Higher Order Thinking Skills in Physical Science of Senior High School Learners

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Abstract — Higher-order thinking skills include critical thinking. Higher-order thinking abilities extend beyond simple information observation and memorizing. When we discuss wanting our pupils to be inventive, creative, and evaluative, we are referring to them. Due to the current state of conditions of our learners today during the result of PISA during previous year the researcher came out to this study.

This study focused on the socio-demographic profile of the teacher-respondents in terms of age, sex, track, School Category (small, big), average grade in science 10, Parent's Monthly income and parent's educational background. Moreover, the study also described the level of higher order thinking skills of a learner on a Physical Science subject be described in terms of understanding, applying, analyzing, evaluating and creating.

Also, it determined the difference in level of higher order thinking skills in small and big schools in Cuyapo. In addition, it described the relationship between the profile of the learner and their level of higher order thinking skills on a Physical Science subject in a big school in Cuyapo. Furthermore, it described the significant relationship between the profile of the learner and their level of higher order thinking skills on Physical Science subjects in a big school in Cuyapo and described the relationship between the profile of the learners and their level of higher order thinking skills in Physical Science in different tracks.

One hundred seventy (170) senior high school learners in the Division of Nueva Ecija were the respondents of the study during the academic year 2022-2023. These respondents were from Cuyapo National High School, Dr. Ramon de Santos National High School, Salagusog National High School, Calancuasan National High School, Paitan Sur National High School and Baloy High School.

Descriptive statistics like mean, percentages, and frequency counts were used to describe the personal and socio-demographic profiles of the senior high school learners. The data was processed and analyzed using correlation analysis. Correlation analysis was used to determine the relationship between the profiles of the respondents and their descriptions of the profiles of the learners and their level of higher order thinking skills in Physical Science in different tracks.

With regards to the correlation of the profile of the respondents in their age from a total of 170 learner's respondents, the majority of respondents were 16-17 yrs. Old and mostly male learners from Technical Vocational Livelihood in big school. The average grade in Science was 75-79 and their parent's income ranges from 6,000-20,000 pesos and the educational background of their parents mostly in secondary level.

As for the higher order thinking skills of the learner on Physical science in terms of understanding and applying implied that more respondents were in basic while analyzing, evaluating and creating were in minimal. The results showed that the students have low higher order thinking skills.

With regards to the significant difference in higher order thinking skills in small and big schools showed that there is no significant difference between the scores of the students in small and big schools in higher-order thinking skills. It has no effect on the learners if they were in the big and small school.

As for the significant relationship between the profile of the learner and level of higher order thinking skills in Physical science subject in big and small school implied that there's nothing to do with their profile.

As for the relationship between the profile of the learners and their level of higher order thinking skills in Physical science in different track had nothing to do with their tracks.

This study offered several suggestions with an emphasis on useful findings. To determine the learners' higher order thinking skills, conduct a study that looks at how instructional styles impact both teachers and pupils. A larger sample size follow-up study to gather more data that would strengthen the study's validity. Conduct a study that focuses on how students perceive various teaching methods. Undertake an investigation that centers on the challenges faced by the students about their study practices both at home and at school. Lastly, do a study on classroom observation that focuses more on the behavioral and psychological perspectives of educators, learners, and administrators.

I. Introduction

The central goal of science education was to help students develop their higher order thinking skills to enable them to face the challenges of daily life, through adopting activities that encourage students to use critical, reasoning, reflective and science process skills (Aktamis et al.,2010) hence the new science curriculum has focused largely on promoting learners' higher order thinking skills (HOTS), through doing different activities that require them to use these skills (Vernez & Constant, 2014).

Promoting students' higher order thinking skills (HOTS) has been the focus of education studies and programs (Jones et al., 2011). Research suggested that higher thinking skills are essential for effective learning and a central goal for science education (Avargil, Herscovitz, & Dori, 2012).The various type of higher order thinking skills (HOTS), identified includes critical thinking CT, reflective thinking RT, creative thinking CT, science process skills SPS and problem solving PS. Research in science education asserted that reflective thinking (RT) and science process skills (SPS) are important higher cognitive skills that should be cultivated among students (Constantinou & Kuys, 2013)

Higher cognitive skills are activated when students encounter unfamiliar problems, uncertainties, questions, or dilemmas (Kim & Tan 2012). Successful applications of these skills in the science classroom result in explanations, decisions, performances, and products that are valid within the context of available knowledge and experience and that promote continued growth in these and other intellectual skills. Furthermore, higher order thinking skills require students to

transfer scientific knowledge and apply it to new situations (Gillies, Nichols, Burgh, & Haynes, 2014).

