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Effect of Contextual Inquiry Approach on Interest Towards Science and Achievement in Earth Science among Grade 10 Students

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ABSTRACT

This study determined the effect of the contextual inquiry approach (CIA) on interest in science and achievement in Earth Science among grade 10 students at Ferrol National High School. In CIA, students are doing inquiry-based learning using situations and materials that are within their context and locality. The pretest–posttest control group quasi-experimental design was employed in the study, which involved two matched classes of 30 students each, both implementing the 7Es inquiry model: elicit, explore, engage, explain, elaborate, evaluate, and extend. The experimental class used the CIA in conducting the activities and providing examples about the concept while the control group used pictures in delivering 10 learning competencies in Earth Science topics. The instruments used were the 40-item researcher-made achievement test in Earth Science and 12-item Science Inventory Test modified from the Program for International Student Assessment. Results showed that the CIA helped improve students' achievement in Earth science ($\eta_p^2 = .11$). In classes implementing the 7Es inquiry model, CIA is comparable to the conventional teaching approach (CTA) in improving students' interest in science. However, interest in science and achievement in Earth Science are not related to each other. This advances the argument that the attitude-achievement paradox is possibly existent among Filipino learners.

Keywords: *contextualization, 7Es, achievement in Earth Science, interest, contextual inquiry*

INTRODUCTION

As teaching approaches continue to flourish from time to time, it is imperative that innovations should keep up with this pacing, otherwise, the educational system cannot ensure quality learning due to obsolescence. This principle serves as the very reason why there has to be an appropriate approach for every gap that exists in the process of teaching and learning.

The goal of science teaching in the K12 Science curriculum is to develop scientific and technological literacy among students. Three of the domains are scientific knowledge, scientific skills, and scientific attitude. More notably, the science education curriculum aims to develop students to become effective communicators, critical and creative problem solvers, responsible stewards of nature, innovative thinkers, and informed decision-makers. These kinds of students can be achieved if they can demonstrate science inquiry skills, understand and apply scientific knowledge and develop and demonstrate scientific attitudes and values. Fortunately, the 7Es model in science teaching has been found to develop these skills and eventually bring about a positive effect on teaching and learning (Gok, 2014).

The Philippines undeniably faces a daunting challenge to prove itself in the international educational landscape because it ranked as the second-lowest in science and mathematics (obtaining 353 in the former and 357 in the latter) among 79 countries (CNN Philippines, 2019), and exhibited a consistently abysmal performance having ranked only 34th out of 38 countries in high school Math, and 43rd out of the 46 participating countries in Grade 8 Science in the Trends in International Mathematics and Science Study (TIMMS) in 2015 for high school.

Considering the claim of experts from the University of the Philippines National Institute for Science and Mathematics Education Development (UP NISMED), the discipline-based curriculum encouraged mostly rote learning instead of inquiry and high levels of thinking. Most research revealed that some of the students here in the country failed to meet the mastery

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of the basic skills needed to learn science and its specific fields.

Aside from the performance being at stake if teaching approaches are compromised, interest in the subject cannot be downplayed in any learning endeavors. It must be dealt with well by the teachers. As evidenced in the study by Anderhag et al. (2016), sustaining the interest of students in science becomes an everyday challenge for teachers. It was also found that primary students lost interest in science during their secondary school contrary to their primary days. Similarly, Dawson (2000) and Osborne et al. (2003) posited that as the children grow, their interests in science tend to decline.

With this in perspective, the teaching approach will always be the greatest factor to account for which justifies the current investigation. This study was conducted to determine the effect of the contextual inquiry approach (CIA) on interest in science and achievement in Earth Science among grade 10 students at Ferrol National High School, Ferrol, Romblon during the school year 2019-2020.

METHODOLOGY

Research Design

The pre-test - post-test control group quasi-experimental design was employed because two intact classes were used and randomly assigning students to either group was not possible. As discussed in the work of Ross et al. (2005), this design is the best option for school-based research where classes are formed at the start of the year, and it is neither practical nor feasible to assign the students randomly to treatments (Table 1). Students in both groups took the pre-test in Achievement Test in Earth Science (ATES) (O1). Post-test in ATES (O2) was administered to both groups immediately after the implementation of the intervention. The dependent variable in the study is the students' post-test scores in ATES. The covariate is their pretest score. The adjusted posttest scores are used in comparing the two groups. Both groups also answered the ISI (O3). Selected students from both groups were likewise interviewed about their experience in learning the lessons (O4).

Table 1. The Research Design.

