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LEVEL OF PERFORMANCE OF GRADE 12 LEARNERS IN TEACHING SCIENCE USING THE PROCESS APPROACH AND THE TRADITIONAL METHOD

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Abstract : This study focused on the level of performance of Grade 12 learners in teaching Science using the process approach and the traditional method at Mangatarem National High School, Schools Division I Pangasinan during the School Year 2023-2024. It was delimited to the level of performance in the pre-test in the teaching of Science to the Senior High School Grade 12 learners when the learners were group as a whole; level of performance of learners in the post-test using the process approach; and level of performance of the Grade 12 learners in the teaching of Science in their post-test using the traditional method. It used descriptive method of research. The researcher used the questionnaire as the main data-gathering tool. The data gathered were properly interpreted using the SPSS for windows. The study found out that generally, Grade 12 learners belong to high average performance during the pre-test in their third grading examination. Grade 12 learners taught in the process approach scored higher mean than those taught in the traditional approach. They are significantly better than those taught in the traditional method. Majority of the Grade 12 learners obtained high average performance during the post-test in the third grading examination using traditional approach. Strategies were based on the needs identified in the study. The researcher recommended that process approach should be used in teaching Science.

Keywords: process approach, traditional method

INTRODUCTION

Science and technology are gaining increasing significance in the global competition among nations. People are increasingly expected to be so well educated that they are able to take proactively and innovatively part in scientific and technological development and, on that basis, being economically successful. They are also expected to develop appropriate powers of judgment concerning the fundamental principles and also the effects of technical products. This applies in particular to physics, being considered as the mother of all sciences due to its fundamental character not only in terms of the results and insight it provides but also with regard to its mindsets.

A modern industrial country must therefore aspire, on the one hand, to safeguarding a generally high standard of knowledge pertaining to physics and other sciences in the population at large in order to take up a leading role in the competing technology-related areas of economy. On the other hand, modern society needs cogitative and politically mature citizens with sound powers of judgment based on their education. In order to achieve all these, schools are of pivotal importance here.

A substantial understanding of science and technology across the widest possible spectrum of society constitutes a resource whose value should not be underestimated in the competition of nations for cultural and economic success. This applies, in particular, to physics with its fundamental character as the “mother” of all sciences in terms of the supplied results and also with regard to its mindsets.

An education in science, and particularly physics, more often than not shapes young people their whole lifetime. It plays a major role in determining their basic knowledge that will accompany them through life and whether they will be motivated to continue learning or even pursue a science or technology degree.

Among school children physics is considered to be one of the least popular subjects. Frequently, those who start school with a natural interest in nature and technology tend to become discouraged or even disinclined to the subject upon finishing their school education.

In the educational context, science processes are mental skills used in handling, dealing with or transforming information and concepts (The Competency Inventory Revision team, 1990). Aside from describing scientific process as essentially processes of thinking, they are also described as perspective, associative, inductive, deductive, creative, imaginative, and critical and problem solving processes (Rivera and Sambrano, 1980).

Science teaching has changed significantly during the past forty years. At one time, much of science teaching is focused on the content of science. But after the launching of the Sputnik Satellite by the Soviet Union in 1957, the US took a new look of science education which eventually changed the whole world view on science teaching. The teaching of science has shifted from content towards process. The Process approach in science teaching is a way of working on thinking about, and studying problems. The use of the process approach in teaching science helps students develop the following skills: analyzing, classifying, collecting data, communicating, comparing, contrasting, controlling variables demonstrating, describing, drawing conclusions, estimating, evaluating, experimenting, forming theories, generalizing, graphing identifying, inferring, interpreting, measuring, observing, predicting outcomes, questioning, recording data, and verifying.

Lind (2002) stresses the importance of creating science process skills opportunities for early childhood students. She argues that the natural development and curiosity of children enable them to instinctively do the basic process skills such as observe, classify, collect and organize data, and measure. Although the teacher or parent might need to assist in small ways, such as recording information, the young child explores and experiments the phenomena he or she encounters in a manner that we know as the basic science process skills.