Statement of the Problem

This study aimed to determine the level of higher order thinking skills of senior high learners in Cuyapo. Specifically, it will seek answers to the following questions:

1. How may profile of the learners be described in terms of:
   1.1 Age;
   1.2 Sex;
   1.3 Track;
   1.4 School Category;
   1.5 average grade in science 10;
   1.6 Parent's Monthly income; and
   1.7 parent's educational background?

2. How may the level of higher order thinking skills of learner on Physical Science subject be described in terms of?
   2.1. Understanding;
   2.2. Applying;
   2.3. Analyzing;
   2.4. evaluating and
   2.5. creating?

3. Is there a significant difference in the level of higher order thinking skills in small and big schools in Cuyapo?

4. Is there a significant difference between the profile of the learner and their level of higher order thinking skills on a Physical Science subject in a big school in Cuyapo?

5. Is there a significant difference between the profile of the learners and their level of higher order thinking skills in a Physical Science subject in a small school in Cuyapo?

6. Is there a significant relationship between the profile of the learners and their level of higher order thinking skills in Physical Science in different tracks?

Hypotheses

In this study, the following hypotheses tested:

There was no significant relationship between the profile of Senior High learners and the level of development of higher order thinking skills (understanding, applying, analyzing, evaluating and creating) of the learners.

There was no significant difference in the level of development of higher order thinking skills (understanding, applying, analyzing, evaluating and creating) of the learners when classified according to the selected profile variables.

Significance of the Study

The findings of this study was beneficial to the following:

Students may be able to track their own higher order thinking skills on Physical Science topics and to assess their weaknesses thus helping them to sharpen their skills to improve their achievements rates.

Teachers may use the output of this study to think about remediation activities on the Physical Science subject in order to enhance their instruction that will augment students' understanding on the science subject.

School Administrators may use the output of this study as a basis for the development of innovative strategies in teaching science subjects to meet students' needs.

The Education Program Supervisor may refer to this study and assess if there is a need for science teachers to undergo training and seminars to amplify their teaching strategies to elevate achievement rates of students in science subject**s.**

Scope and Limitation of the Study

This study was limited to the assessment of Physical Science subjects. The study involved all Senior High learners of Cuyapo within the School Year 2023-2024. The result of the summative test that was given to the learners served as the mere basis of their level of higher order thinking skills in the Physical Science subject.

Definition of Terms

The following terms are operationally defined to give information on this study:

Analysis. Break down objects or ideas into simpler parts and find evidence to support generalization. (Bloom's Taxonomy, Pappas et al., 2012)

Evaluation. Make and defend judgments based on internal evidence or external criteria. (Bloom's Taxonomy, Yahya et al., 2012)

Higher Order Thinking Skills. It basically means thinking that is taking place in the higher-levels of the hierarchy of cognitive processing.

Learners. In this study, learner refers to the one who is enrolled under senior high who will be used as respondents.

II. Methodology

Research Design

Descriptive Correlational was a quantitative approach in research employed in this study. According to Babbie (2010), Quantitative methods emphasized objective measurements together with the statistical, Mathematical or numerical analysis of data collected through polls, questionnaires, and surveys, or by manipulating pre-existing statistical data using computational techniques. Quantitative research focused on gathering numerical data and generalizing it across groups of people or to explain a particular phenomenon.

Moreover, the researcher used a descriptive method of research. Valdez (2011), stated that the Descriptive method of research concerned with the description of the data and characteristics about a population. The goal is the acquisition of factual, accurate and systematic data that can be used in averages, frequencies and similar statistical calculations.

The qualities of a population or group and the connections between its constituent pieces can both be discovered through descriptive correlational research.

Sampling Design

The respondents of the study were the Senior High School Learners in Grade 11 who have Physical Science as a core subject during the second semester for the School Year 2023-2024 in Cuyapo District.

The respondents of this study were 170 learners from the Senior High School in the District of Cuyapo. The researcher used a random sampling procedure to determine the respondents.