Group	Pretest	Treatment	Posttest
1	O_1	CIA	O_2, O_3, O_4
2	O_1	CTA	O_2, O_3, O_4

where:
1- Experimental Group
2- Control Group
O_1- Pretest- Achievement Test in Earth Science (ATES)
O_2 – Posttest- Achievement Test in Earth Science (ATES)
O_3 – Posttest in Interest Inventory (ISI)
CIA- Contextual Inquiry Approach
CTA- Conventional Teaching Approach
O4 – Random interview

Achievement Test in Earth Science

The ATES is a 40-item multiple-choice type teacher-made test developed based on the Table of Specifications (Table 2). The topics covered in the test were parallel to the K12 grade ten learning modules. The test items were validated by five experts in the field: one Ph.D. in Educational Management and teaching science subjects in college, two science professors in college, one Master Teacher in Science, and two high school teachers. The experts' suggestions were considered in the revision of the test items.

To establish the reliability of the ATES, it was pilot tested among grade 11 students at Ferrol National High School (FNHS). This study considered 30 grade 11 senior high school students since the test intends to measure achievement on Earth Science topics covered in grade 10. Hence, grade 11 students were the most appropriate test takers of the test as shown in the work of Lantano (2009). Rasch analysis was used in determining the item reliability of ATES resulting in α=0.88. This means that the instrument is acceptable.

Interest in Science Inventory

The ISI is a researcher-made test that contains item indicators measuring student interest in science (OECD, 2007). The draft of ISI was initially composed of 30 items. However, when it was administered to another section of grade 10 students not included in the study, the items were reduced to 12 only with a Cronbach's alpha value of 0.80. This established the acceptability and reliability of the developed ISI.

Data Collection

A letter of permission was sent to the Principal of FNHS. Then, the validated instruments were pilot tested: ATES to 43 grade 11 students and ISI to another section of grade 10 with 30 students in the same school who were not included in the study. The experimental and control groups were identified as explained in the previous section. A letter of consent was sent to the parents of the students informing them that their children were participating in the study. The confidentiality of data was emphasized.

The Contextual Inquiry Approach Intervention

Contextual inquiry is a learning approach that uses local information and materials in the teaching and learning process. This includes names, situations, or settings that are needed to give context to the lesson, activities, or tests. In this study, 7Es as a model for inquiry approach was implemented in both the control and experimental groups. In the experimental group, however, some phases of 7Es are localized and

contextualized. Localized learning refers to the process of relating the learning content to local information and materials in the learner' community. In localized learning, the learning content includes local information and local materials used in teaching. During instruction, the teacher uses examples, names, situations, and settings to give context to test questions or problem-solving exercises within the locality or immediate community.

Table 2. Table of Specifications of the Achievement Test in Earth Science.

Learning Competencies	**Teaching Hours**	**%**	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating	**No. of Items**
1. Describe the distribution of active volcanoes, earthquake epicenters, and major mountain belts. **(S10ES-Ia-j-36.1)**	9	60%	6 (1-6)	6 (7-12)	5 (13-17)	3 (18-20)	2 (21-22)	2 (23-24)	24
2. Describe the different types of plate boundaries. **(S10ES-Ia-j-36.2)**	5	33%	4 (25-28)	3 (29-31)	2 (32-33)	2 (34-35)	1 (36)	1 (37)	13
3. Explain the different processes that occur along the plate boundaries. **(S10ES-Ia-j-36.3)**	1	7%	1 (38)	1 (39)		1 (40)			3
	15 hrs.	**100%**	**11**	**10**	**7**	**6**	**3**	**3**	**40**