In a similar study, Preece and Brotherton (2007) again found that teaching the science process skills in early secondary can have long-term positive effects on science achievement. Finally, Bilgin (2006) found that hands-on science process skill instruction increased eighth grade students' skills in a positive manner, along with increasing positive attitudes towards science. Other research, such as Molitor and George (2006), has found that students with science process skill training or instruction do markedly better than those with no training. Not only are the science process skills important for science achievement, but are easily transferable to other subject areas as well. Several authors mention the cross-curricular nature of the science process skills (Sunal & Sunal, 2003; Martin et al., 2001; Rillero, 2008). Ostlund (2008) cites a multitude of studies that demonstrate how science process skills are related to reading abilities, reading readiness, and allows students also to better develop language skills. She goes on to discuss the many studies that demonstrate how the science process skills enhance both oral and written communication skill and language development of special needs students. Finally, Ostlund presents how the science process skills are essential to math, particularly helping students move from one cognitive development level to the next, enhance operational abilities, and enhance problem-solving skills. Ostlund points out that the science process skills are also coupled with critical thinking skills, which is likely the reason why the process skills lend themselves so readily to other subjects.

The science process skills are also strongly associated to logical thinking (Padilla, Okey & Dillashaw, 2003) and formal operational abilities (Padilla, 1991) in addition to critical thinking. Settlage and Southerland (2007) justify the purpose for teaching the skills by arguing that they provide students with active learning, sense-making tools, language development, a community of learners, and foster a natural sense of curiosity. Further, the science process skills are essential to scientific creativity and creative thinking. In an article concerning academically gifted elementary students, Meador (2003) links the science process skills to thinking like a scientist, and argues that both are essential for fostering creativity. Thus, she contends that creative thinking and science process skills are intertwined and those who use science process skills are better at scientific creativity.

Creativity and higher mental processes also have a high likelihood of being transferred to other subject areas (Karsli, Sahin, & Ayas, 2009). The benefits of science process skill instruction for students are eminent. The National Science Teachers Association (NSTA, 2002), in their position statement, explicitly states that teachers should create first-hand exploratory investigations that focus on inquiry and the process skills to enhance student learning. Students who have science teachers that are knowledgeable about the science process skills gain with appropriate and effective skill instruction. Likewise, students who are exposed to science process skill instruction demonstrate a higher level of science achievement and enhance their math and language arts abilities. Students provided with the process skill instruction tend to have and be able to use higher mental process and creativity. Therefore, science educators must develop teachers who are competent in the knowledge and teaching of the science process skills, to consequently ensure that students get effective and valuable skill instruction.

Science Process Skills and the Nature of Science. The nature of science is an element of the science curriculum that allows students the ability to fully understand how science as a discipline functions. Some of its tenets include that science is a way of understanding our world, science is a tentative and creative enterprise, and science is not a single method (Chiappetta & Koballa, 2010). It is important that we teach science process skills not only because of the aforementioned benefits to teachers and students, but also because of its link to the nature of science. In his chapter for Britton, Glynn, and Yeany's text, Padilla (1991) clearly points out that the process skills should be taught because they "more accurately reflect the nature of science and the typical activity of scientists" (212). He argues that activities based in the process skills provide students an opportunity to view the true nature of science through the perspective of a scientist.

Rowland, Stuessy, and Vick (2007) developed a workshop for in-service teachers to teach them the basic science process skills. In providing reasoning for teaching the process skills, the authors point out that a process approach 1) highlights that science is a way of understanding our world; 2) makes them do science as scientists do and 3) develops scientific attitudes. These factors are important as they emphasize that developing the science process skills in teachers is important if the educational community is to impart a positive attitude towards science on our students and demonstrate the nature of science to their students. Rezba, Sprague, McDonnough, and Matkins (2007) devotes an entire textbook to the science process skills and a sub-section to how the science process skills help teach the nature of science, and Rillero (2008) declares the process skills "promote an understanding of the nature of science", both citing similar reasons to Rowland et al. (1987). While several research studies have mentioned how the science process skills are related to particular tenets of the nature of science, very few have explicitly looked at their relationship.

There are many process skills encompassed in the conduct of scientific inquiry. It is a complicated business, and it is not appropriate to teach all process skills at once or to teach all of them at all age levels of students. The concept of the spiral curriculum provides an appropriate guide for the teaching and studying of process skills in science. Appropriate selections of science process skills can be taught and studied in the early years of primary school. The young students can be given the opportunity to observe, handle things and explore the environment. The basic learning which pupils achieve from these initial experiences can be used as a basis for building a more extensive understanding of science process skills in the later years of primary school and on into secondary school.

