. (2006). From the Achievement Gap to the Education Debt: Understanding Achievement in U.S. Schools. *Educational Researcher*, *35*(7), 3-12. https://doi.org/10.3102/0013189X035007003

Llopart, Mariona & Esteban-Guitart, Moisès. (2016). Funds of knowledge in 21st century societies: inclusive educational practices for under-represented students: A literature review. *Journal of Curriculum Studies*, *32*(1), 1-17. https://doi.org/10.1080/00220272.2016.1247913

Matengu, M., Korkeamäki, R. L., & Cleghorn, A. (2019). Conceptualizing meaningful education: The voices of indigenous parents of young children. *Learning, Culture and Social Interaction, 22*, 1-9. https://doi.org/10.1016/j.lcsi.2018.05.007

McGee, E.O. (2020). *Black, Brown, Bruised: How Racialized STEM Education Stifles Innovation*. Harvard Education Press.

McKinley, E. (2016, August 08). STEM and Indigenous Learners [Paper presentation]. *Research Conference 2016 - Improving STEM Learning: What will it take?* Retrieved from https://research.acer.edu.au/research_conference/RC2016/8august/1

McKnight, A. (2016). Meeting Country and Self to Initiate an Embodiment of Knowledge: Embedding a Process for Aboriginal Perspectives. *The Australian Journal of Indigenous Education*, *45*(1), 11-22. http://dx.doi.org/10.1017/jie.2016.10

Meerah, T. S. M., & Halim, L. (2012). *Science teaching and learning for marginalized students*. National Library Board.

Miller, B. G., & Roehrig, G. (2018). Indigenous cultural contexts for STEM experiences:

snow snakes' impact on students and the community. *Cultural Studies of Science Education*, *13*, 31-58. https://doi.org/10.1007/s11422-016-9738-4

Mills, K., Bonsignore, E., Clegg, T., Ahn, J., Yip, J., Pauw, D., Cabrera, L., Hernly, K., & Pitt, C. (2019). Connecting Children's Scientific Funds of Knowledge Shared on social media To Science Concepts. *International Journal of Child-Computer Interaction*, *21*, 54-64. https://doi.org/10.1016/j.ijcci.2019.04.003

Molina, E., Candelo-Becerra, J. E., & Ojeda-Camargo, E. (2018). Understanding Electricity Saving Behavior of Rural Indigenous Communities in La Guajira Department, Colombia. *Journal of Engineering Science and Technology Review*, *11*(6). 47-53. https://doi.org/10.25103/jestr.116.07

Moll, L. C. (2019). Elaborating Funds of Knowledge: Community-Oriented Practices in International Contexts. *Literacy Research: Theory, Method, and Practice, 68*(1), 130-138. https://doi.org/10.1177/2381336919870805

Moll, L. C., Amanti, C., Neff, D., & Gonzalez, N. (1992). Funds of knowledge for teaching: Using a qualitative approach to connect homes and classrooms. *Theory into practice*, *31*(2), 132-141.

Morrison, A, Rigney, L-I, Hattam, R., & Diplock, A. (2019). *Toward An Australian Culturally Responsive Pedagogy: A Narrative Review of The Literature*. University of South Australia. https://doi.10.13140/RG.2.2.13031.52641

Nasip, A. M., & Ong, E. T. (2021). 5E Inquiry-Based Teaching Module for Primary School Science Teachers: A Need Analysis. *Review of International Geographical Education Online*, *11*(4).

Nasip, A.M., & Ong, E.T. (2021). Pandangan Guru Terhadap Tahap Kesukaran Topik-Topik Sains Tahun Satu. *Jurnal Ilmi*, *11*(1), 26-33.

Nordin, N. A., & Wahab, N. A. (2021). Concept Paper on the Development of a Forest School Module Based on Indigenous Knowledge to Maintain the Sustainability of the Orang Asli Community. *Jurnal Pendidikan Asian*, *1*(1), 10-21. https://doi.org/10.53797/aspen.v1i1.2.2021

Nordin, R., Hassan, M. S., Fern,V. W. R., Cherley, M., & Subramaniam, L. B. (2020). Indigenous Education for The Orang Asli: Legal Perspectives and Best Practices. *Journal of Nusantara Studies*, *5*(2), 365-383. http://dx.doi.org/10.24200/jonus.vol5iss2pp365-383

Olszewski-Kubilius, P., Steenbergen-Hu, S., Thomson, D., & Rosen, R. (2017). Minority Achievement Gaps in STEM: Findings of a Longitudinal Study of Project Excite. *Gifted Child Quarterly*, *61*(1), 20-39. https://doi.org/10.1177/0016986216673449

Organisation For Economic Co-Operation and Development OECD. (2012). *Creating Effective Teaching And Learning Environments: First Results from TALIS*. OECD Publishing.