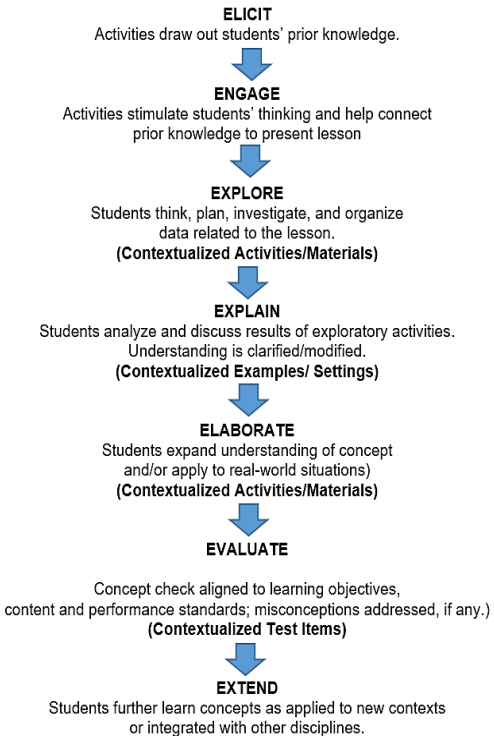

Figure 1. The Contextual Inquiry Approach

For instance, during the exploration phase, students used locally available materials. A laboratory sheet with procedures of what to do was distributed to each one of them. They answered the questions after doing the activity. In the explanation stage, local information or examples were also given to the students. In this way, their interest could be stimulated because of relatable and localized examples which could potentially result in better understanding and retention of science concepts. The 7Es inquiry model was similarly employed in the CTA group but the materials and information were not localized. Instead, pictures were used and presented to the students. The complete contextualization's embedded within the 7Es inquiry model as used in the study are found in Appendix F.

Figure 1 models how the Contextual Inquiry Approach can be done in science classes. On the other hand, the control group used the 7E learning model where they were exposed to concepts with activities that are not localized and contextualized.

Data Processing and Analysis

Descriptive statistics such as the mean (*M*) and standard deviation (*SD*) were used to present the preliminary information of ATES and ISI scores as well as the characteristics of respondents in terms of age and their grade in science. The science grade of grade 10

CIA and CTA classes, the mean pretest scores in ATES, and the mean post-test score in ISI were compared using the *t*-test for independent samples. One-way analysis of covariance (ANCOVA) was used in testing the significant difference between CIA and CTA groups in terms of their post-test mean score in ATES using their pretest scores as covariates (Fraenkel et.al.,2012; Gall et al.,1996; Wiersma, 1995; Best & Kahn, 1993; Sprinthhall et. al.,1991). The ANCOVA also allows the determination of the effect of the intervention on the posttest that is not predictable by the pretest. In defining the effect of the intervention, the effect size was used. In ANCOVA, the effect size was interpreted as: 0.10 = small, 0.25 = medium, 0.40 large (Cohen et. al., 2001). For *t*-test, the effect size was interpreted as: 0.01 = small effect, 0.06 =moderate effect, and 0.14 = large effect (Cohen, 1998). In determining the relationship between interest in science and students' achievement in Earth Science, Pearson product-moment (r) correlation was used.

RESULTS AND DISCUSSION

Comparison of Earth Science's Achievement

Table 3 shows the pretest and post-test mean scores of students in the Achievement Test in Earth Science from both CIA and CTA. It appears that students from the CTA class (M = 11.93, SD = 2.99) have lower pretest mean scores than those from the CIA class (M = 12.37, SD = 4.76) with a mean difference of 0.44. However, a t-test for two independent samples established that this difference was not significant, $t(60) = 1.16$, $p = .252$, hence their comparability. As to the posttest scores in ATES, CIA class (M = 21.03, SD = 6.28) obtained a higher mean score than the CTA class (M = 17.57, SD = 5.13) with a difference of 3.46.

Table 3. Descriptive Analysis of Pretest and Post-Test Mean Score in Achievement Test in Earth Science

Group		N	Mean	SD
Pretest	CIA	30	12. 37	4.76
	CTA	30	11.93	2.99
Posttest	CIA	30	21.03	6.28
	CTA	30	17.57	5.13

A one-way between-groups analysis of covariance (Table 4) was conducted to compare the effectiveness of the two teaching approaches on the dependent variable, the posttest mean score on the Achievement Test in Earth Science. Students' scores on the ATES pretest were used as a covariate in this analysis. After adjusting for pretest ATES scores, there was a significant difference between CIA (M = 21.03, SD = 6.28) and CTA (M = 17.57, SD = 5.12) on posttest scores in the Achievement Test in Earth Science, $F(1,57) = 6.85$, $p = .011$, $\eta_p^2 = .11$, a small Cohen's effect size (Cohens et al., 2001). Therefore, using the pretest mean score in Earth Science Achievement Test recorded as a covariate, the class exposed to the contextual inquiry approach have a significantly higher post-test mean score than the class taught using the conventional teaching approach.

The findings supported the claim of Satriani and colleagues (2012) that contextual learning can motivate learners to take charge of their learning and to relate knowledge and its application to the various contexts of their lives. Likewise, it will also make learning more meaningful when students do practical activities.