Within schools, one of the major deficiencies which sadly arises out of the teaching and studying of science is that students develop very limited understanding of scientific concepts. For example, they can write a definition for osmosis, but not associate any meaning with the definition. They can say and write the words, "An acid is a proton donor," but they attach no meaning to the words. For the teaching and studying of science to be of substantial value, the students must be able to apply scientific concepts, procedures and attitudes to their wider life. The value of learning science is greatly enhanced when the students are lead into an extensive understanding and a practical conception of how scientific concepts and principles apply to themselves personally, to their families, their communities and their nation.

Statement of the Problem

This study assessed the on the level of performance of the Senior High School Grade 12 learners in teaching Science using the process approach and the traditional method at Mangatarem National High School, Schools Division Office I Pangasinan during the School Year 2023-2024.

Specifically, it sought to answer the following sub-problems:

1. What is the level of performance in the pre-test in the teaching of Science to Grade 12 when the learners were group as a whole?

2. What is the level of performance of Grade 12 learners in the the post-test using the process approach?

3. What is the level of performance of Grade 12 learners in he teaching of Science in their post test using the traditional method?

4. Is there a significant difference in the mean performance of the Grade 12 learners in pre-test and their post-test using the process approach and the traditional method?

5. On the basis of the findings, what intervention measures can be proposed to enhance the teaching of Science to Grade 12 learners?

METHODOLOGY

This chapter discussed the method and procedure employed to answer the research problems identified in the study. More specifically, it discussed the research design, sources of data, instrumentation and data collection and tools for data analysis.

Research Design

Basically, this study used the descriptive method of research. It described the degree by which two or more quantitative variables are related. It is chosen as an appropriate method for this present study because it provided the description of the level of performance in the teaching of Science in Grade 12 using the process approach and the traditional method at Mangatarem National High School, Schools Division Office I Pangasinan during the School Year 2023-2024 in terms of the level of performance in the teaching of Science in Grade 12 in their pre-test when the learners are categorized into two groups, level of performance of Grade 12 learners in the teaching of Science in their post-test using the process approach, and level of performance of Grade 12 learners in the teaching of Science in their post test using the traditional method.

Sources of Data

The respondents of this study were the Grade12 learners and teachers Mangatarem National High School, Schools Division Office I Pangasinan during the School Year 2023-2024.

Instrumentation and Data Collection

The data gathering instrument of the study was a questionnaire for the science teachers and their school heads. The questionnaire for the teachers focused on the level of performance in the teaching of Science in Grade 12 in their pre-test when the learners were grouped as a whole. The mean and standard deviation were obtained and the individual scores of the learners were converted into standard scores. There were six equivalent standard scores, three groups left side of the mean which are low average, below average and poor and three groups from the mean to the right, thus high average, above average and outstanding. Then the post-test were administered to those taught the process approach and the individual scores were converted likewise into standard scores serving as their level of performance.

The researcher conducted library research and consulted past studies relevant to the present study to crystallize her own concept of the study.

The researcher made a questionnaire which was presented to the members of the Research Panel for initial evaluation. Then the instrument was submitted for final evaluation and validation by experts on questionnaire construction. A validation questionnaire was utilized in this regard. The product of this process was the questionnaire in its final form.

The approval and permission to conduct the study was obtained by the researcher from the Division Superintendent of Pangasinan I.

The questionnaire was personally administered by the researcher to the teachers to ensure fast and immediate response and 100% retrieval.

The data gathered were subjected to appropriate statistical treatment analysis and interpretation.

Tools for Data Analysis

The different problems were tabulated, organized resulting in systematically reducing them into tables after which these data were analyzed using statistical measure using the mean, the standard deviation and converting each learners score into standard scores.

The individual scores can be located along the six standard deviation unit at the base of the normal curve and assigned their descriptive ratings.

Viewed wholistically, the three areas of the normal curve is viewed generally into 3 groups. Thus at ±1 0 unit from the mean is assigned the descriptive rating as the average. From +1.01 to 3 standard deviation is the area above average and at the left side of the normal curve, from -1.01 to1.01 to 3. SD is the area of the below average to poor. These 3 areas are further sub-divided into smaller groups. Thus, the area of the average is grouped into low average i.e .01 to. 1.01 of the left side of the normal curve conversely at the right side of the curve, from +01 to 10 is high average; from 1.0.1 to 2 SD is above average and from 2.01 to 3 SD unit is the area and from 2.01 to 3 SD unit is the area of outstanding, and from 2.01 to 3 SD unit is the area of outstanding.

