An analysis of Cultural Intelligence in Different Regions of Papua New Guinea based on Physics Education

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Abstract. Cultural intelligence is important in a globalized world where people from different cultures interact effectively. The cultural factors that influence education in Papua New Guinea are language barriers, traditional knowledge in science, the teaching methods, students' attitude towards science and the societal or family expectations. In our study, we selected physics education because physics is the study of matter and energy which is closely associated with the environment and supports all branches of engineering. Cultural quotient has been calculated in different regions of PNG by conducting a survey on first-year university students from different regions taking physics. Cultural quotient was found to be higher in Highland's region and lower in Islands region. Remedial methods have been suggested to improve the cultural quotient in all regions of PNG.

Keywords: Papua New Guinea, Physics Education, Cultural Intelligence, Language.

Author Biography:

Michael Gaoma is a passionate educationist with over twenty years of experience in teaching and training. He holds a Bachelor of Science degree from the University of Papua New Guinea, Post Graduate Diploma in Education from the University of Goroka and Master of Education from Charles Sturt University, NSW, Australia. Currently, Michael works at the Papua New Guinea University of Technology as a lecturer in the School of Applied Physics. He is also a final year PhD student. His study focusses on embracing cultural intelligence to improve physics education here in Papua New Guinea. Michael is a skilled team player through professional networking and collaborative spirit. He is also heavily involved in students' holistic development programs and activities.

1. INTRODUCTION

Papua New Guinea is a country in the Pacific that has a population of over 10, 000, 000 with 7,000 different cultures and over 830 distinct native languages. About 20% of the population live in urban centers while 80% of it represents the rural dwellers. The significantly biased population disparity between the urban and the rural inhabitants is geographically dispersed by rugged mountains and ranges. In addition to this, the scabrous geographical landscape of the country has muddy swamps and deadly flowing rivers. The cultural and geographical diversity and linguistic complexity are more specific and unique in the four regions of the country.

Papua New Guinea is divided into four regions called *Southern*, *Islands*, *Momase* and *Highlands*. Each of the four regions have several of both unique and common cultures and languages. Culture plays a significant role in shaping the people's behavior, beliefs, and values in these four regions of the country. Some of the cultural norms are unique to a specific region while others are common to the four regions. For example, traditional dressing and reconciliation are unique but the respect for elders and family values are common in the four regions. One of the key functions of cultural norms is to provide a sense of belonging and identity to individuals within the respective regions. The four regions also embrace the common universal cultural values such as love and justice and the specific one like welcoming strangers into their communities and homes. Cultural values are the key principles or morals that underpin regionalism and culturalism in Papua New Guinea. Local Papua New

Guinean students bring regionalism and culturalism into classrooms at all levels of educations system and keep them alive. Kukari (2004) noted that being deeply rooted in their cultural belief systems, both the religious and cultural beliefs influence the way students learn in Papua New Guinea. Hence the efforts to determine the levels of cultural quotient (CQ) in the four regions are highly desirable.

Cultural intelligence (CQ) is the ability to effectively understand, adapt, and work in different cultural contexts. It encompasses four components, including Cognitive CQ, based on knowledge, Metacognitive CQ, based on strategy, Motivational CQ, based on drive and Behavioral CQ, based on action, which help individuals navigate and succeed in culturally diverse environments. According to Ott & Michailova (2016) Cultural Intelligence (CQ), is an individual's capability to function and manage effectively in culturally diverse situations and settings. Experts in cultural intelligence can perform an important function in helping members of different cultural backgrounds to be more effective in multicultural settings. They can also use their skills for effective communication by bridging language barriers and resolving different communication styles. Cultural Intelligence can be used as a tool to mediate the high levels of relationship and process related conflict arising from different cultural misunderstandings. It can also be used to reduce the time that culturally diverse teams take to reach a conclusion. Dogra & Dixit (2018) stated that 'Cultural Intelligence gives an insight on understanding why some of the individuals are able to cope and succeed in a diverse environment than others' (p. 1). Thomas (2017) found that culturally intelligent people are at a distinct advantage and they are more likely to make correct determinations for the reasons why people who were culturally different behaved as they did.

Cultural intelligence plays a vital role in successful global leadership. It is essential for global leaders to effectively navigate diverse international environments. Understanding global business etiquette is crucial for respecting cultural differences and fostering positive relationships. Leaders with high cultural intelligence are better equipped to lead diverse teams and drive inclusive work environments. Effective cross-cultural engagement strategies enable global leaders to communicate and collaborate seamlessly across cultures. Developing cultural intelligence helps leaders to overcome challenges related to cross-cultural communication. Leadership is the ability and capacity to influence others and is the exercise of authority and making decisions (Bass, 1990).

