Science Education International
31(2), 185-194
https://doi.org/10.33828/sei.v31.i2.8

ORIGINAL ARTICLE

Culturally Relevant Science Teaching: A Case Study of Physics Teaching Practices of the *Obo Monuvu* Tribe

Karizza Jane B. Pejaner[1]*, Voltaire M. Mistades[2]

[1]Department of Agriculture, Makilala Institute of Science and Technology, Makilala, Cotabato, Philippines, [2]Department of Science Education, De La Salle University, Manila, Philippines

***Corresponding Author:** karizzajanebp@gmail.com

ABSTRACT

The knowledge and practice of science are rooted in culture. One specific theory that reflects this idea is that of culturally relevant science teaching. The challenge in the Philippines, being a multicultural nation, is that each indigenous community would have its own set of culture and beliefs. Indigenous peoples suffer from the failure of the mainstream education system to address the context of the indigenous community (ECIP, 2007). With the end in mind of documenting culturally relevant science teaching (CRST), this study was conducted among the Grade 8 physics teachers of the *Obo Monuvu* tribe of Cotabato. The research employed qualitative case study as its research design using observation, interview, focus group discussion, and archiving as its data gathering procedure. The results showed 12 commonly used teaching practices. These teaching practices, according to the teachers, were developed as a result of the following factors: (a) Teacher's adjustments, (b) students' view education, and (c) problems that teachers encounter in teaching physics. Among the teaching practices, ten practices reflect academic success, three practices reflect cultural competence, and none for sociopolitical consciousness. The study suggests reviewing the science curriculum and instruction such that it becomes relevant to the *Obo Monuvu* tribe.

KEY WORDS: culturally relevant science teaching, indigenous peoples education, *Obo Monuvu* tribe, physics teaching practices, science education

INTRODUCTION

Science, according to Iaccarino (2003), has been practiced by individuals in all civilizations throughout history and is an accumulated knowledge based on their lived experiences. These experiences are dependent on their way of life – their culture. Moreover, the knowledge and practice of science are deeply rooted in culture. Iaccarino added that how science is done inside the classroom depends on the culture in which it is practiced.

It has been argued that inside the classroom, physics and other branches of science are still taught in such a way that culture is given less emphasis (Cobern and Loving, 2001). Boutte *et al*.. (2010) reported that using culture in teaching is misperceived by teachers to be only applicable to subjects such as language arts, social studies, and fine arts not for "hard sciences" (p. 2), of which physics is considered one. Physics cannot be separated from people's history, culture, and worldview (Handayani *et al*.., 2019). Thus, scholars on this field insist on integrating the local knowledge to better understand the physics taught at school (Cobern and Loving, 2001; Boutte *et al*.., 2010).

One challenge in the Philippines, being a multicultural nation, is that each indigenous community would have its own set of culture and beliefs. Teachers who teach students with different cultural background might result in the neglect of some students' cultures. In fact, these struggles were noted in the 2007 consolidated report of the Episcopal Commission on Indigenous Peoples (ECIP). IP shared how they suffered from the failure of the mainstream education system to address the indigenous community context.

To address these concerns, the Department of Education (DepEd) implemented the National IP Education (IPEd) Policy Framework (DepEd Order No. 62, s. 2011) and IP Education (IPEd) Curriculum Framework (DepEd Order No. 32, s. 2015). These frameworks were created not only to cater the needs of indigenous students, which is mandated by the Philippine's constitution but also to empower their culture. Cuares (2019) reported on the initiatives by the DepEd to intensify its advocacy for culturally responsive education. One was to formulate culture-based lesson plans. However, little has been done to document its use for subjects such as science and mathematics. In Region XII, Cuares reported only three indigenous communities who formulated culture-based lesson plans – the B'laan, T'boli, and Tagakaolo communities.

Despite the above-mentioned initiatives, IP tribes still consider themselves disempowered (Masendo, 2015), as they show fear in going to school and desire for an education that is relevant to them. In fact, out of 5.1 million IP youths, only 1.2 million were enrolled in elementary and secondary (Cornelio and de Castro, 2016).

Science Education International
31(2), 185-194
https://doi.org/10.33828/sei.v31.i2.8

It is true that there are a lot of factors that may contribute to the success and failure of the indigenous students in learning science, especially physics. Yet, this paper argues that the lack of culture integration in teaching physics takes a huge share in the difficulty of the indigenous students to grasp physics concepts. With the end in mind of documenting culturally relevant science teaching (CRST), this study was conducted in one of the sub-groups of Manobo in Region XII – the *Obo Monuvu* tribe of Cotabato. This group was not reported by Cuares (2019) to have made significant actions to intensify culturally responsive education despite its huge number across the region. Documenting how teachers of *Obo Monuvu* tribe teach physics based from their experience would help DepEd in formulating culture-based lesson plans.

LITERATURE REVIEW

The Philippines is diverse in terms of culture and language. There are 11 million IPs and 110 indigenous ethnolinguistic groups located in 65 of 78 provinces in the country (Cornelio and de Castro, 2016). Sixty percent (60%) of the indigenous population is found in Mindanao and categorized into two groups: Muslims, or *Moro*, and the *Lumad*, the generally accepted term used to refer non-Islamized groups (Trinidad, 2012).

The Manobo tribe is one of the indigenous groups in Mindanao. This indigenous community is considered one of the most populous indigenous groups (Masendo, 2015). This indigenous community occupies a wide area that has resulted in different Manobo groups with distinct characteristics of these subgroups. They are hunters and warriors and preserve their culture through oral tradition including myths, tales, legends, dances, performing arts, literary arts, and epic (NCCA, 2015). The *Obo Monuvu* tribe is a subgroup of Manobo. They are alternately known as *Obo Manobo* or *Manuvu* or *Menuvu*.

