Learning Physics: Cross-cultural Perceptions of Students in Carmen, Cotabato

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Abstract: The Cotabato province is home to ethnolinguistic communities that differ in language, belief system, and culture. This survey project aims to reinforce teachers' understanding of learners in a multicultural classroom by exploring students' perceptions (interest, self-efficacy, and attitude) in learning Physics. The sample of 93 senior high school students belonged to the three major ethnolinguistic groups in Carmen, Cotabato, namely, Cebuano, Ilonggo, and Maguindanaon. A descriptive-comparative design was employed to accomplish the following objectives: (a) to determine the extent of interest, self-efficacy, and attitude of students in learning Physics; (b) to determine the similarities and differences in perceptions in learning Physics across sex, age, ethnolinguistic group, and religious affiliation and (c) to determine the relationship between the interest, self-efficacy, and attitude toward learning Physics. The results indicate students' high interest in relatable concepts explaining how things work. They manifest less self-efficacy in understanding Physics concepts, but once apprehended, they display higher self-efficacy in transferring those concepts to daily life. They also show less preference for calculations; while lessons relevant to their everyday lives generally yield positive attitudes toward learning the subject. Findings also reveal no significant difference between their perceptions in learning Physics when grouped based on sex and age. Maguindanaon students have significantly lower self-efficacy in learning Physics. Muslim students hold significantly lower self-efficacy in learning Physics than Catholics and Protestants. Lastly, interest, self-efficacy, and attitude toward learning Physics are positively correlated.

Key Words: multicultural education; science education; interest in Physics; self-efficacy in Physics; attitude toward Physics.

1. INTRODUCTION

Culture is the way of life - a paradigm that shapes how people make sense of phenomena in the environment (Iaccarino, 2003; Keraro & Okere, 2008). Accordingly, beliefs, attitudes, and performance in science indeed receive influence from one's cultural background, as suggested by the studies (Anderson, 2020; Bello, 2015; Morales, 2014; Pejaner & Mistades, 2020; Reiss, 2010).

Pew Research Center provides that across all of their survey's individual science knowledge items, there were variations by race and ethnicity (Anderson, 2020). In developing countries like the Philippines,

science education anchors on Western concepts and principles and is taught by those for whom science is often unrelated to, if not their culture, some aspects of their way of living (Iaccarino, 2003). In addition, cultural diversity among Filipino learners evinces that indigenous beliefs and preferences are unique in each ethnic/ethnolinguistic group (Morales, 2014). On a different note, Orleans (2007) maintains that the number of Physics classes teachers handle affects learners' perceptions and performance in the subject. Unlike in the Metro Manila, Physics teachers in SOCCSKSARGEN and Autonomous Region in Muslim Mindanao hold the least number of Physics loads. What is more concerning is the fact that learners in rural areas still carry some beliefs firmly rooted in indigenous concepts about natural phenomena, which in some cases, do not adhere to the accepted scientific explanations taught in school (Keraro & Okere, 2008; Bello, 2015; Pejaner & Mistades, 2020).

The above issues inspired the researcher to explore the learners' perceptions in learning Physics in Carmen, Cotabato – a relatively small area in south-central Mindanao inhabited by people of different ethnolinguistic groups. It is an attempt to strengthen the understanding of a multicultural classroom which has always been highly relevant to the area. Specifically, this study aims to: (a) determine the perceptions (i.e., interest, self-efficacy, and attitude) of students in learning Physics; (b) determine the similarities and differences in perceptions across sex, age, ethnolinguistic group, and religious affiliation and (c) determine the relationship between the interest, self-efficacy, and attitude toward learning Physics.

2. METHODOLOGY

2.1 Participants

The survey involved 93 senior high school students between 16 to 24 years old. They were selected using quota sampling to attain 31 equal numbers of respondents who belong to the three major ethnolinguistic groups in the municipality of Carmen, Cotabato: Cebuano, Ilonggo, and Maguindanaon (Philippine Statistics Authority, 2002).

2.2 Materials

This study utilized a questionnaire adapted from Dare's (2015) research entitled "Understanding Middle School Students' Perceptions of Physics Using Girl-Friendly and Integrated STEM Strategies: A Gender Study." The survey included four socio-demographic questions (i.e., sex, age, ethnolinguistic group, and religious affiliation) and 15 Likert-type questions subdivided into three constructs of perceptions: Interest, Self-efficacy, and Attitude (Uitto, 2014). The instrument's reliability was tested by determining Cronbach's alpha ($\alpha = 0.854$).

2.3 Design and Procedure

Examining the nature and distributions of variables among groups and determining similarities and differences required a descriptive-comparative approach as a primary design of this study (Sousa, Driessnack, and Mendes, 2007). The online questionnaire was administered from November to December 2020. Prior to that, a formal communication letter was sent to school officials, and students were informed of the survey's nature. The analysis consisted of measures of central tendency, t-test, One-way ANOVA, independent samples Kruskal-Wallis's test, Mann-Whitney U test, Pearson correlation, and Tukey procedure, performed by the Statistical Package for Social Sciences. Confidence interval is set to 95% ($p < .05$).