Research Instrument

The instrument is a teacher-made test consisting of 50 multiple-choice type of questions on Physical Science topics including (Physics: Force and Motion, Elements, Atom, Work, Energy and Power, Sounds, Light and Electricity), The area grouping of HOTS is based on the Bloom's Taxonomy (understanding, applying, analyzing, evaluating and creating) according to (Chang & Mao, 1999; Pappas et al., 2012; Yahya et al., 2012). The researcher seeks the help of the Science School Head of Dr. Ramon De Santos National High School and School Testing Coordinator of Baloy High School to validate the coherence of the test questions.

The teacher – made test will be tested by the selected 20 Senior High learners of private school in Cuyapo Nueva Ecija. To verify the test items, the result will be validated through an item analysis in order to assess items that have to be omitted, replaced, or paraphrased until the researcher will come up with a 50-item test questions.

Data Gathering Procedure

In the data collection, the researcher asked permission from the Schools Division Superintendent and District Supervisors to conduct the study at Cuyapo District.

The researcher submitted a communication letter to six Senior High School principals to seek permission as well to explain the rationale of the study. Upon their approval, the researcher conducted the data gathering.

After the data collection, the researcher proceeded with the tabulation, analysis and interpretations of the collected data. The data were statistically treated and interpreted.

III. Results and Discussion

This study focused on the socio-demographic profile of the teacher-respondents in terms of age, sex, track, School Category (small, big), average grade in science 10, Parent's Monthly income and parent's educational background. Moreover, the study also described the level of higher order thinking skills of a learner on a Physical Science subject be described in terms of understanding, applying, analyzing, evaluating and creating.

Also, it determined the difference in level of higher order thinking skills in small and big schools in Cuyapo. In addition, it described the relationship between the profile of the learner and their level of higher order thinking skills on a Physical Science subject in a big school in Cuyapo. Furthermore, it described the significant relationship between the profile of the learner and their level of higher order thinking skills on Physical Science subjects in a big school in Cuyapo and described the relationship between the profile of the learners and their level of higher order thinking skills in Physical Science in different tracks.

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Descriptive statistics like mean, percentages, and frequency counts were used to describe the personal and socio-demographic profiles of the senior high school learners. The data was processed and analyzed using correlation analysis. Correlation analysis was used to determine the relationship between the profiles of the respondents and their descriptions of the profiles of the learners and their level of higher order thinking skills in Physical Science in different tracks.

1.Profile of the Respondents

1.1   Age

There were one hundred fifty-two or 89.41% of the respondents are 16 to 17 years old while 17 or 10.0% of them are 18 to 19 years old. Further, 1 or 0.59% of the respondents are 20 to 21 years.

The findings imply that more respondents were 16 to 17 years old were the ideal age for Grade 11 learners.

1.2 Sex

There were ninety-two or 54.12% of the respondents are male while seventy-eight or 45.88% are female. The findings imply that more respondents are male.

1.3 Academic Track

There were fifty-eight or 34.12% are TVL, fifty or 29.41% are GAS, thirty-nine or 22.94% are HUMSS while twenty-three or 13.53% are ABM. The findings imply that more respondents are in TVL track and majority of respondents have predilection on Academic Track, they rated high in personality as the basis on choosing tracks/strands.

1.4 School Category

There were one hundred nineteen or 70% are in big schools while fifty-one or 30% are in small schools. The findings imply that more respondents are in big schools. The research found small schools to be superior to large schools on most measures.

1.5 Average Grade in Science 10

There were one hundred three or 60.59% are in 75-79, fifty-four or 31.76% are in 80-84 while thirteen or 7.65% are in 85-89.

The findings imply that more respondents are in 75-79 average grade in Science 10. The study implied that science literacy has always been low.

1.6 Parent's Monthly Income

There were eighty-nine or 52.35% are in 6,000- 20,000, forty-two or 24.71% are in 21,000-31,000, thirty-five or 20.59% while four or 2.35% are in 31,000-40,000 monthly income. The findings imply that more respondents are in 6,000-20,000 monthly income. The average income of a family in the Philippines as of 2021 is PHP 307.19 thousand per year, and the average expenditure is PHP 228.80 per year.

1.7 Parent's Educational Background

There were one hundred six or 62.35% are in Secondary Level, fifty-six or 32.94% are in College Level, five or 2.94% are in Elementary Level while three or 1.76% are in College Undergraduate. The findings imply that more respondents are in Secondary Level. Educated parents provide a better environment for their children and have been the basis of many interventions. Parental education may be a direct input into the production function that generates a higher quantity of other inputs through the effect of educational levels of household income.

