Attitude towards Science and Process Skills of Junior High School Students

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Abstract - *This study evaluated the attitude towards science and the science process skills of grade 10 students including the prevailing conditions in terms of teaching approaches and school resources of selected secondary schools in the Philippines. It involved 256 students and 19 teachers from 4 schools categorized into; big school, small school, laboratory school and a private school. The results revealed that students have overwhelmingly highly positive attitude towards science but not well-developed science process skills. A highly positive attitude on the social context of science but not on the context of a school science. Analysis of the teaching approaches employed and the resources available provide evidence to why the science process skills were not properly acquired. Findings from this study also show that teachers must provide interesting lessons in science to develop science process skills which are the foundations of critical thinking and higher order thinking skills necessary for the technology-based society of today and the future. Moreover, teachers' mind set on how science teaching be implemented must be properly reconsidered.*

Keywords: *Science Attitude, Process Skills, Junior High School*

INTRODUCTION

Attitude is essential in learning [1]. An individual with positive attitude toward science or any other subject drives him to concentrate on it, be motivated and interested. Since most human behavior which include writing, reading and speaking etcetera are products of learning, a positive attitude equates to acquiring skills that reinforces back the positive attitude [2]. Attitude toward science is an important area in educational research for a variety of reasons. Studies confirm that it has positive correlation to achievement in science; classroom environment, which includes variety of teaching approaches, innovative learning strategies and student-centered instructional designs have all been found to have positive correlation with attitude toward science. This attitude in turn influences views about science, future career choices and classroom participation; it enhances the learning of scientific information and more importantly develops science process skills [3].

The study of Yager and Mc Cormack (2009) as cited by [4], verifies that the longer the student study regular school science, the more negative attitude is developed toward studying science, science class and their science teacher. Not surprisingly, that the OECD Amsterdam Conference in 2015, declares that "governments must take concrete steps to make S & T studies more attractive" [5]. It was an answer to the continuous decline of students enrolling in Science and Technology courses. The decreasing interest and negative attitude in science are the identified reasons for this dearth. This situation is not, however, confined to the education sector but also a major concern in the economy of many countries.

The occasional shortages of high skill labor in STEM fields in some countries prompted its policymakers to outline economic policy agenda to properly respond to this emerging problem [6]. Many governments are now sponsoring STEM-related programs in order to maintain a high-quality supply of human capital capable of doing research, promote innovation and effectively use technology. For example, in the United States of America on November 2009, President Obama declared a range of STEM initiatives while the United Kingdom appoints a National STEM Director and promoted STEM agenda [7]. The digital future of our society will be determined by citizens who are able to understand and help shape the multifaceted impacts of Science and technology on our world. It is therefore in the interests of society, and the responsibility of educators, to improve students' attitude towards Science, and to prepare students to live in a highly scientific and technological society. [8].

Science Process Skills, on the other hand, is also as important area in educational research. These are the skills that simplify learning, activate students, develop students' sense of responsibility in their own learning and increase the permanency of learning. Influenced directly by the attitude towards science, these skills are the thinking skills that we all use to get information, think of the problem and formulate the results [9]. These are the skills used by scientists as an elaborated form of the scientific method. Developing science process skills is essential not only to science but on how to apply science in everyday life. They are cognitive skills which are used to understand and develop the information; enable students to think critically, decide and find answers to their curiosity [10].

If these skills are not acquired, students will find learning difficult; they could not get meaningful learning experiences. The absence of the latter contributes immensely to the decline in the interest and to the negative attitude toward science. Science education therefore, should facilitate the necessary learning environment such as active participation, life integration, meaningful learning for science process skills be developed in schools.

This study was carried out to determine the attitude toward science and the science process skills of grade 10 students in selected secondary schools. The assessment reveals that students have a high or highly positive attitude toward science but under-developed science process skills. This research also proves that varied teaching technique must be introduced to engage students in learning science; while school resources do not necessarily translate to positive attitude and better skills.

OBJECTIVES OF THE STUDY

The study assessed the Attitude towards Science and Process Skills of Junior High School students and the prevailing conditions of selected Secondary Schools in Camarines Sur, Philippines. Specifically, it aimed to determine the Attitude towards Science and Process Skills of Grade 10 students; determine the prevailing conditions in selected Secondary Schools in terms of teaching approaches and school resources.