Indigenous and local communities across Asia are often undermined and labeled as 'unscientific' and primitive (De Vera, 2007). These labels are mainly due to the spiritual nature of the culture of indigenous communities. DepEd (2015) and the Episcopal Commission on IP (ECIP) (2007) reported the same problem and pointed out discrimination as the main reason for indigenous students to give up their education. Education eventually became the avenue for the deterioration and the misuse and abuse of the culture of indigenous communities (ECIP, 2007).

The reported desire of the Manobo tribe for an education that will empower their culture supports the above-mentioned problem (Masendo, 2015). Jorolan (2005) emphasized a remark from the *Lumad* (the generally accepted term used to refer non-Islamized groups in Mindanao) respondents that they are willing to go to school if the curriculum is *Linumad* (meaning, of Lumad nature). *Lumad* described education to be enough if it includes knowledge of their cultural customs, traditions, practices, beliefs, and values. Manobos recognized the importance of education to raise themselves out of poverty, disempowerment, and exploitation (McMahon, 2012; Trinidad, 2012; Masendo, 2015).

The protection of the rights of IP tribes, especially in education, is stipulated in the constitution. DepEd recognizes this right of indigenous students and implemented the above-mentioned DepEd orders. With the implementation of the K to 12 Program, the DepEd aims to realize its culture-sensitive and relevant education goals and strengthen its commitment to education for all. The implementation of IPEd is seen to be important as it will enable them to walk in two worlds – the modern and indigenous worlds (Trinidad, 2012).

Teaching should bridge the distances between school instruction and ways of knowing and realities within the homes and communities (Boutte *et al*.., 2010) of indigenous students. Science education should be relevant to indigenous students' lives (Mckinley *et al*.., 2008). Teachers should be knowledgeable of the community's culture, nature of science, and epistemology. The lack of relevance to students' lived realities results in the underperformance of indigenous students in science (Mckinley *et al*.., 2008).

Scholars and educators suggested different ways on how to teach indigenous students. Handayani *et al*.. (2019) suggested that indigenous knowledge and/or indigenous science should be integrated in science teaching. Santoro *et al*.. (2011) emphasized that teachers should understand and be knowledgeable of the indigenous ways of knowing, indigenous students' lives outside the classroom, and how to build relationships with indigenous students and their community. Khupe (2014) and Wa-Mbaleka (2013) saw the usefulness of IKSP being included in teaching science. Others proposed sociocultural perspective (Lemke, 2001), educational decentralization (Milligan, 2006), decolonizing education (Trinidad, 2012), culturally relevant education (Ladson-Billings, 1995a), and culturally responsive education (Mckinley *et al*.., 2008). What is common to these proposed strategies or approaches is that they emphasize the need to know the students, their culture, and the community where they live.

Culturally relevant pedagogy (CRP)

CRP is a pedagogy that includes culture in education (Ladson-Billings, 1995b). It had been found to address diverse cultures successfully. The term culturally relevant is one of the many labels to works that connect the students' home culture and the school – this includes culturally appropriate, culturally congruent, culturally responsive, culturally responsible, culturally compatible, culturally respective, culturally rooted, culturally-based, culturally oriented, and multicultural education (Ladson-Billings, 1995b; Harmon, 2012; Qiao and Tan, 2008; Nam *et al*.., 2013). Culturally relevant and culturally responsive terms have been used interchangeably in literature or described as two terms for the same thing. Gay (2000, as cited in Harmon, 2012) defines culturally responsive teaching as multidimensional, empowering, and transformative while CRP as the use of cultural knowledge, prior experiences, and strengths of students to make learning relevant and effective.

Science Education International
31(2), 185-194
https://doi.org/10.33828/sei.v31.i2.8

Gay later defined culturally responsive teaching just like culturally relevant teaching (Hernandez *et al*.., 2013).

CRP was coined by Ladson-Billings (1995a). It rests on the following criteria: An ability to develop learners academically, willingness to nurture and support cultural competence, and the development of sociopolitical or critical consciousness. Furthermore, CRP has three broad conceptions regarding self and other, social relations, and knowledge. It was built on the idea that all students are capable learners and that the content of the topics taught at school should be grounded from their cultural contexts including the experiences and values (Kelly-Jackson and Jackson, 2011). CRP became the lens of many scholars in improving their teaching and research (Baskerville, 2008; Kelly-Jackson and Jackson, 2011). On the other hand, others find it challenging (Nam *et al*.., 2013) because it has no specific method or strategy (Young, 2010).

CRST

Klenowski and Gertz (as cited in Santoro *et al*.., 2011) emphasize the need to adopt CRP in teaching indigenous students. CRST is based on Ladson-Billings' theory but is specific for science teaching. In her initial writings, Ladson-Billings did not focus on science as it was not a priority in elementary school programs back in the 1990s (Mensah, 2011).

CRST aims to integrate indigenous knowledge systems to counteract the practice of teaching science detached from the sociocultural contexts of students (Abrams *et al*.., 2013). It is a two-way learning process between the teacher and the students, and it should incorporate locally relevant events into science instruction, recognize, and respect traditional beliefs and history, and integrate traditional ecological knowledge into science instruction (Nam *et al*.., 2013). The use of this pedagogy was proven to increase student participation, awareness about societal biases based on scientific biases, and embodiment of good cultural values (Laughter and Adams, 2012).