Comparison of Interest in Science

Table 5 shows the result of an independent samples t-test conducted to compare the post-test mean scores in ISI for CIA and CTA classes. There was no significant difference in scores between CIA (M = 47.13, SD = 4.32) and CTA (M = 48.93, SD = 5.04), $t(58) = 1.49$, $p = .14$, $\eta^2 = 0.037$. Thus, the class exposed to CIA does not have a significantly higher mean score in ISI than the class taught using the conventional teaching approach.

The result of this study affirmed the claims of Suryawati and Osman (2017) that the CTL approach is not significantly different from the conventional approach in terms of attitude towards science. The findings indicated that the students were able to work as a team but being responsible is still at a low level. This scenario might be due to a low level of cognitive maturity and self-confidence among the students. Lack of responsibility skills was detected through qualitative observation, where students were less concerned about the instrument's condition as well as the overall cleanliness after every lab activity.

In addition, the results of this study do not support the claims that context-based approaches result in improvement in attitudes towards science (Benneth et al., 2007; Febriani et al., 2017). This can be possibly explained by using the 7Es as an inquiry model in both groups which was claimed to have the greatest effect on the learning interest of the students (Samba et al., 2016; Senol & Oskay, 2017; Gibson & Chase, 2002) positively. This might have overshadowed the effect of the CIA on students' interest in science as supported by the narratives of the students.

Relationship between Interest in Science and Earth Science Achievement

Table 6 illustrates the overall relationship between the Interest and post-test mean score in the Achievement Test in Earth Science using the Pearson product-moment correlation coefficient. Overall, the result indicates no correlation between the two variables, $r(58) = -.10$, $n = 60$, $p = .94$. Likewise, no

significant correlations between ISIT and ATES scores were observed within CIA, r(58) = -.06, n = 30, p = .76, and CTA, r(58) = 0.04, n = 30, p = .82) classes. Therefore, there is no significant relationship between the students' scores in ISI.

This result is contrary to the conventional knowledge wherein the interest in the subject, an effective trait that is attitudinal is expected to have a strong bearing on one's academic performance (Amrai & Parhon, 2011; Koller et al., 2001). However, based on the Attitude-Achievement Paradox, learners can achieve highly in science without necessarily holding a positive attitude towards it (Osborne et al., 2003). Such paradox is prevalent among black Americans and other races and is affected by factors such as ethnic background and social class, race, sample selection, and sample size (Ma & Kishor, 1997; Mickelson, 1990). Interestingly, this result mirrors the state of Filipino learners in general who holds a positive attitude toward science (Talisayon et.al., 2006) but have disappointing performance in science-related international surveys such as TIMSS and PISA during the last few decades (Imam et al., 2014). In the context of the Romblomanon learners, similar findings have also been reported in the quasi-experiment of Fetalvero (2017) among college students.

Table 4. ANCOVA Test Between-Subjects Effects in Achievement Test in Earth Science.

Source	Type III Sum of Squares	df	M^2	F	Sig.	η_p^2
Corrected Model	902.553[a]	2	451.277	21.761	0.000	.433
Intercept	408.148	1	408.148	19.681	0.000	.257
Pretest	722.286	1	722.286	34.830	0.000	.379
Group	142.049	1	142.049	6.850	0.011	.107
Error	1182.047	57	20.738			
Total	24434.000	60				
Corrected Total	2084.600	59				

[a] R^2 = 0.433 (Adjusted R^2 = 0.413)

Table 5. *t*-Test Analysis for independent samples on students' post-test mean Interest toward Science Inventory Test score between CIA and CTA groups.

Group	Sample Size	Mean	SD	Mean Difference	df	t	Sig.
CTA	30	48.93	5.03	1.80	58	1.49	.143
CIA	30	47.13	4.32				

Table 6. Correlation between Interest and Achievement Test in Earth Science (ATES).

	Independent Variable	Dependent Variable Post-ATES
Overall		
Interest	Pearson Correlation	-.01
	Sig. (2-tailed)	0.94[ns]
	N	60
CIA Class		
Interest	Pearson Correlation	.06
	Sig. (2-tailed)	.76[ns]
	N	30
CTA Class		
Interest	Pearson Correlation	.04
	Sig. (2-tailed)	.82[ns]
	N	30

CONCLUSION

Based on the findings, the researcher concluded that the contextual inquiry approach can help improve students' achievement in Earth science. Moreover, in classes implementing the 7Es inquiry model, the contextual inquiry approach is comparable to the conventional teaching approach in improving students' interest in science. Lastly, interest in science and achievement in Earth Science are not related to each other. This advances the argument that the attitude-achievement paradox is existent among Filipino learners.

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CONFLICT OF INTEREST

The author declares no conflict of interest.

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