METHODS

The study described the attitude towards science and science process skills of grade 10 students and associated it with the prevailing conditions in selected secondary schools in the Philippines. It was conducted to a group of 256 students, 127 are boys and 129 are girls; selected through purposive sampling technique and total enumeration for 19 science teachers. The respondents involved in the study were those enrolled and teaching for school year 2016-2017 in the four schools namely San Jose National High School, Pili, Camarines Sur (DepEd High Schools – large); Doňa. Basilia Memorial High School, Caroyroyan, Pili, Camarines (DepEd High Schools – small); Central Bicol State University of Agriculture- Laboratory High School, Pili, Camarines Sur; and University of Santa Isabel - Pili campus (Private School).

The grade 10 students were specifically chosen for the main reason that they have the longer time studying science compared to other levels. The respondents' attitude towards science at this point can also be used to gauge the science experience they have had for the last ten years of their lives; and in terms of science process skills, they are expected to have been acquired the integrated science process skills.

Attitude towards Science Questionnaire

The questionnaire from the 2011 Trends in International Mathematics and Science Study (TIMMS) developed by the International Association for the Evaluation of Educational Achievement (IEA) was selected to assess attitude towards science [11]. After undergoing a face validation and modifying some of the words to make it more locally applicable, an Inter-Reliability Test was conducted to determine its Reliability. Five senior science teachers evaluated the questionnaire and the resulting Kappa value is 0.998, which was high enough to be used as a survey instrument. The new evaluation questionnaire consisted of 15 statements with possible responses assigned as 5 = Strongly Agree, 4 = Agree. 3 = Neutral, 2 = Disagree, 1 = Strongly Disagree. Results were verbally interpreted as 1.00 – 1.99 = Highly Negative, 2.00 – 2.99 – Negative, 3.00 – 3.99 = Neutral, 4.00 – 4.99 = Positive, 4.99 – 5.00 = Highly Positive [12].

Science Process Skills Questionnaire

The students' science process skills refer to the skills in conducting the full cycle of investigation which is determined by the questionnaire Science Process Skills Inventory by Mary E. Arnold & Virginia Bourdeau [13]. The process skills assessed include: asking questions, designing and conducting investigation, measuring, analyzing and evaluating information, procedures, and claims, and communicating results. Students are required to answer the questionnaire consisted of 11 statements with five-point frequency response with corresponding verbal interpretation of

1.00 – 1.99 = Never Used, 2.00 – 2.99 – Rarely Used, 3.00 – 3.99 = Sometimes Used, 4.00 – 4.99 = Usually Used, 4.99 – 5.00 = Always Used [10].

Prevailing Conditions Questionnaire

To gather data from the schools and teachers, a questionnaire has been developed to provide feedback in terms of teaching approaches used and resources available. There are various strategies used for teaching science. Teaching strategies determine the approach a teacher may take to achieve learning objectives. Teaching strategies are used by teachers to create learning environments and to specify the nature of the activity in which the teacher and students will be involved during the lesson. In this study, 5 commonly used approaches in teaching were included in the questionnaire, this include; discovery approach, conceptual approach, inquiry approach, contextual approach and traditional approach. Teachers were asked to rate themselves how frequent they use the approaches within a week.

School resources assessed in this study include textbooks, science laboratory and computers for science lessons. These resources were analyzed based on the information gathered on the quantity and frequency of use in teaching science. The comparison for school resources is denoted whether it is available or not available in schools.

Prior to the conduct of the study permission was requested from DepEd Division of Camarines Sur through the Schools Division Superintendent. The approved request to conduct the study were sent to the school heads and principals of the recipient secondary schools. A schedule to conduct the study was permitted by the respective principals and was endorsed to the science department head. The identified Junior High School students and teachers were requested to answer the questionnaires.

The questionnaire was then personally distributed by the researcher to each class. A brief introduction about the purpose of the study and the assurance that their responses would not have any effect on their grades nor in any other performance or achievement tests was given. In addition, they were also assured that none of their responses nor their participation to the survey will be publicly conveyed, as the result of the survey will be kept in strict confidence. They were given an option to write or not to write their names. For reference purpose, however, the questionnaires were labelled and coded. The same procedures have been extended to teachers who participated in the survey. The collected data were analysed using statistical mean, frequency count and chi-square.