The formula for the mean used was

$M = A.M \, (\sum f x^2) \, 6$

N

And the formula used for the the standard deviation was:

$$SD = i\sqrt{\frac{\sum fx^2}{N} - C^2}$$

The formula used for the calculation of the standard score was

$$SS = \frac{RS - M}{\sigma}$$

Where: SS = Standard score
RS= Raw Score of each student
M= group mean

σ = Group standard deviation

RESULTS AND DISCUSSION

This chapter deals in the presentation, analysis and interpretation of the data gathered to answer sub-problems of the investigation.

Level of Performance of Grade 12 Learners during the Pre-Test Third Grading Examination

This part of the study answered sub-problem no.1.

It can be seen in Table 1 that majority of the Grade 12 learners belong to area of high average performance during the pre-test in their third grading examination with 13 or 45%. There were also 12 or 38% who have low average performance with 11 or 38%. There was only 1 or 3% who is below average. There were only 4 or 14% pupils who have above average performance.

The pre-test result of the entire class revealed that there were more Grade 12 learners scoring above the mean and lesser for those scoring below the mean.

Table 1. Level of Performance of Grade 12 Learners during the Pre-Test Third Grading Examination

Level of Performance	Frequency	Percentage
Above Average	4	14
High Average	13	45
Low Average	11	38
Below Average	1	3
Total	**29**	**100**

Table 1 A. Pre-Test Result of the Grade 12 Learners during the Third Grading Period Using the Concept of Standard Scores

Name	Raw Score	Z- Score	Standardized Score	Descriptive Performance
P1	33	1.97	697	Above Average
P2	29	1.37	637	Above Average
P3	29	1.37	637	Above Average
P4	29	1.37	637	Above Average
P5	26	0.91	591	Average (High Average)
P6	26	0.91	591	Average (High Average)
P7	25	0.76	576	Average (High Average)
P8	24	0.61	561	Average (High Average)
P9	23	0.46	546	Average (High Average)
P10	23	0.46	546	Average (High Average)
P11	23	0.46	546	Average (High Average)
P12	22	0.31	531	Average (High Average)
P13	21	0.16	516	Average (High Average)
P14	21	0.16	516	Average (High Average)
P15	20	0.05	505	Average (High Average)
P16	20	0.05	505	Average (High Average)
P17	20	0.05	505	Average (High Average)
P18	19	-0.15	485	Average (High Average)
P19	19	-0.15	485	Low Average (Average)
P20	19	-0.15	485	Low Average (Average)
P21	18	-0.30	470	Low Average (Average)
P22	18	-0.30	470	Low Average (Average)
P23	18	-0.30	470	Low Average (Average)
P24	18	-0.30	470	Low Average (Average)
P25	18	-0.30	470	Low Average (Average)
P26	17	-0.45	455	Low Average (Average)
P27	16	-0.60	440	Low Average (Average)
P28	15	-0.75	425	Low Average (Average)
P29	13	-1.06	394	Below Average

Mean – 19.97
SD- 6.60

Level of Performance of the Grade 12 Learners during the Post Test Third Grading Examination using Process Approach

Table 2 below disclosed that, there were 15 learners composing the Process Approach group. Only one was rated above average. Five were rated High Average and nine were rated low average. However the group mean for the Process Approach was 32.27 very much higher than when grouped wholly and with a standard deviation of 6.14. When compared to the pre-test result of the entire class, the group mean was 19.97 and the Standard Deviation is 6.60. The mean was lower by 12.3 score points.

Table 2. Level of Performance of Grade 12 Learners during the Post Test Third Grading Examination using Process Approach

Level of Performance	Frequency	Percentage
Above Average	1	7
High Average	5	33
Low Average	9	60
Total	**15**	**100**

Table 2 disclosed that majority of the Grade 12 learners have low average performance during the post test of the third grading examination using process approach with 9 or 60%. There were also 5 or 33% who obtained high average performance. Only 1 or 7% has an above average performance. It must be noted that the low average level is still considered average although such level is below the mean. Also take note that the mean of the process group was very much higher or 12.7 points than those of the entire group comparatively speaking.