Oxtero, I. A. (2022). Implementation Of Indigenous People (IPEd) Program In Agusan Del Sur: A Case Study. *Asian Journal of Research In Education And Social Science*, *4*(2), 76-90. https://doi.org/10.55057/ajress.2022.4.2.8

Perkins, K., & Wiley, S. (2014). Minorities. *Encyclopedia of critical psychology*, 1192-1195.

Preston, C. M., Hubber, P. J., & Xu, L. (2022). Teaching About Electricity in Primary School Multimodality and Variation Theory as Analytical Lenses. *Research in Science Education*, *52*, 949-973. https://doi.org/10.1007/s11165-022-10047-9

Rahman, M. N. A., Alias, N., DeWitt, D., & Rahman, A. (2021). Home Based Education Programme for Orang Asli Children: An Analysis of Their Educational Needs. *Perspektivy Nauki I Obrazovania - Perspectives of Science and Education*, *49*(1), 329-337. https://doi.org/10.32744/pse.2021.1.23.

Ramos., D & Kiyama, J. M. (2021) Tying it All Together: Defining the Core Tenets of Funds of Knowledge. *Educational Studies*, *57*(4), 429-449. https://doi.org/10.1080/00131946.2021.1904932

Renganathan, S. (2021). Exploring The Relationship Between Home-School Language And Literacy Practices Of Minority Indigenous Children From Underprivileged Background. In Chong, S. L. (Ed.), *Charting An Asian Trajectory For Literacy Education: Connecting Past, Present And Future Literature*. (pp 20-37). Routledge.

Ricci, J. L., & Riggs, E. M. (2019). Making A Connection to Field Geoscience for Native American Youth Through Culture, Nature, And Community. *Journal of Geoscience Education,* *67*(4), 1-18. Retrieved from https://dx-doi-org.eresourcesptsl.ukm.remotexs.co/10.1080/10899995.2019.1616273

Richards, J., Hove, J., & Afolabi, K. (2008, June). *Explaining the Aboriginal-non-Aboriginal gap in student performance in BC schools.* In Annual Meeting of the Canadian Economics Association, University of British Columbia, Vancouver, BC.

Rosnon, M. R., & Talib, M. A. (2019). Indigenous Education Rights: The Malaysian Case. *International Journal of Academic Research in Business and Social Sciences, 9*(10), 149-167. http://dx.doi.org/10.6007/IJARBSS/v9-i10/6470

Rosnon, M. R, Gill, S. S., Zainal Badari, S. A., W Ab Rahman, N. A, & Goh, A. D. H. (2019). Petunjuk Pembangunan Komuniti Orang Asli: Suatu Analisis Penggunaan Barangan Dan Perkhidmatan. *Malaysian Journal of Society and Space*, *15*(1), 132-146. https://doi.org/10.17576/geo-2019-1501-10

Sabudin, G., & Halim, L., (2020). A Systematic review: Teaching approaches and the impact of Funds of Knowledge in science learning. *Jurnal Pendidikan Sains Dan Matematik Malaysia*, *10*(1), 21-38. https://doi.org/10.37134/jpsmm.vol10.1.4.2020

Sarimin, A. H. A., & Rahman, S., (2018). The perception of indigenous students towards the curriculum and relevance in life. *E-Prosiding Persidangan Antarabangsa Sains Sosial Dan Kemanusiaan*, 105-124.

Sawalludin, A. F., Jia Min, C. L., & Mohd Ishar, M. I. (2020). The Struggle of Orang Asli in Education: Quality of Education. *Malaysian Journal of Social Sciences and Humanities (MJSSH), 5*(1), 46-51. https://doi.org/10.47405/mjssh.v5i1.346

Shaari, A. S., Yusoff, N., Ghazali, M. I., & Dali, M. H. (2011). Kanak-Kanak Minoriti Orang Asli di Malaysia: Menggapai Literasi Bahasa Melayu. *Jurnal Pendidikan Bahasa Melayu, 1*(2), 59-70.

Singar, S. N., & Zainudin, A. (2017). Exploring The School Dropout Factors Among Indigenous Student in Melaka. *Journal Of Administrative Science Special Edition: Socio-Economic Issue*, *14*(3), 1-13.