3. RESULTS AND DISCUSSION

3.1 Socio-demographic Profile

Out of 93 respondents, the majority (66%) were females. Most (73%) of them fall under the age bracket of 16-18 years old. The number of Cebuano, Ilonggo, and Maguindanaon students was equally predetermined, with the frequency count of $n = 31$ respondents in each group. In terms of religious affiliation, most of them were Catholics (42%), and 32 (34%) were Muslims. Only 22 (24%) were Protestants.

3.2 Perceptions of Students in Learning Physics

3.2.1 Interest in learning Physics

Table 1 summarizes students' interest in learning Physics with an overall mean of 3.65 (*SD* = 1.00). Statement number 1, "I like learning how things work," got the highest mean (*M* = 4.15, *SD* = 0.92) which verbally describes "Agree." The figure is congruent to a study stating that focusing on real-world contextual relevance and emphasizing conceptual understanding spark learners' interest in Physics (Hazari et al., 2010). Item number 5, "Physics is one of my favorite subjects in senior high school," got the lowest mean (*M* = 3.06, *SD* = 1.14) with the verbal description of "Neutral." It supports the findings of Djudin (2018) and Erinosho (2013) that Physics is one of the least preferred subjects of interest to students.

Table 1. Interest in learning Physics

Statements	Mean	*SD*
1. I like learning about how things work.	4.15	0.92
2. I am interested in the topics we are discussing in Physics.	3.92	0.98
3. I like to learn about Physics topics outside the school.	3.78	1.01
4. I would like to have a career where Physics plays a role.	3.32	0.97
5. Physics is one of my favorite subjects in senior high school.	3.06	1.14
Total	3.65	1.00

3.2.2 Self-efficacy in learning Physics

Table 2 reports the extent of students' self-efficacy in learning Physics with an overall mean of 3.55 (*SD* = 1.08). Item number 2, "My knowledge in Physics helps me deal with situations in my everyday life," got the highest mean (*M* = 4.04, *SD* = 0.98) which translates to "Agree." In contrast, item number 1, "I easily understand Physics topics," got the lowest mean (*M* = 3.02, *SD* = 1.01), described as "Neutral." This confirms Lomoljo's (2017) study where students often associate Physics with abstract terms and long, cruel examinations that make the students less confident in learning the subject.

Table 2. Self-efficacy in learning Physics

Statements	Mean	*SD*
1. I easily understand Physics topics.	3.02	1.01
2. My knowledge in Physics helps me deal with situations in my everyday life.	4.04	0.98
3. Anyone can be good at Physics.	3.98	1.01
4. Being good at math does not mean being good at Physics.	3.56	1.05
5. I am confident in doing calculations in Physics classes.	3.14	1.33
Total	3.55	1.08

3.2.3 Attitude toward learning Physics.

Responses regarding the students' attitudes toward learning Physics got an overall mean of 3.86 (*SD* = 0.96). Item number 5, "I like when I can relate to the topics in Physics class," garnered the highest mean (*M* = 4.32, *SD* = 0.85), which describes "Strongly Agree." In contrast, item number 2, "I like using math to solve science problems," got the lowest mean (*M* = 3.42, *SD* = 1.07) which describes as "Agree." The data support the findings of Ekici (2016) that mathematical calculation is the main reason students perceive Physics as a difficult subject. In addition, Kelly (2018) adds that students are more engaged when they feel that their learning relates to life outside the classroom.

Table 3. Attitude toward learning Physics

Statements	Mean	*SD*
1. I prefer to work in groups in Physics Classes.	3.88	0.92
2. I like using math to solve science problems.	3.42	1.07
3. I prefer hands-on activities when learning Physics.	3.90	0.98
4. I like participating in class discussions about Physics.	3.77	0.98
5. I like when I can relate to the topics in Physics class.	4.32	0.85
Total	3.86	0.96

3.3 Differences in Students' Perceptions in Learning Physics

3.3.1 Difference between sexes

The *t*-test reveals no significant difference between the interest, self-efficacy, and attitude of both sexes toward learning Physics. It supports the findings of Kayan and Boyuk (2011), Awodun et al. (2014), and Dare (2015). However, it contradicts the finding that boys have greater self-efficacy in their abilities in mathematics or "hard sciences" [Chemistry and Physics] than girls (Louis & Mistele, 2012; Peters, 2013) and that biology courses and careers attract more females than other areas of science do (Britner, 2008).

3.3.2 Difference between age groups

Independent samples Kruskal-Wallis's test was used to determine if there are significant differences in students' perceptions across age groups. The results indicates that there was no significant difference between interest (p = .143), self-efficacy (p = .832), and attitude (p = .326) of students toward learning Physics. The data might be attributed to the close age brackets of the respondents, as they are all in senior high school.