The specific calculation of the Standard Scores and equivalent description ratings of each individual scores were found in Table 2A on the next page.

Table 2A. Post Test-Using Processes Approach in the Third Grading Period

Name	Raw SCORE	Z- Score	Standardized Score	Descriptive Performance
P1	41	1.07	607	Above Average
P2	39	0.83	583	Avergae (High Average)
P3	37	0.58	558	Average (High Average)
P4	35	0.34	534	Average (high Average)
P5	33	0.09	509	Average (high average)
P6	33	0.09	509	Average (high average)
P7	32	-0.03	497	Low Average (Average)
P8	31	-0.16	484	Low average (Average)
P9	30	-0.28	472	Low Average(Average)
P10	30	-0.28	472	Low Average (Average)
P11	30	-0.28	472	Low Average (Average)
P12	29	-0.40	460	Low Average (Average)
P13	29	-0.40	460	Low Average(Average)
P14	28	-0.52	448	Low Average (Average)
P15	27	-0.65	435	Low Average (Average)

Mean-32.27
SD-8.14

Level of Performance of Grade 12 Learners Taught Through the Traditional Methods

Table 3 in conjunction with the Table 3A indicated the level of performance of the learners taught through the traditional method. There was only 1 or 5% pupils who scored above average; 13 or 72% who were rated as high average and 4 or 22% who were rated low average. The mean of the traditional group was 24.47 and a standard deviation of 7.10. When compared to the post-test of the third grading examination using process approach (table 2) such post test of the traditional method was lower in terms of the obtained mean it being 32.27, by 8.20.

The complete data on the standard Scores of the Traditional Group is found in the table 3A.

Table 3. Level of Performance of Grade 12 Learners during the Post Test Third Grading Examination Using Traditional Method

Level of Performance	Frequency	Percentage
Above Average	1	7
High Average	9	64
Low Average	4	29
TOTAL	**14**	**100**

Table 3A. Post Test Using Traditional Method Third Grading

Name	Raw SCORE	Z-SCORE	Performance SCORE	Standardized Descriptive
P1	33	1.20	620	Above Average
P2	30	0.78	578	Average (High Average)
P3	30	0.78	578	Average (High Average)
P4	30	0.78	578	Average (High Average)
P5	28	0.50	550	Average(High Average)
P6	28	0.50	550	Average(High Average)
P7	27	0.36	536	Average (High Average)
P8	26	0.22	522	Average (High Average)
P9	26	0.22	522	Average (High Average)
P10	25	0.07	507	Average(High Average)
P11	23	-0.21	479	low Average (Average)
P12	22	-0.35	465	Low Average (average)
P13	20	-0.63	437	Low Average (Average)
P14	19	-0.77	423	Low Average (Average)

Mean-24.47
SD-7.10

Significant Difference in the Mean Performance of the Grade 12 Learners in their Post-Test Using the Process Approach and the Traditional Method

On the basis of the obtained data as shown in Table 4 and 4A, respectively, there was a significant difference in the performance of the two groups in the teaching of science using the traditional approach and the process approach. The obtained test of critical Ratio of 2.76 is higher than 1.96 at the .05% level and 2.58 at the .01% level, meaning at both levels, this research was sure 99 times out of 100 trials that the difference in the mean performance of 7.8 scores, in favor of the group taught via the process approach performed very significantly higher than those taught the traditional method.

Table 4. Science Grade 12 Learners' Post Test-Using the Process Approach during the Third Grading Period

Name	Score
P1	41
P2	39
P3	37
P4	35
P5	33
P6	33
P7	32
P8	31
P9	30
P10	30
P11	30
P 12	29
P13	29
P14	28
P15	27

Mean- 32.27
SD- 8.14

Table 4A. Science Grade 12 Learners' Post Test-Using the Traditional Approach during the Third Grading Period

Name	Score
P1	33
P2	30
P3	30
P4	30
P5	28
P6	28
P7	27
P8	26
P9	26
P10	25
P11	23
P12	22
P13	20
P14	19

Mean-24.47 SD- 7.10

Recommendations

1. Process Approach should be used in teaching Science.
2. ICT should be used in teaching through the Process Approach.
3. Demonstration teaching in school wide or division wide should be conducted.
4. Science tools and equipment should be acquired.
5. In-service training using ICT in Science teaching should be held.

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