RESULT AND DISCUSSION

A. Attitude towards Science

Science is normally perceived as a difficult subject [14]. In fact, worldwide trend shows a decline in enrolment when it comes to science related courses [5]. The result of this study, however, reveals a picture of science as interesting, easy, helps them in their daily life, it's one of their strength and the list continues. Only 5 out of 15 statement where students felt negative or highly negative. Overall results show that grade 10 students have highly positive attitude towards science as reflected in Table 1.

The result is similar to the research findings of the UP team researchers that compared the Philippines to 10 countries on science-related attitudes and interests of students. Among the eleven countries which surveyed, the Philippine results showed more than 90% of students indicating positive science related interests and experiences. Out of eleven countries, the Philippines, on the average, ranked second [15].

The use of similar questionnaire, however, in assessing attitude has been criticized for the inconsistent results it produces and because more importantly the attitude objects are concerned more with aspects of science in society and not attitude to science as a school subject [16]. Consequently, many studies reveal the same results. The English Assessment of Performance Unit [17], showed that even though science is not considered easy, majority of 15-year 0ld students find science as interesting and useful for jobs. This is similar to the work of Ebenezer and Zoller [18] to a 1564 Grade 10 which showed that 72% of the sample thought that science is valuable and important, yet nearly 40% indicated that they found science classes boring. These surveys reveal a clear disparity between the students' notions of science, which becomes the foundation of their attitude towards it.

While the results showed an overall positive attitude, it is important to note that most of the students that were categorized as positive can be considered entirely as an appreciation of what science can do for them. On the other hand, several of the technical aspects of science did not necessarily received a high or highly positive rating. Hence, while the students understand the good things that science can do for them, doing science is actually a different thing.

Table 1. Frequency distribution of students with highly positive and positive attitude towards Science

Statements	University Laboratory HS (n=17)		DepEd Nat'l HS (Big school) (n=127)		DepEd Nat'l HS (Small school) (n=31)		Private School (n=81)		All Schools (n=256)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
1. Science is interesting	15	88.2	112	88.2	27	87.1	74	91.4	228	89.1
2. I wish I had to study science	12	70.6	110	86.6	27	87.1	77	95.1	226	88.3
3. Science is easier for me than any other subject	11	64.7	99	78.0	22	71.0	55	67.9	187	73.0
4. Science is easier for me than for many of my classmates	14	82.4	92	72.4	22	71.0	58	71.6	186	72.7
5. I think learning science will help me in my daily life.	11	64.7	88	69.3	21	67.7	54	66.7	174	68.0
6. Science is one of my strengths	12	70.6	79	62.2	20	64.5	57	70.4	168	65.6
7. Science does not make me confused and nervous	12	70.6	81	63.8	20	64.5	51	63.0	164	64.1
8. I learn many interesting things in science	8	47.1	85	66.9	22	71.0	42	51.9	157	61.3
9. I enjoy learning science	8	47.1	79	62.2	23	74.2	40	49.4	150	58.6
10. I need science to learn other school subjects	10	58.8	76	59.8	21	67.7	42	51.9	149	58.2
11. I usually do well in science	3	17.6	54	42.5	13	41.9	23	28.4	93	36.3
12. I learn things quickly in science	5	29.4	53	41.7	17	54.8	13	16.0	88	34.4
13. I read about science in my spare time	7	41.2	49	38.6	11	35.5	11	13.6	78	30.5
14.I am good at working out difficult science problems	4	23.5	41	32.3	12	38.7	17	21.0	74	28.9
15. My teacher thinks I can do well in science with difficult materials	3	17.6	39	30.7	11	35.5	13	16.0	66	25.8
No. of statements with highly positive and positive attitude	*8*		*10*		*11*		*9*		*10*	

One might love science, but this does not mean they are good at it or love doing things related to it. These results also reflect the nature of how science is taught in the country. Most lessons in science are carried out through lectures but minimal laboratory activities or experiments. Often times, these lectures are followed by a rigorous and successive exercises that focus on how an equation works. To further increase students' interest in science, innovative teaching methods that construct understanding by actual manipulation and conducting experiments should be considered by science teachers.

SCIENCE PROCESS SKILLS

Overall, only one science process skill is always or usually used by more than half of the students. *Using the result of the investigation to answer the question asked* is always or usually used by 129 out of 256 or 50.4% of the respondents. This result clearly shows that ten of science process skills are sometimes, rarely or never used by grade 10 students.