Singhori, M. H. (2008). Introduction to Need Analysis. *English For Specific Purposes World,* (4), 1-25.

Smith, G. F., Jung, H., & Zenker, F. (2022). From Tas-Based Need Analysis To Curriculum Evaluation: Putting Methodological Innovations To The Test In An English For Academic Purposes Program. *English For Scepcific Purposes, 66*, 80-93. https://doi.org/10.1016/j.esp.2022.01.001

Smith, J. A., Gupta, H., Moore, S., Fleay, J., Stahl, G., Uink, B., Harvey, A., Radoll, P., Hill, B., Bennett, R., Vigona, J., & Merlino, A. (2021). *Higher Education Aspirations, Participation, and Achievement of Australian Indigenous Males (Final Report).* Darwin: Menzies School of Health Research.

Summers, M., Kruger, C., & Mant, J. (1998). Teaching Electricity Effectively in The Primary School: A Case Study. *International Journal of Science Education*, *20*(2), 153-172. https://doi.org/10.1080/0950069980200203

Talib, J., & Muslim, N. (2007). How do Orang Asli children fail at school? *MALIM: Jurnal Pengajian Umum Asia Tenggara*, *8*, 51-76.

Tzou, C., Bang, M., & Bricker, L. (2021). Commentary: Designing Science Instructional Materials that Contribute to More Just, Equitable, and Culturally Thriving Learning and Teaching in Science Education. *Journal Of Science Teacher Education*, *32*(7), 858-864. https://doi.org/10.1080/1046560X.2021.1964786

Upadhyay, B., Atwood, E., & Tharu, B. (2020). Actions For Socio-political Consciousness in A High School Science Class: A Case Study of Ninth Grade Class with Predominantly Indigenous Students. *Journal of Research in Science Teaching, 57*(7), 1119-1147. https://doi.org/10.1002/tea.21626

Van den Hurk, A., Meelissen, M., & Van Langen, A. (2019). Interventions in Education to Prevent STEM Pipeline Leakage. *International Journal of Science Education*, *41*(2), 150-164. https://doi.org/10.1080/09500693.2018.1540897

Van Leeuwen, T. (2005). *Introducing Social Semiotics*. Routledge.

Waddington, J., Siqués, C., Carolà Vilà, M., & Moreno, M. N. J. (2021). A Funds Of

Knowledge Approach To Promoting School Engagement. *Psicologia em Pesquisa*, *1*(1), 132-148. http://doi.org/10.34019/1982-1247.2020.v14.27698.

West, R. (1994). Needs analysis in language teaching. *Language Teaching*, *27*(1), 1-19.

Wilson, A. (2014). Addressing Uncomfortable Issues: Reflexivity as a Tool for Culturally Safe Practice in Aboriginal and Torres Strait Islander Health. *The Australian Journal of Indigenous Education, 43*(2), 218-230. https://doi.org/10.1017/jie.2014.24

Wilson-Lopez, A., Mejia, J. A., Hasbun, I. M., & Kasun, G. S. (2016). Latino Adloscent's Fund of Knowledge Related to Engineering. *Journal Of Engineering Education*, *105*(2), 278-311. https://doi.org/10.1002/jee.20117

Wood, L., Kiperman, S., Esch, R. C., Leroux, A. J., & Truscott, S. D. (2017). Predicting Dropout Using Student- And School-Level Factors: An Ecological Perspective. *School Psychology Quarterly, 32*(1), 35-49. https://doi.org/10.1037/spq0000152

Yusof, M. N. M., & Tahir, Z. (2017). Importance of Information Technology - Driven social media in Public Institutes of Higher Education. *Journal of Social Science and Humanities*, *12*(3), 1-10.

Zainal, R., Selamat, S., Abdullah, M. H., Isa, K., Rozali, M. Z., & Saleh, H. M. (2022). Humanism Approach Among Teachers to Increase Indigenous Students Participation. *Journal of Techno-Social*, *14*(2), 64-73. https://doi.org/10.30880/jts.2022.14.02.009

Zhou, G. (2012). A Cultural Perspective of Conceptual Change: Re-examining the Goal of Science Education. *McGill Journal of Education, 47*(1), 109-130. https://doi.org/10.7202/1011669ar

Zidny, R., Sjöström, J., & Eilks, I. A. (2020). Multi-Perspective Reflection on How Indigenous Knowledge and Related Ideas Can Improve Science Education for Sustainability. *Science & Education*, *29*, 145-185. https://doi.org/10.1007/s11191-019-00100-x

Copyrights