3.3.3 Difference between ethnolinguistic groups

Analysis of variance (ANOVA) shows no significant difference between their interest and attitude toward learning Physics. However, there is a significant difference between their self-efficacy in learning Physics (F(2,90) = 9.536, p < .001, $\eta 2$ = .175; Table 4).

Table 4. Perceptions across ethnolinguistic groups

Construct	F(2,90)	η2
Interest	0.749	.016
Self-efficacy	9.536**	.175
Attitude	2.344	.049

**p<.001

Tukey procedure (post hoc) reveals no significant difference between the self-efficacy in learning Physics of Cebuano (M = 3.58, SD = 0.43) and Ilonggo (M = 3.78, SD = 0.42) students (p = .194). However, a significant difference was found in Cebuano and Maguindanaon students (p = .030) and between Ilonggo and Maguindanaon students (p < .001). Maguindanaon students have a significantly lower self-efficacy in learning Physics (M = 3.28, SD = 0.42) among the three groups. This is consistent with the results of Orleans (2007) that Region 12 and ARMM, where Maguindanaon students reside, have lesser confidence in learning Physics. Parallel to Morales's (2014) findings, the lack of teachers who can speak or who belong to the Maguindanaon ethnolinguistic group could explain why Maguindanaon students are less confident as they perceive the subject as isolated and irrelevant. On a different note, most Cebuano and Ilonggo students live in town, while Maguindanaon students reside in barangays. This could affect their perceptions in learning the subject, as explained by the results of Pejaner and Mistades (2020), Bello (2015), and Keraro and Okere (2008).

3.3.4 Difference between religious affiliations

Independent samples Kruskal-Wallis's test shows no significant difference in students' interest and attitude toward learning Physics. Still, there is a significant difference in their self-efficacy in learning Physics (p = .004).

Table 5. Self-efficacy across religious affiliations

Self-efficacy		Mean Difference	U	p
Upper	Lower			
Protestant	Catholic	.104	364.0	.324
Protestant	Muslim	.445	182.5*	.003
Catholic	Muslim	.341	401.5*	.009

*p<.0165

A post hoc Mann-Whitney U test with Bonferroni correction reveals no significant difference in self-efficacy in learning Physics between the Protestant and Catholic students. However, the self-efficacy of Muslim students is significantly lower than that of Protestant (p = .003) and Catholic (p = .009) students (see Table 5). Findings are congruent to Reiss's (2010) that religious beliefs influence the learners' perspectives and acquisition of scientific concepts, both positively and negatively.

3.4 Relationship between Interest, Self-efficacy, and Attitude toward Learning Physics

Pearson correlation *r* reveals a positive medium correlation between interest and self-efficacy in learning Physics ($r(91) = .45$, $p < .001$), a positive medium correlation between interest and attitude toward learning Physics ($r(91) = .57$, $p < .001$), and a strong positive correlation between self-efficacy and attitude toward learning Physics ($r(91) = .60$, $p < .001$).

Table 6. Relationship between the constructs

	Construct	*M*	*SD*	1	2	3
1	Interest	3.65	0.69	–		
2	Self-efficacy	3.55	0.49	.45**	–	
3	Attitude	3.86	0.67	.57**	.60**	–

***p<.001*

It implies that when the students' interest in Physics increases, it is more likely that their self-efficacy and attitude toward learning Physics also increase and vice versa. This is similar to Wenno's (2014) study that when students find the topic interesting, they tend to be more motivated and attentive in class discussions.

4. CONCLUSIONS

Concepts explaining the workings of the environment draw more interest to the students, yet they do not regard Physics as their favorite subject. They manifest less self-efficacy in understanding Physics concepts, but once learned, they exhibit high confidence in applying them to reality. Preference gravitates less toward solving problems and more toward lessons relevant to their everyday life. Thus, instruction must strengthen conceptual understanding and emphasize its interplay with the mathematical skills needed for the subject. Also, teachers should localize examples and questions and avoid culturally biased ones found in the books.

Sex and age are not factors of perceptions in learning Physics. The analysis found no significant difference in interest and attitude toward learning Physics among the ethnolinguistic groups. However, Maguindanaon students have lower self-efficacy in learning Physics. Furthermore, Muslim students' self-efficacy in learning Physics is substantially lower than that of Catholic and Protestant students. Therefore, teachers must be immersed in the Maguindanaon culture and language; must at least be familiar with the Muslim way of life; and have developed cultural sensitivity throughout their careers. Also, empowering science teachers native to the area is deemed necessary.

Lastly, a positive relationship between interest, self-efficacy, and attitude toward learning Physics is evident. When students find the subject interestingly relevant to their daily lives, they tend to have higher self-efficacy and positive attitudes toward it. As a result, culturally relevant teaching practices are in high demand in rural areas.

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