Individual schools, however, show variation on the science process skills that are always or usually used by 50% or more of the students. The University LHS has the most number of skills that are always or usually used, with 5. The other DepEd schools have two each while the private school surprisingly has zero. This result for private school is not consistent with its moderately equipped categorization in terms of school resources; it has textbooks, science laboratory and computer for use in their science lessons, where most of these resources are either absent or limited in the other schools.

DOST-SEI-UPNISMED [19] noted that science process skills are mostly developed when students are exposed to science on a "hands-on, or minds-on process. This statement eloquently explains the result of this study.

Table 2. Frequency distribution of students who always and usually use the science process skills when working on science investigation

Skills	University LHS (n=17)		DepEd NHS (Big) (n=127)		DepEd NHS (Small) (n=31		Private School (n=81)		All Schools (n=256)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
1. Use the results of investigation to answer the question asked	8	47.1	66	52.0	15	48.4	40	49.4	129	50.4
2. Use of science knowledge to form a question	11	64.7	54	42.5	16	51.6	39	48.1	120	46.9
3. Use of science terms to share the results	11	64.7	67	52.8	13	41.9	28	34.6	119	46.5
4. Use models to explain results	11	64.7	54	42.5	13	41.9	40	49.4	118	46.1
5. Create a graph for presentation of data to others	8	47.1	60	47.2	13	41.9	34	42.0	115	44.9
6. Analyze the results of a science investigation	11	64.7	51	40.2	15	48.4	35	43.2	112	43.8
7. Ask a question that can be answered by collecting data	11	64.7	49	38.6	10	32.3	37	45.7	107	41.8
8. Record data accurately	8	47.1	48	37.8	17	54.8	32	39.5	105	41.0
9. Communicate a science procedure to others	7	41.2	43	33.9	14	45.2	30	37.0	94	36.7
10. Create a display to communicate my data and observations	5	29.4	43	33.9	15	48.4	31	38.3	94	36.7
11. Design a science procedure to answer a question	5	29.4	41	32.3	9	29.0	29	35.8	84	32.8
No. of skills always and usually used	*5*		*2*		*2*		*0*		*1*	

Among the schools and the 19 science teachers surveyed, only 2 schools have science laboratory, 14 teachers or 79% answered "never" to use science experiments and conduct investigation, while 4 teachers answered to use it once in a month. No wonder that the overall result showed that science process skills in all schools are not well-developed.

Furthermore, Hackling [20] adds that science education needs to involve authentic and practical investigations to develop science process skills which constitute science literacy. The general practice in these schools of not using science experiments and not engaging students in a hands-on or minds-on process, signal that developing science literate student is still far from reality.

Nonetheless, teachers are aware of the importance of conducting science investigations. Several factors, however, hinder them from performing it. Some of the reasons mentioned from the teachers' survey were: (1) school has laboratory equipment but no laboratory room; (2) managing a big class is difficult; (3) no working tables available in the classroom; (4) during science activities, students may damage the materials and teachers are liable for any damage materials; and (5) no time for preparation. These reasons given by the teachers are consistent to the claims by Mendoza [21] made in his published article.

The science process skills often designated as inquiry skills are necessary for dealing with everyday life and in developing an understanding of the natural world [22]. Perhaps most important that these skills are set in situations in which the students can relate them to their personal experiences, so inquiry skills are seen as "connected" rather than separate entities [23]. These investigative processes require hands-on/minds-on activities, laboratory inquiries, unfortunately not common in the schools surveyed. The overall result of 10 science process skills or inquiry skills that are less-developed to the students may be attributed to the frequency of exposing students to science investigation. With the number of importance of process skills to the lives of the students as mentioned, it is necessary to address this issue.

Teaching Approaches

Traditional approach is "always" used teaching approach across schools and other approaches are used either "sometimes" or "frequently". Inquiry approach which is considered to be very suitable for motivating and challenging and potentially offering opportunities for higher level thinking, creativity, and independence in learning and group-work is sparingly used.