The three criteria of Ladson-Billings' CRP (the academic success, cultural competence, and sociopolitical consciousness) in this framework mean: Academic Success or excellence is about allowing multiple points of entry (Laughter and Adams, 2012). It should engage students in practicing: Critical thinking, high expectations of themselves, make long term goals, and understand the relationship of concepts to real-life situations (Young, 2010). Developing academic success can be done by way of engaging students to learning science in multiple and authentic ways through an exploration of their interests (Laughter and Adams, 2012), should result in student learning (Boutte *et al*.., 2010), encourages students to choose academic success (Krasnoff, 2016; Laughter and Adams, 2012), should also develop academic power (Laughter and Adams, 2012; Ladson-Billings, 1995a), assess and monitor students' learning (Laughter and Adams, 2012), setting high standards (Wa-Mbaleka, 2013; Young, 2010), and requires contextualized teaching (Boutte *et al*.., 2010).

Cultural competence involves structures and networks (Laughter and Adams, 2012). The science that emerges in our school is a product of the science that we have in the community. Science instruction uses local community knowledge and students' interest. Cultural competence is the inclusion of culture in teaching to develop cultural pride, not just to connect previous knowledge (Ladson-Billings, 1995b; Laughter and Adams, 2012).

Sociopolitical consciousness is described as moving to something bigger (Laughter and Adams, 2012), moving beyond the confines of the classroom-based science teaching (Boutte *et al*.., 2010), and a way of addressing issues of social justice and inequality in the classroom (Byrd, 2016; Soriano and Sandoval, 2007).

METHODOLOGY

This qualitative case study sought to determine the teaching practices of Grade 8 physics teachers in teaching Force, Laws of Motion, Uniform Circular Motion, Work, Energy, and Power concepts to *Obo Monuvu* students. It was set within the social constructivist paradigm where knowledge is socially constructed and emerges from peoples' social practices (Yazan, 2015). In this study, it means that truth or knowledge is based on the practices developed by the physics teacher as they interact with their students. Specifically, it was a single, illustrative case study that described how physics concepts were taught among the *Obo Monuvu* students. Ethnographic approach was also employed to capture the whole picture of the events and situation to better understand, describe, and give meaning to the documented practices. Furthermore, this study follows Merriam's (1998) approach to case study to ensure reliability and validity.

This study was conducted in one of the IP secondary schools in Kidapawan City, Cotabato – the Puas Inda Integrated School – Secondary. The school is considered an IP community with *Obo Monuvu* students comprising 83% of the total population. Two physics teachers and ten *Obo Monuvu* students were identified as participants. To determine the ten students, community consultation with National Commission on IP was conducted. Initially, this study would only include one teacher (Teacher 1) of Grade 8 since there is only one section available for that grade level. Another teacher (Teacher 2) became a participant of the study as she handled the physics class of teacher 1 on the first 2 weeks of class observation.

Ethical approval from the NCIP of Kidapawan City, elders of the indigenous community, local government, Department of Education, Kidapawan City Division, and the participating school were sought before conducting this study. The teaching practices were determined based from classroom observations, focus group discussion (FGD) with *Obo Monuvu* students, interview with the physics teachers, and analysis of daily learning log (DLL).

In documenting the teaching practices of the physics teachers, two interview guides were used and an observation protocol.

Science Education International
31(2), 185-194
https://doi.org/10.33828/sei.v31.i2.8

One interview guide was used to interview the physics teachers who participated in this study. The main goal of this protocol is to reaffirm observed teaching practices. Before making the questions, classroom observations were done (from June to October 2018, the first grading period) and DLLs were collected. From the classroom observations and DLL, questions were made on why those teaching practices were used, other teaching practices they do, their reason/s for doing it, how they prepare students for the next grade level, and how they compare their previous and current ways of teaching. Then, the interview with the teachers was conducted. The second one was used to solicit the teaching practices from the students during FGD. The FGD was conducted after the NCIP approved the study and issued the compliance certificate. The observation protocol was used based on Laughter and Adams (2012). It contained the observed physics teaching practices extracted from descriptive field notes, the three criteria of CRST, and the reasons of the teachers on using it. Then, the CRST connection for the resulting practices was reflected and included in the said protocol.

Ethnographic analysis was used in interpreting and describing the practices of the physics teachers. Ethnographic analysis is a way of analyzing data collected in an ethnographic nature of research which involves the following strategies: Coding for descriptive labels, sorting for patterns, identifying outliers, generalizing constructs, and theories, and memoing with reflective remarks (Sangasubana, 2011). Data analysis was performed while gathering data.

Figure 1: The indigenous peoples education program corner

Figure 2: Classroom setting of Grade 8 science class (July 3, 2018)

RESULTS AND DISCUSSION

Classroom setting description

In the Grade 8 classroom observed in this study, most of the students do not wear their uniforms and were noticeably loud and could not stay still. One teacher explained that this kind of behavior of students was seen to be normal as the indigenous community is nomadic. The classroom is wide enough to cater for 34 students, it is clean, and has an allotted area for subject corners. One corner is remarkably unique as it does not represent any subject for Grade 8. The corner is called the IPEd corner, as shown in Figure 1. The same corner can be found in other classrooms in the school. It contains the legal basis for the implementation of the IPEd Program and pictures of the activities of IP. According to Teacher CESS, putting the IPEd corner aims to "*emphasize na part sila sa learning* (emphasize that they are part of learning)."

The majority of the students, the *Obo Monuvu,* were seated at the back while the minority, the Bisaya and Ilonggo, were seated in front. There is a difference between a regular classroom and this classroom. In a regular classroom, the minority is usually inactive and performs lower than most of the students (Ladson-Billings, 1995a; Boutte *et al*.., 2010; Gay, 2000; Laughter and Adams, 2012). However, in this classroom, it was the opposite. Figure 2 shows the classroom setting.