Choosing physics to understand and embrace the role of cultural intelligence to improve physics education in multicultural classroom settings is vital and necessary. Physics is the multidisciplinary and unifying discipline in the field of natural sciences, engineering and technology. Physics deals with the study of the nature, the basic laws that govern the natural phenomena and the behaviour of matter. The fundamental focus of physics is the study of the relationship between matter and energy which underpins the other areas of study. Matter is composed of elementary particles that interact through fundamental forces.

In physics, there is a wide range of branches such as mechanics, heat, light, sound condensed matter, atomic and molecular physics, elementary particle physics, astrophysics, nanophysics and so on. It is the most difficult science subject having inseparable progressive levels of mathematics with the global trend of declining statistics of students' enrollment. The research in physics includes semiconductor devices that became the heart of the modern technology. Physics concepts are applied to develop and improve infrastructure and services in health, energy, technology, environment, communication, bioscience, space science education, transport, meteorology and entertainment and so on. These sectors play a vital role for sustainable growth of the world. Physics education plays a significant role in educating and training educationists, technical and professional experts who contribute in local, national and global transformation with creative and innovative visions, ideas and skills. Windschitl (2009) "explained that physics education can offer a rich context for developing many 21st-century skills, such as critical thinking, problem solving, and information literacy especially when instruction addresses the nature of science and promotes use of science practices. …these skills not only contribute to the development of a well-prepared workforce of the future but also give individuals life skills that help them succeed hence are skills enhance effective leadership skills".

Cultural Quotient (CQ) for physics education is a measure of the subject content and learning environment which align with the students' cultural context and values. It gives the student's familiarity with applications or examples. It depicts how well the teaching methods accommodate with diverse cultural backgrounds. Also, it reflects the student's motivation in learning physics shaped by his cultural experience.

In this paper we calculated the cultural quotient of physics education in the four different regions of Papua New Guinea. We analyzed the cultural intelligence by conducting a survey among the first- year university

students taking physics. The data collected was entered into Google Forms as a survey administration software and used the Google Sheets for effective sorting in spreadsheets. We also proposed measures to develop cultural intelligence among students in regions whose cultural quotient scores are low.

2. METHODOLOGY

The number of students who took part in the study from the four regions of Papua New Guinea is given in Table 1.

Table 1. The number of students who took part in the study from the four regions of Papua New Guinea.

REGIONS						TOTAL	
INSTITUTION		SOUTHERN	MOMASE	HIGH LANDS	ISLANDS		
UPNG	Male	6	15	33	3	57	
	Female	3	12	14	11	40	**97**
UNI TECH	Male	13	10	24	4	51	
	Female	6	12	10	4	32	**83**
UoG	Male	5	7	28	3	43	
	Female	1	0	4	0	5	**48**
TOTAL	**Male**	24	32	85	10	**151**	228
	Female	10	24	28	15	**77**	
	TOTAL	**34**	**56**	**113**	**25**	228	

The survey questionnaire accommodates and explains four different categories. They are 1) learning and understanding physics, 2) aspirations of physics education, 3) influences of English language in learning physics and 4) physics knowledge from the community. The cultural factors that influence physics education in Papua New Guinea are 1) language barrier, 2) interactions of physics concepts with indigenous knowledge, 3) the perception of physics in Papua New Guinea's cultural values and 4) the family or societal expectations that impact the physics education. To calculate CQ, we took some indicators based on 1) understanding the concepts of physics with culturally relevant examples, 2) curriculum flexibility to include local phenomena and availability of teaching and learning resource materials, 3) students' interest, participation and motivation in physics and 4) culturally relevant teaching styles (story telling). To quantitatively evaluate the responses of specific cultural backgrounds, a Likert-scale system is used to measure the student's attitude and engagement of physics education. For measuring qualitative responses related to cultural relevance and engagement, we assigned weightage points based on the depth of the relevant responses (Ang et al., 2007). This is tabulated in Table 2.

Table 2. The assigned weightages for categories 1) Learning and understanding physics, 2) Aspirations of Physics education, 3) Influence of English language in learning Physics and 4) Physics knowledge from the community.