Table 3. Teaching Approaches of Science teachers from different schools

Teaching approach	Univ. Lab. HS	DepEd NHS (Big school)	DepEd NHS (small)	Private School	Overall WM	Interpretation
Discovery approach	4.00	3.71	4.50	4.15	**4.01**	Frequently
Conceptual Approach	3.50	3.71	2.89	4.07	**3.63**	Frequently
Inquiry approach	3.70	3.69	2.67	3.84	**3.56**	Sometimes
Contextual Approach	3.75	4.19	3.44	4.40	**4.04**	Frequently
Traditional	4.25	4.43	5.00	4.60	**4.53**	Always

Table 4. School resources available for science lessons

School resources	**Univ. Lab. HS**	**DepED NHS (big school)**	**DepEd NHS (small)**	**Private School**
Textbooks	Not available	Available	Available	Available
Science Laboratory	Available	Not available	Not available	Available
Computers available to use for science lessons with internet connections	Not available	Not available	Not available	Not available
Computers available to use for science lessons without internet connections	Not available	Not available	Not available	Available
Overall	Slightly equipped	Slightly equipped	Slightly equipped	Moderately equipped

This high preference of teachers in the use of traditional approach, which limits the learning opportunities, is influenced by the number of students in the class. Analysis of teachers' responses reveal that the 40-45 class size among schools defines the learning environment that the students will experience in their classrooms. Several studies have confirmed the influence of classroom environment as a significant determinant of attitude of students. The study of Myers and Fouts [24] suggests that the most positive attitudes were associated with a high level of involvement, very high level of personal support, strong positive relationships with classmates, and the use of a variety of teaching strategies and unusual learning activities. The work of Piburn [25], Ebenezer and Zoller's [18] provide evidences that the use of a variety of teaching strategies is an important variable in generating interest in science education. The common use of traditional approach rather than an inquiry approach as reflected in this study may provide reason for the very low results of students' science process skills.

Resources

The university laboratory high school and DepEd National HS (Big and small) are slightly equipped while private school is moderately equipped in terms of school resources for used in science lessons as shown in Table 4. Studies have exposed that resources are crucial for improving instruction [26]. The extent and quality of school resources can have an important impact on the quality of classroom instruction.

The quality of school as defined by report of UNICEF [27] includes environments that provide adequate resources and facilities such as the presence of adequate instructional materials and textbooks, working conditions for students and teachers, and the ability of teachers to undertake certain instructional approaches. Hence, a more equipped school can potentially provide a variety of teaching strategies and unusual learning experience for students proven to be crucial in the attitude of the students which is a prerequisite to develop science process skills. The "slightly adequate" to "moderately adequate" resources of the sample schools may have a big impact to underdeveloped process skills of the students.

CONCLUSION AND RECOMMENDATION

It is evident from the result of this study that taken as a whole, grade 10 students have positive attitude towards science. This result however, a positive or highly positive in 10 out of 15 statements, was not transformed into well-developed science process skills, since a positive attitude towards science is needed for students to better acquire these skills. Nonetheless, this can be attributed to the limitation of the questionnaire used – where the social context of science is presented rather than science as a school subject. This however, provides a clear view for teachers, who play a major role in the development of attitude and skills, the disparity of how science is experienced by students

outside and inside of a classroom. Teachers should make science lessons as interesting as possible the way students enjoy them. Students perceived science in terms of technological developments in the world associated with personal computers, telecommunications and developments in space. School, in contrast, presents science as a series of milestones represented by the most significant discoveries of the last century. To improve students' interest in science, schools need to be more prospective rather than retrospective. The result of this study also confirmed the need for a variety of science teaching in helping students appreciate science and better develop skills. The use of varied teaching strategies can be implemented if the school is equipped with necessary resources. The presence of learning resources, however, do not guarantee – as evident in the case of the private school in this study – a better result in the attitude and process skills of the students. Yet, the mere presence of this resources and its availability for classroom use is a motivation already for them.

The importance of science process skills is highlighted in the literature cited in this study. It now becomes essential that every student should develop science process skills while they are studying. They will use these skills throughout their lives. These skills are the foundations of the critical and higher order thinking skills needed to thrive and be competitive in a more technological based society of today and the near future. This becomes a reminder for teachers to reconsider the end targets of their science lessons – instead of passing the convenient knowledge, students should be taught how to attain this knowledge.

For further study, a bigger sample may be used to cover more schools. The use of another questionnaire to assess attitude towards science can be made, and look into other factors that influence it – like motivation. It is suggested further, that for a comprehensive interpretation and implication of similar study, qualitative data in the form of interview may be added. Finally, to improve students' science process skills and maintain their positive attitude toward it, scientific movies, documentaries, use of gadgets, integration of other subjects and science related activities outdoors may all be applied.

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