Teacher 1 has a bachelor of secondary education with a major in biology while Teacher 2 has a bachelor of secondary education with a major in physical science. At the time of this study, Teacher 1 had taught for more than 5 years while Teacher 2 had taught for 3 years in the school. Like the other teachers of the school, both of the study's teachers were not familiar with the culture of the *Obo Monuvu* tribe and were not *Obo Monuvu* themselves. Both were Bisaya and resided in the town area (which is a 1-h ride from the school).

Physics teaching practices

There are 12 teaching practices that emerged from classroom observations, interviews, archiving, and FGD. These are: (1)Using the "simplest term possible;" (2) giving contextualized examples and definitions; (3) lecture and discussion; (4) using vernacular in teaching; (5) demonstrating affective attributes; (6) doing simple, challenging activities and experiments; (7) using teaching methods and materials that maximizes on students' visual learning style; (8) reviewing the basics; (9) using strategies to monitor and assess learning; (10) using teaching strategies in preparation to higher grade level; (11) homework; and (12) spoon-feeding. Out of 16 classroom observations, four focused on the topic of force, two on Laws of motion, one on Uniform Circular Motion, two on work, five on energy, and two on power. Table 1 presents the frequency with which the physics teachers used the teaching practices.

Science Education International
31(2), 185-194
https://doi.org/10.33828/sei.v31.i2.8

Table 1: Frequency of using the Physics Teaching Practices vis-a-vis the Physics topics they were used

Physics teaching practice	Physics topics						Frequency (N_{Total}=16)
	Force (*n*=4)	Laws of Motion (*n*=2)	Uniform circular motion (N=1)	Work (*n*=2)	Energy (*n*=5)	Power (*n*=2)	
1. Using the simplest term possible	✓ (1)	✓ (1)			✓ (2)		4
2. Giving contextualized examples and definitions	✓ (1)	✓ (2)		✓ (1)	✓ (3)		7
3. Lecture and discussion	✓ (4)	✓ (1)	✓ (1)	✓ (2)	✓ (3)		11
4. Using vernacular in teaching	✓ (4)	✓ (2)	✓ (1)	✓ (2)	✓ (5)	✓ (2)	16
5. Demonstrating affective attributes	✓ (4)	✓ (2)	✓ (1)	✓ (2)	✓ (5)	✓ (2)	16
6. Doing simple, challenging activities and experiments	✓ (1)	✓ (1)		✓ (2)	✓ (3)	✓ (1)	8
7. Using teaching methods and materials that maximizes on students' visual learning style	✓ (3)	✓ (2)		✓ (2)	✓ (2)	✓ (1)	10
8. Reviewing the basics	✓ (2)	✓ (2)		✓ (2)	✓ (5)		11
9. Using strategies to monitor and assess learning		✓ (1)		✓ (2)	✓ (3)		6
10. Using teaching strategies in preparation to higher grade level	✓ (1)	✓ (1)			✓ (1)	✓ (2)	5
11. Homework	✓ (1)	✓ (1)					2
12. Spoon feeding	✓ (1)				✓ (1)		2

n=Number of science classes for each topic

Based on Table 1, the most used physics teaching practices were the use of vernacular and demonstrating affective attributes. These two practices were consistently used throughout the observation period. On the other hand, the least used were spoon-feeding and homework. The 12 teaching practices will be discussed in detail below.

Using the "simplest term possible"

Teachers translated physics concepts to simplest term possible using words that were familiar to the students. For example, kinetic energy was being translated as energy when *kanang galihok ka* (moving) and balanced forces as *pantay* (balance).

Giving contextualized examples and definition

Students found it hard to understand definitions based on the book. Thus, teachers created their own examples and meaning of the physics concepts based on the context for the students. For example, teachers used students' concept of riding and driving, potting, and vehicles that were based on the context of the community in teaching motion (specifically, speed, velocity, and acceleration), energy, and the second law of motion. The inclusion of the basic day-to-day activities of the students was their only way to include culture in teaching physics. Both teachers had difficulty in using culture in teaching physics. As a result, they also found it difficult to contextualize instructional materials and outputs which were required in the IP Education Curriculum Framework and by DepEd. This led teachers to resort to written quizzes, examination, and other written outputs.

Lecture and discussion

Teachers would end up doing lectures as they must cover a lot of competencies in a limited time. Aside from that, it allowed the students to understand and follow the flow of problem-solving. Teacher 2 saw lectures to be more effective than the inquiry-based approach of DepEd. On the other hand, discussion was highlighted in both teachers' DLL. However, during observation most discussions for both teachers tended to go back to lecture as students tended to be non-participative.

Using vernacular in teaching

Bisaya is not the mother-tongue of the *Obo Monuvu* tribe. However, they have learned to communicate using that language as they socialize with the people outside the community. It became a part of their culture as most *Obo Monuvu* students can speak and understand this language already. For some, they use it more frequently than their own language, especially at school. Using *Bisaya* as the medium for teaching was seen to be necessary as students found it hard to understand and comprehend whenever English was used.

Science Education International
31(2), 185-194
https://doi.org/10.33828/sei.v31.i2.8

Demonstrating affective attributes

Teachers demonstrated friendliness, sensitivity to students' culture, giving attention to each student, teaching at a slow pace so students could follow, preparing the students for the lesson by talking to them first, encouraging students to participate, and humor to prevent boredom. Teachers' demonstrated friendliness as they experienced that being strict did not engage the students in the learning process and resulted in absences and dropouts. They added that being friendly encouraged the students to learn and a way for teachers to instill in students that they should not be shy and ashamed of themselves. Shyness is a part of their culture. For this reason, they helped them build their confidence through board work. Teachers emphasized the need to be sensitive to avoid violating the culture of the students. They demonstrated this by discussing answers with considerations to avoid embarrassing the students, appreciated students' effort, solicited ideas from the students, and understood the nature of the students.