Categories	Indicators	Weightage
1. Learning and understanding physics	There are just too many formulas and equations to remember and understand in physics	1.0
	There are just too many symbols and constants to remember and understand their meanings in physics	1.0
	It was difficult to tell my peer group the problems I had in learning physics in Grades 11 and 12 because physics was just difficult.	1.0
	It was difficult to tell my physics teacher the problems I had in learning physics in Grades 11 and 12 because physics was just difficult.	1.0
	It was difficult for me to participate in Grades 11 and 12 physics classes discussions because physics itself was just difficult.	1.0
	If a student is weak in physics, then that student is also weak in other science subjects	1.0

	If a student is strong in physics, then that student is also strong in other science subjects.	1.0
	I was told by family friends at home that physics was going to be a difficult subject to learn in grades 11 and 12 and that was when I began to get scared of learning physics.	1.0
	I was told by my school friends that physics was going to be a difficult subject to learn in grades 11 and 12 and that was when I began to get scared of learning physics.	1.0
	I was told by my grade 11 physics teacher that physics was going to be a difficult subject to learn and that was when I began to get scared of learning physics.	1.0
2. Aspirations of physics educati	Physics is unheard of at primary and high school levels until you reach grade 11	1.5
	Physics is just naturally difficult regardless of how much effort you put in to understand	1.5
	Applying physics in real life experiences is hardly seen or heard of in grades 11 and 12.	1.5
	Future career opportunities in Physics are not common and not popular in grades 11 and 12.	1.5
	Future career opportunities in Physics are not known in grades 11 and 12.	1.5
	I was forced by the education system to take up physics in grade 11	1.5
3. Influences of English language in learning physics	It is not easy to learn physics from other sources apart from the physics teacher	2.0
	The language translation process from mother tongue to motu or tok pisin then to English makes it much more difficult to understand physics.	2.0
	It was difficult for me to share my views on teaching and learning physics in Grades 11 and 12 because it was also difficult for me to use the language and expressions of physics.	2.0
	Because physics was difficult to learn, I would have learnt better if my physics teacher was from the same region as I am.	2.0
4. Physics knowledge from learning physics the community	I have family members who graduated in physics and other sciences and engineering and that encouraged me to study physics even the subject was challenging.	1.5
	The difficulty of physics was only a challenge. I appreciated learning new techniques, ideas and methods of solving problems and that encouraged me to continue studying physics at university level.	1.5
	In physics I learnt new ideas and things which not many people know and do and this makes me feel proud and unique to continue study physics at university level.	1.5
	Laws of physics are laws of life	1.5

From the score of each indicator, a weighted average of the overall CQ is calculated using the formula

$$CQ = \frac{\sum(W_i \times D_i)}{\sum W_i}$$

where W_i = weight assigned to each indicator and D_i = average score for each indicator.

Similarly, weighted average CQ levels for the four categories for each region were determined using the same formula (Ang et al., 2007).

3. RESULTS AND DISCUSSION

Table 3: The weighted average of the CQ levels for the four regions under study.

Region	**Weighted Average CQ Levels**
Southern	14.24
Momase	14.75
Highlands	52.27
Islands	9.56

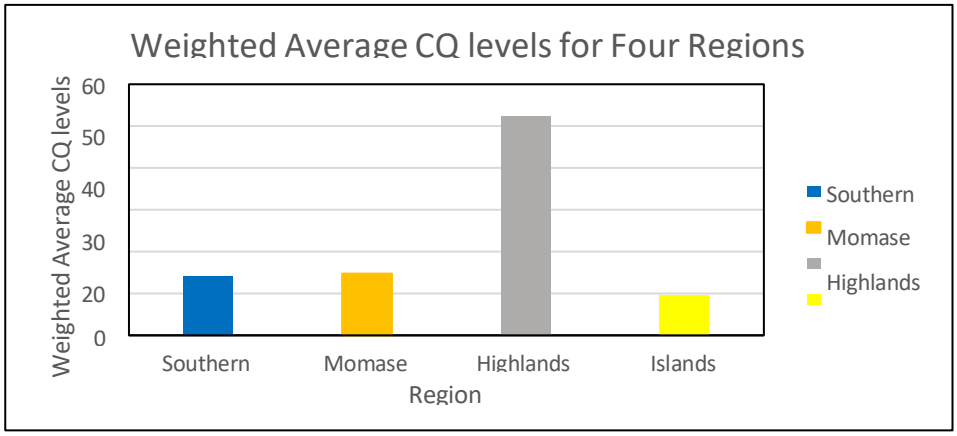

Fig. 1: The weighted average Cultural Quotient levels in the four regions.

Table 4: The weighted average of the CQ levels for the four categories for the four regions under study.