2. Level of Higher Order Thinking Skills of Learner-respondents on Physical Science Subject

2.1 Understanding

There were one hundred thirty-two or 77.65% scores 3-5 (basic), thirty-one or 18.24% scores 6-8 (Moderate), seven or 4.11% scores 0-2 (minimal) while zero or 0.00% were 9-10 (high level). The findings imply that more respondents are in basic which scores 3-5. Parental education may be a direct input into the production function that generates a higher quantity of other inputs through the effect of educational levels of household income.

2.2 Applying

There were eighty-five or 50% scores 3-5 (basic), seven two or 42.35% scores 0-2 (Minimal), thirteen or 7.65% scores 6-8(moderate) while zero or 0.00% were 9-10 (high level). These results point to the need for more study to examine the barriers to teachers' use of higher-order thinking strategies in an online setting.

2.3 Analyzing

There were one hundred seven or 62.94% scores 0-2(minimal), fifty-four or 31.76% scores 3-5 (basic), nine or 5.29% scores 6-8(moderate) while zero or 0.00% were 9-10 (high level. The chance offered by Revised Bloom's classification-focused learning exercises permits pupils to engage in active learning and grow their metacognitive skills. The students can consider their own learning abilities, as well as being forthright and sure of their understanding.

2.4 Evaluating

There were one hundred thirty-six or 80.00% scores 0-2(minimal), thirty-three or 19.41% scores 3-5 (basic), one or 0.59% scores 6-8(moderate) while zero or 0.00% were 9-10 (high level. These results suggest that the Revised Bloom's Taxonomy provided a complete categorization of the mental processes needed for abstraction.

2.5 Creating

There were one hundred fifty-three or 90.00% scores 0-2(minimal), seventeen or 10.00% scores 3-5 (basic), zero or 0.00% scores 6-8(moderate)and 9-10 (high level. It shows that the

distribution of the higher order thinking skills in the reading comprehension questions in Contextual English textbook is unequal.

3. Significant Difference in Higher-order thinking skills in Small and Big Schools

The result showed that there is no significant difference between the scores of the students in small and big schools in higher-order thinking skills. It has no effect on the learners if they were in the big and small school.

4. Significant relationship between the profile of the learner and their level of higher order thinking skills in Physical Science subjects in big school.

There was no significant relationship between the profile of the learner and their level of higher-order thinking skills in Physical Science subjects in big schools was not rejected. It implies that the respondents' higher-order thinking skills had nothing to do with their profile.

Those with high HOTS scores are more likely to get high GPA whereas students with low HOTS typically get low GPAs in classes. Because of this, the worth of deciding which students to accept, HOTS can be a useful signal. Students in senior high education should have high levels of HOTS in order to succeed in their studies.

5. Significant relationship between the profile of the learner and their level of higher order thinking skills in Physical Science subjects in Small Schools.

There was no significant relationship between the profile of the respondents and their level of higher-order thinking skills in Physical Science subjects in small schools was not rejected. It implies that, generally, the level of higher-order thinking skills of the respondents had nothing to do with small schools.

Higher-order thinking is one of the key 21st century skills that teachers want their students to master. At this point, students are thinking critically about what they are learning.

6. Significant relationship between the profile of the learners and their level of higher order thinking skills in Physical Science in different track

There was no significant relationship between the profile of the learners and their level of higher-order thinking skills in Physical Science in different tracks was not rejected. It implies that, generally, the level of higher-order thinking skills of the respondents had nothing to do with their tracks. Students that use higher order thinking go beyond memorization of facts and perfect repetition of what they have learnt.

IV. Conclusion

Based on the findings of the study, the following conclusions were drawn:

1. Most of the respondents were 16 to 17 years old. Most of them were males, TVL in track, big schools, average grade in grade 10 were 75-79, parent's monthly income was 6,000-20,000 pesos and parent's highest educational attainment was secondary level.

2. It can be gleaned that the higher order thinking skills of the learners in senior high school has low results, higher order thinking skills of the learners were not used by the learners properly they lacked higher order thinking skills based on the result.

3. There was no significant difference between the scores of the students in small and big schools in higher-order thinking skills.

4. There was no significant relationship between the profile of the learner and their level of higher-order thinking skills in Physical Science subjects in big schools.

5. There was no significant relationship between the profile of the respondents and their level of higher-order thinking skills in Physical Science subjects in small schools.

6. There was no significant relationship between the profile of the learners and their level of higher-order thinking skills in Physical Science in different tracks.

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