Doing simple, challenging activities, and experiments

As much as, the teachers wanted their students to experience doing all the activities and experiments in the textbook, they did not have the facilities and equipment to do so. Therefore, they resorted to simple but challenging activities and experiments. In a conversation with the teachers in the school, they described the students as kinesthetic learners. Group activities allowed students to improve teamwork especially for *Obo Monuvu* students who were reluctant to participate. Teachers selected the activities and experiments based on three criteria: Availability of materials, time, and capability of the students. This was because they faced challenges such as lack of materials in doing the activity, time in doing the activity and experiment, low success in doing the activity, students remembered the activity but not the physics concept behind it and enjoyed the activity but learned nothing from it, when students answered questions from the book, they found it hard to answer how and why questions, teachers found it hard to give instructions, and activities in textbooks were not contextualized and were difficult for them to do. Figure 3 shows an instance where the teacher gave a simple, challenging experiment.

Using teaching methods and materials that maximizes on students' visual learning style

Both teachers emphasized that the students were visual learners. During the observation, students were more attentive to pictures, drawings on the board, and the like. For this reason, they either used illustration, pictures, drawing, and BITAYMAX in teaching physics. BITAYMAX is an instructional material that is taken from the *Bisaya* term *bitay* which means "hang." Both teachers use BITAYMAX where they write important information about the lesson in a manila paper, cartolina, or sticky paper, and hang it on the chalkboard [Figure 4]. Illustrations were used in giving examples, providing students a visual representation of their lesson and differentiating physics concepts. Using pictures allowed students to visualize reality.

Figure 3: Instance when the teacher gave a simple, challenging experiment

Figure 4: Instance when the teacher used *bitaymax* (June 7, 2018)

Reviewing the basics

It was inevitable for both teachers to review the prerequisite physics concepts before beginning the new lesson. However, they kept on reviewing the same basic concept every new lesson. One instance was when Teacher 2 kept on reviewing the concepts of height and distance. This was because students did not usually study at home and found it hard to recall the basic concepts which were usually taught when they were in Grade 7. When both teachers were asked for the possible reason, they shared that after the class, the students still worked on their farms or at home. They were given the responsibility to provide for their family at a young age and they even became parents for their siblings. Reviewing the basics was one way to connect the prior knowledge and grade-level expectations.

Using strategies to monitor and assess learning

Teachers monitored and assessed students' learning through think-pair-share, reflection, and generalization.

Science Education International
31(2), 185-194
https://doi.org/10.33828/sei.v31.i2.8

Using teaching strategies in preparation to higher grade level

Teachers prepared their students for the next grade level through reporting, teaching force, and acceleration as early as Grade 7, and reminding students to keep their notebooks.

Homework

Homework was observed during the introduction of balanced and unbalanced forces. However, not all students were able to do their homework. Teachers of the school explained that the inability of the students to do their homework was primarily because no one at home was able to support them as most of the parents had not gone to school. Moreover, homework was taken from the book and books were limited. As a result, they rarely give homework.

Spoon-feeding

Teachers thought that spoon-feeding was the best approach in teaching the students. Teacher 2 shared that she was enthusiastic at first and wanted to teach everything including the experiments. However, the level of understanding of the students held her back until she got tired. She added no matter how much she taught the students how to answer; no one could get it correctly, especially during the examinations. This was the main reason why she thought spoon-feeding was the best approach to students – that is, giving the students the correct answers so they could get perfect scores. In an informal conversation with her, she expressed her worry about her failure to do discovery learning as she finds it hard to do so with the nature of the students. Furthermore, most of the students have a large number of absences and often just go to school during the examinations. In a conversation with one teacher, she noted that many students were absences because their parents asked them to work with them on the farm. As a result, teachers gave time for the students to review before taking summative tests, quizzes, and the like.

Table 2 shows the CRST connection of the teaching practices.

Factors affecting the development of the physics teaching practices

According to both teachers, their teaching practices had developed by the way they taught physics to their students. Specifically, they thought it was a result of the following factors: (a) Teachers' adjustment; (b) students' view in education; and (c) students' difficulties. These factors emerged during the interview and some were observed during the class.

Table 2: Culturally relevant science teaching connection of the teaching practices

Strategy/method/approach	Reflection and/or interpretation		
	Academic success	Cultural competence	Sociopolitical consciousness
1. Using the simplest term possible	Increases students' learning by going beyond mastery of the physics vocabulary		
2. Giving contextualized examples and definitions	Develops academic power. Allows students to view physics concepts through their personal lenses (Boutte *et al*., 2010) which results in the relevant, meaningful and useful learning (IPEd Framework)	Connects students IKSP to Physics concepts	
3. Lecture and Discussion	Allows the students to be active participants in learning (Laughter and Adams, 2012)		
4. Using vernacular in teaching		As *Bisaya* became a part of the indigenous community's culture, its use makes comprehension and learning easier (Hernandez *et al*., 2013)	
5. Demonstrating affective attributes	Values students' culture and allows the students to feel empowered and confident (Gay, 2000), allows greater opportunity for academic success (Sachs, 2004; Mistades, 2011) and minimizes alienation (Richards, 2007)	Helps in knowing the students, building good teacher-student relationships, and affirming their cultural identity (Young, 2010)	
6. Doing simple, challenging activities and experiments	Enables students to explore their interest while learning the application (Gay, 2000) of physics and actively participate. It also allows variety of ways in which students learn physics (Laughter and Adams, 2012)		
7. Using teaching methods and materials that maximizes on students' visual learning style	Allows variety of ways in which students learn Physics (Laughter and Adams, 2012)		
8. Reviewing the basics	Connects the prior knowledge and grade-level expectations		
9. Using strategies to monitor and assess learning	Values what the students have academically		
10. Using teaching strategies in preparation to higher grade level	Allows students to develop academic power		
11. Homework	Allows students to develop academic power		
12. Spoon feeding			