Categories	Weighted Average CQ Levels			
	Southern	Momase	Highlands	Islands
1	13.7	13.3	51.9	8.8
2	12.2	11.5	42.3	7.2
3	7.5	9.0	32.3	5.0
4	27.3	29.8	94.5	20.5

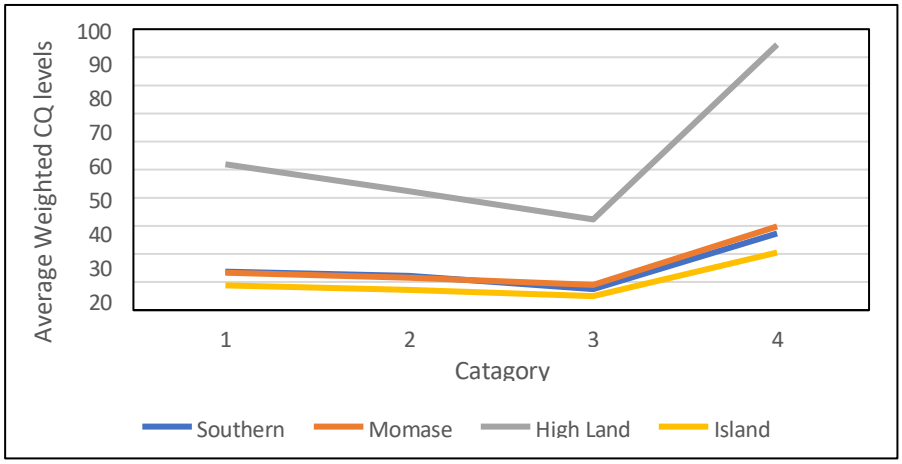

Fig. 2: The weighted average CQ levels based on the four categories

Table 3 shows that Highlands Region has the highest weighted average CQ level of 52.27. Momase Region, Southern Region and Islands region have their weighted average CQ levels as 14.75, 14.24 and 9.56 respectively. Fig. 1 shows the significant disparity between the weighted average CQ levels of Highlands Region and the other three regions. This study highlights that culture does influence the way students learn physics in Papua New Guinea with varying levels of CQ across the four regions. This finding aligns with Kukari (2004) who found that classrooms for teaching and learning in Papua New Guinea are polarized by religious and indigenous cultural beliefs.

Fig. 2 and Table 4 show two significant findings of this study. One is the uniform behaviour of each of the graphs for the four regions. This means that students in Papua New Guinea bring both commonly shared and unique cultural beliefs into their grades 11 and 12 physics classrooms. They also face common challenges and difficulties in learning physics. The impacts of these challenges also vary across the four regions. The other observation is that for all the four regions there is significant decrease in the weighted average CQ levels for

category three. The Highlands region has relatively the highest weighted average CQ level for this category compared to the other three regions. This study shows how English language affects students learning physics in Papua New Guinea. Language barriers cause fragmentations in physics classrooms in Papua New Guinea when it comes to interpretations, discussions and thought processing of physics concepts. This finding is supported by Morales (2015) who reported that culture and language integration in the teaching and learning processes of physics concepts allow students to develop positive attitude to science, their culture, and native language.

Physics classrooms in Papua New Guinea settings mean more than teaching and learning environment. The dynamics of linguistic and cultural diversity play a significant part in shaping both the teachers' and students' attitudes towards physics. These unseen forces are what both physics teachers and students need to contain to have meaningful and lifelong teaching and learning. Some of the recommendations to enhance the cultural Intelligence are given below.

- Introduce cultural awareness in schools and universities.
- Conduct cultural competency workshops and training programs in schools and communities.
- Promote cross-cultural interactions like Community events, multicultural festivals and intergroup dialogues that share their customs, food, music and traditions.
- Government and private organizations can organize exchange programs that allow people to travel, live and work in different cultural settings.
- Encourage multicultural programs in media.
- Identify community leaders and empower them to foster empathy and open-mindedness.
- Utilize technology to enhance cultural practices on a global perspective.
- Celebrate diverse cultural programs and encourage reflective practices.

4. CONCLUSION

CQ levels vary significantly across the four regions of Papua New Guinea. A critical highlight in this study is the weighted average of the CQ levels for the influence of English language in teaching and learning physics in Papua New Guinea. In our study, we observed that average cultural quotient is high in the high land region compared to other regions. In this paper we highlighted the remedial measures to improve the CQ levels across the four regions. PNG is known for its cultural diversity with different traditions, customs and life patterns. We recommend to run Physics teacher's upskilling programs to develop and implement appropriate pedagogies for physics teaching and learning in Grades 11 and 12 at in multicultural settings. Also, embrace cultural and language integration in physics curriculum to capture local phenomena.

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