Science Education International
31(2), 185-194
https://doi.org/10.33828/sei.v31.i2.8

Factor 1: Teachers' adjustment

Teacher 1 clarified that the teaching practices they had were a result of their adjustment as they did not have any training in teaching and dealing with indigenous students. The lack of training made them unable to understand and know the culture of the students, interact less with the community, misunderstood IP students and brand them as "*may attitude problem* (with attitude problem)." DepEd's implementation of the IPEd curriculum entails the recruitment of IP teachers and the conduct of training. However, none of these were realized. The training conducted by DepEd right now focused on activities that Teacher LGR described as "ideal" and was only applicable to schools in the city. Furthermore, teachers' practices were a result of their adjustment in teaching subjects that were not within their field of specialization. Teacher 1 is not physics major. However, she is forced to teach physics due to DepEd's spiral curriculum.

Factor 2: Students' view in education

Obo Monuvu students believe that education is important in learning and will serve as an avenue to getting a job, a way to answer during conversations, and be updated. On the contrary, both teachers thought that students viewed education as nothing more than graduating high school. Teacher 2 shared that her students would always respond, "*Ay mam basta makuhaman lang mi high school* (As long as we finish high school)." Similarly, Teacher 1 thought that students' lack interest and education for them was just for compliance. Students often married at an early age as this is acceptable cultural practice. As a result, only a few proceed to Grade 10.

Factor 3: Students' difficulties

The teaching practices of both teachers also stem from the difficulties of the students. First was students' difficulty in mathematics. Teacher 1 said that students cannot do even simple multiplication, subtraction, and division. Thus, she allowed the use and sharing of calculators or cellphones. Second was students' difficulty in learning the conversion of units. As a result, teachers taught directly the units of the different physics concepts and avoid conversion. Teaching this way avoided confusion on the part of the students. Third was students' difficulty in deriving formula. Hence, teachers did not give problems that involved derivation. Teachers decided to focus on the concepts instead and avoid derivation. Finally was students' difficulty in comprehending the English language. Students found it hard to answer questions in English. For this reason, teachers ignored grammar, sentence construction, and spelling if the thought was there, accept answers in Tagalog, and guide the students in answering the questions. The said difficulties of the students lead to low performance in the institutionalized examinations and evaluation. Low performance in the institutionalized examinations required these teachers to do remedial during summer. However, it was difficult for teachers to require students to attend the remedial class during summer. This was because students' priority was work. There were times when students requested the teachers to give them take home activities and examinations instead because even if they wanted to go to school, they did not have any money and anything to eat. They needed to go outside the community and work as most of the students provided for their younger siblings' education.

CONCLUSIONS

Among the teaching practices, ten practices reflected academic success, three practices reflected cultural competence, and none for sociopolitical consciousness. Focusing on academic success was seen to be necessary as both teachers believed that students had no vision of the future and had low retention power. Although the school performed poorly in the division evaluation, teachers did want their students to achieve academic success. Academic success was the most used tenet of CRST in this study. Developing academic success was done by engaging students in learning science in multiple and authentic ways through an exploration of their interests, should result in student learning, encourages students to choose academic success, should develop academic power, assess, and monitor students' learning, setting high standards, and requires contextualized teaching. Teachers' teaching practices focused on these determinants of academic success.

In this study, the cultural competence done represented a little of what Ladson-Billings' and Laughter and Adams' proposed. Inside the classroom, they applied many of the applications and connections of the physics concepts to their everyday lives such as potting, driving, household chores, and traveling. However, it was only limited to those activities. Other indigenous knowledge systems and practices of the students were not considered due to teachers' lack of knowledge of the culture of the students. The use of contextualized examples indirectly helped the students to practice what they had learned in the classroom in their daily lives (Omar *et al*.., 2015). Aside from that, this seems the students were taught physics as a Western science, not as an indigenous knowledge or a part of their culture. This may cause a problem as this may separate school science and indigenous knowledge. Students may think that the physics they learned from school was for school purposes only and may not be relevant to their lives.

Teachers' practices inside the classroom were somehow opposite to what they did outside. The school as a community showed more cultural competence than inside the classroom. Activities and initiatives were conceptualized to the culture of the community. DepEd's mandate on the use of the cultural attire every Friday was practiced although not all students were able to participate. Furthermore, the principal spends 1 h a week to talk to each section about their culture. In addition, some school activities engaged students to use their culture like IP Day and the competition on indigenized trash bins.

The researcher considers the IPEd corner as a way of meeting sociopolitical consciousness as its purpose is to make the students feel that they are part of the teaching and learning process. This is because most of the students identify themselves as inferior. The researcher sees this tenet to be in the

Science Education International
31(2), 185-194
https://doi.org/10.33828/sei.v31.i2.8

beginning phase. The prevalence of inferiority and shame still proves that students and teachers have not resolved the issues of social justice inside the classroom. Relating social issues with the lesson strengthens students' understanding and increases the effectiveness of teaching (Omar *et al*.., 2015). However, some teachers do not see the need to address sociopolitical consciousness in their pedagogy (Young, 2010).

Even though students believed that the teachers demonstrated effective teaching, both teachers were doubtful of their teaching ability. Teacher 1 shared that she would sometimes ask her coteachers if the students performed well when they did the strategy, method, or approach that she was planning to do. Or she would ask if they encountered the same problem as hers in teaching the students. Similarly, whenever Teacher 2 discussed her difficulty in teaching, she would ask the researcher's idea on how to teach it properly and expressed her frustration during the interview. The doubts of the teachers regarding their teaching practices were clearly because of their lack of training in teaching the IP students and lack of knowledge of their culture. Krasnoff (2016) believes that public education faces a major challenge in addressing the unique needs of students because teachers are inadequately prepared which limits them in choosing effective teaching practices. Aside from that, the curriculum of teacher education and education-related courses do not include subjects on IP education. Indeed, how can you teach if you lack the experience to do so?

Teachers expressed a lot of challenges in teaching indigenous students. The problems mentioned above mean that DepEd somehow failed to meet its requirements in the implementation of the IPEd Framework and its advocacy on culturally relevant education. Furthermore, teachers expressed disappointments as they are required to follow certain standards and practices (referring to indigenization/localization) that they are not trained or capable to do. It was also a challenge for a teacher to teach subjects that were not within their field of expertise. The spiral curriculum of DepEd requires science teachers to teach subjects even if it is not their major field.

One's pedagogical stance is indeed as important as their knowledge of the content in teaching science effectively (Boutte *et al*.., 2010). It is commendable how teachers adjust their teaching to cater the needs of the students. One specific practice is their demonstration of positive attributes to lessen students' shyness, avoid violating their culture, and, in a way, to improve their learning. This is not emphasized in the IPEd Framework (DepEd, 2015). Ironically, the supposed points of interface between IPEd and the national system of education (culturally relevant curriculum, learning and teaching resources, and capacity building) were not observed in the school.

RECOMMENDATIONS

The knowledge gained from this study leads to the following recommendations:

The tenet sociopolitical consciousness from CRST should be emphasized in teaching science.

Strong support should be given by the government to the indigenous students to finish their education, especially at the tertiary level. In this way, the indigenous community will be encouraged in sending their children to school.

The indigenous students should be encouraged to pursue courses in education and specialize in physics or science to address the need of native teachers in the community. This might also help in educating the students as there is someone whom they can relate to.

A science curriculum that is relevant to the context of the *Obo Monuvu* should be established.

Capacity building and teaching resources, as specified in the IPED framework, should be provided in the indigenous schools. DepEd should develop instructional materials specific for *Obo Monuvu* or conduct training for teachers in developing these materials

A program for IP education or addition of IP education subjects in teacher education curricula should be considered; and

Standard assessment should not be given to students from IP communities. Instead, examinations should be localized to address the uniqueness of the culture of the indigenous community.

REFERENCES

Abrams, E., Charles, P., and Guo, C.J. (2013). Contextualizing culturally relevant science and mathematics teaching for indigenous learning. *International Journal of Science and Mathmatics Education*, 11, 1-21.

Baskerville, D. (2008). Navigating the unfamiliar in a quest towards culturally responsive pedagogy in the classroom. *Teaching and Teacher Education*, 25, 461-467.

Boutte, G., Kelly-Jackson, C., and Johnson, G. (2010). Culturally relevant teaching in science classrooms: Addressing academic achievement, cultural competence, and critical consciousness. *International Journal of Multicultural Education*, 12(2), 1-20.

Byrd, C.M. (2016). Does culturally relevant teaching work? An examination from student perspectives. *SAGE Open*,1, 1-10.

Cobern, W.W., and Loving, C.C. (2001). Defining "science" in a multicultural world: Implications for science education. *Science Education*, 85(1), 50-67.

Cornelio, J.S., and de Castro, D.T. (2016). The State of indigenous education in the Philippines today. In: Xing, J., and Ng, P.S. (Eds.), *Indigenous Culture*, *Education and Globalization*. Berlin: Springer. p159-179.

Cuares, W. (2019). *Towards Culturally Responsive Education for IP Learners*. Available from: https://www.sites.google.com/site/wenelycuares/teamannouncements/johndoevotedmvpoflastgame. [Last accessed on 2018 Feb 26].

De Vera, D.E. (2007). *Indigenous Peoples in the Philippines: A Country Case Study*. Vietnam: RNIP Regional Assembly.

Department of Education (DepEd). (2011). *Adopting the National Indigenous Peoples (IP) Education Policy Framework, DepEd Order No. 62*, *S.* Available from: http://www.deped.gov.ph/orders/do-62-s-2011. [Last accessed on 2018 Feb 23].

Department of Education (DepEd). (2015). *Adopting the Indigenous Peoples Education Curriculum Framework, DepEd Order No. 32, S.* Philippines: Department of Education (DepEd). Available from: http://www.deped.gov.ph/orders/do-32-s-2015. [Last accessed on 2018 Feb 24].

Episcopal Commission on Indigenous Peoples (ECIP). (2007). *Indigenous*

Science Education International
31(2), 185-194
https://doi.org/10.33828/sei.v31.i2.8

Peoples Education: "From Alienation to Rootedness". ECIP National Conventions on IP Education. Available from: https://www.hurights.or.jp/archives/pdf/asia-s-ed/v11/13indigenous%20peoples%20education%20-%20philippines.pdf. [Last accessed on 2019 Jul 02].

Gay, G. (2000). *Culturally Responsive Teaching: Theory, Research, and Practice.* 2nd ed. New York: Teachers College Press.

Handayani, R.D., Wilujeng, I., Prasetyo, Z.K., Triyanto T., and Tohir, M. (2019). An identification of indigenous knowledge related to the thermal physics concept. *Journal of Physics: Conference Series*, 1170(1), 1-7.

Harmon, D.A. (2012). Culturally responsive teaching though a historical lens: Will history repeat itself? Interdisciplinary. *Journal of Teaching and Learning*, 2(1), 12-22.

Hernandez, C.M., Morales, A., and Shroyer, G. (2013). The development of a model of culturally responsive science and mathematics teaching. *Cultural Studies of Science Education*, 8, 803-820.

Iaccarino, M. (2003). *European Molecular Biology Organization (EMBO) Reports*.

Jorolan, G. (2005). Perceived effects of education among female members of the ata Manabo, Mandaya and Mansaka communities in the Davao region. *Banwa*, 2(1), 86-132. Available from: https://www.2.upmin.edu.ph/index.php/research-publications/publications/385-perceived-effects-of-education-among-female-members-of-the-ata-manabo-mandaya-and-mansaka-communities-in-the-davao-region. [Last accessed on 2018 Apr 14].

Kelly-Jackson, C.P., and Jackson, T.O. (2011). Meeting their fullest potential: The beliefs and teaching of a culturally relevant science teacher. *Creative Creation*, 2(4), 408-413.

Khupe, C. (2014). *Indigenous Knowledge and School Science: Possibilities for Integration*, *PhD Thesis*. Johannesburg: University of Witwatersrand, Faculty of Science.

Krasnoff, B. (2016). *Culturally Responsive Teaching: A Guide to Evidence-Based Practices for Teaching All Students Equitably.* United States: Region X Equity Assistance Center Education Northwest.

Ladson-Billings, G. (1995a). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal*, 32(3), 465-491.

Ladson-Billings, G. (1995b). But that's just good teaching! The case for culturally relevant pedagogy. *Theory into Practice*, 34(3), 159-165. Available from: http://www.jstor.org/stable/1476635. [Last accessed on 2018 Apr 14].

Laughter, J.C., and Adams, A.D. (2012). Culturally relevant science teaching. *Urban Education*, 47(6), 1106-1134.

Lemke, J.L. (2001). Articulating communities: Sociocultural perspectives on science education. *Journal of Research in Science Teaching*, 38(3), 296-316.

Masendo, A.L. (2015). The Manobo tribe then and now: An ethnography. *International Journal of Scientific and Engineering Research*, 6(3), 227-242. Available from: http://www.oaji.net/articles/2016/488-1468328844.pdf. [Last accessed on 2019 Mar 31].

Mckinley, B., Brayboy, J., and Castagno, A.E. (2008). How might native science inform ïnformal science learning? *Cultural Studies of Science Education*, 3, 731-750.

McMahon, I. (2012). *A Critique of the Scholarship Program Created by Overseas Missionary Fellowship in Partnership with the Indigenous People in Central Mindanao*, *PhD Dissertation*. England: University of Gloucestershire. Available from: https://www.academia.edu/6631833/a_critique_of_the_scholarship_program_created_by_overseas_missionary_fellowship_in_partnership_with_the_indigenous_manobo_people_in_central. [Last accessed on 2018 Jul 08].

Mensah, F.M. (2011). A case for culturally relevant teaching in science education and lessons learned for teacher education. *The Journal of Negro Education*, 80(3), 296-309.

Merriam, S.B. (1998). *Qualitative Research and Case Study Applications in Education.* 2nd ed. San Francisco: Jossey-Bass, Inc.

Milligan, J.A. (2006). Reclaiming an ideal: The islamization of education in the Southern Philippines. *Comparative Education Review*, 50(3), 410-430.

Nam, Y., Roehrig, G., Kern, A., and Reynolds, B. (2013). Perceptions and practices of culturally relevant science teaching in American Indian classrooms. *International Journal of Science and Mathematics Education*, 11(1), 143-167.

National Commission for Culture and the Arts (NCCA). (2015). *Manobo*. Available from: https://www.ncca.gov.ph/about-culture-and-arts/culture-profile/manobo. [Last accessed on 2019 Jan 11].

Omar, N., Noh, M., Hamzah, M., and Majid, L. (2015). Multicultural education practice in Malaysia. *Procedia-Social and Behavioral Sciences*, 174, 1941-1948.

Qiao, X., and Tan, H. (2008). *An Overview of Culture-Sensitive Pedagogy*. Available from: http://www.comm.louisville.edu/iic/if%20journal/if%201%20(2)%202008/if1(2)2008-qiao-tan.html. [Last accessed on 2018 Jul 08].

Sangasubana, N. (2011). How to conduct ethnographic research. *The Qualitative Report*, 16(2), 567-573. Available from: https://www.nsuworks.nova.edu/tqr/vol16/iss2/14. [Last accessed on 2019 Jan 23].

Santoro, N., Reid, J.A., Crawford, L., and Simpson, L. (2011). Teaching indigenous children: Listening to and learning from indigenous teachers. *Australian Journal of Teacher Education*, 36(10), 65-76. Available from: http://www.ro.ecu.edu.au/ajte/vol36/iss10/5. [Last accessed on 2019 Mar 16].

Soriano, C., and Sandoval, C. (2007). *Indigenous People's Education in the Philippines*. Philippines: Asian South Pacific Association of Basic and Adult Education.

Trinidad, A.T. (2012). *Learning to be Indigenous: Education and Social Change among the Manobo People of the Philippines, PhD Thesis*. Manchester: University of Manchester, Department of Social Anthropology.

Wa-Mbaleka, S. (2013). Quality education for native Filipinos: A phenomenological case study of Indigenous learners. *IAMURE International Journal of Social Sciences*, 6(1), 1-15.

Yazan, B. (2015). Three approaches to case study methods in education: Yin, Merriam, and Stake. *The Qualitative Report*, 20(2), 134-152. Available from: https://www.nsuworks.nova.edu/tqr/vol20/iss2/12. [Last accessed on 2019 Aug 14].

Young, E. (2010). Conceptualizing and actualizing culturally relevant pedagogy: How viable is the theory in classroom practice? *Journal of Teacher Education*, 61(3), 248-260.