The Scientific Attitude of Science Teachers and Their Students

ROMMEL C. CRUZ

Philippine Normal University
DepEd- Malolos City
Malolos City, Bulacan, Philippines

Abstract: This study was undertaken to assess and determine the relationship between the scientific attitude of Grade 10 Science teachers and students of the City Division of Malolos. The descriptive method of research using two sets of questionnaires was employed in gathering the data. To find out the scientific attitudes exhibited by teachers and students, The researcher used an attitude scale covering the ten behavioral indicators that a person with a scientific attitude consistently manifested constructed by Lolita M. Salmorin (1983). The students and the teachers were asked to accomplish the attitude scale during the first semester of the school year 2017-2018. The study revealed that the scientific attitudes exhibited by Grade 10 Science Teachers, in descending order were, open-mindedness, respect for evidence, resourcefulness, creativity, curiosity, questioning attitude, believing in cause and effect relationship, honesty, humility, patience, and determination, and intellectual responsibility. The students, on the other hand, ranked the above behavioral indicators in descending order were open-mindedness, respect for evidence, curiosity, questioning attitude, believing in cause and effect relationship, resourcefulness and creativity, honesty, intellectual responsibility, patience, and determination, and humility. The study found that there is no significant relationship between the scientific attitudes of teachers and students, specifically in the following behavioral indicators: open-mindedness, respect for evidence, questioning attitude, curiosity, believing in cause and effect relationships, resourcefulness and creativity, honesty, and patience and determination. Likewise, there was a significant relationship between the teachers and the students with the following attitudes; intellectual responsibility and humility.

I. Introduction

The scientific attitude is a mental outlook distinguished by an impartial and unbiased method and the application of empirical approaches in the quest for understanding (Nugent, 2013). An approach to investigations that benefits from accuracy, intellectual honesty, open-mindedness, suspended judgment, criticalness, and a habit of looking for true cause and effect relationships

Scientific attitudes are normally associated with the mental processes of scientists. In their own rights, a person who has the habit of following the scientific method and has a scientific attitude can be called a scientist. In the course of studying science, the students will use their developing scientific knowledge, skills, and attitudes to further develop investigative skills and attitudes.

Amid technological revolution and changes in the field of education where the center of the learning process shifted from the teacher to student-centered learning process, the researcher wanted to find out if the teacher's scientific attitude affects the student's scientific attitude.

Having a scientific attitude consists in being willing to accept only carefully and objectively verified facts, and to hold a single fact above the authority of the oldest theories. Nothing can be called scientific that is not based on such an attitude. And by being scientific, one cannot be fooled by extraordinary "phenomena" that entail public safety and security.

Acquiring scientific attitudes develops a strong and positive interaction among scientists. When talking about intellectual honesty it can be best illustrated by the examples given by the following scientist; Isaac Newton acknowledges the fact that he built his laws of motion on the past as well the works of Galileo and other scientists. It was not a hidden fact that his first law was very much like Galileo's concept of Inertia. Never claiming that he worked out physical laws on his own, Newton gave credit to the contributions of Galileo and other physicists, saying that he was able to expand his vision 'by standing on the shoulders of giants' (Bernard of Chartes, 1675).

II. Methods

Method of Research Used

This study utilized the descriptive-correlational method of research to describe the relationship between the scientific attitude of the science teachers and their students. A descriptive correlational method refers to a type of study in which information is collected without making any changes to the study subject. A descriptive-correlational explores the relationship between variables using statistical analyses (Bernard, 2012). The researcher used the method to gather information about prevailing conditions or situations for descriptions and interpretation of a large population.

Sampling Technique

Random sampling was done to identify the participants in the study. Random sampling is a part of the sampling technique in which each sample has an equal probability of being chosen. A sample chosen randomly is meant to be an unbiased representation of the total population.

The researcher assigned numbers to each of the respondents and draw them using the fishbowl technique. The researcher had drawn the number of respondents according to the sample size per school.

Description of the Respondent

The respondents are all Grade 10 students and their Grade 10 science teachers from the thirteen (13) public high schools from the Division City Schools of Malolos. With Grade 10 total population of students as of June 30, 2017, from Schools Division Office of City of Malolos Enrolment data of 3,355. There are 28 Science Teachers who participated in the study.

Instrumentation

This study utilized the descriptive-correlational method of research using the following instruments: Salmorin's (1983) Student's Attitude Scale and Teacher's Attitude Scale prepared by Lolita M. Salmorin of the Philippine Normal College now presently known as Philippine Normal University where she served as the Dean of the College of Science. The instruments are characteristic reactions reflective of scientific attitudes. It is made up of five (5) columns including the statements with indicators such as SA (Strongly Agree), A (Agree), D (Disagree), and SD (Strongly Disagree).

Data Gathering Procedure

The researcher submitted his letter of request st to survey different schools in the division of Malolos last June 23, 2017. The endorsement letter approved by the School Division Superintendent of the City of Malolos was released on July 21, 2017. The Researcher presented the letter to the school principals for proper endorsement and asked for the schedule for the administration of the questionnaire. The data gathering lasted from August 9, 2017, until September 21, 2017. It was properly endorsed to Institute for Data and Statistical Analysis (IDSA) through Mr. Peter Galanido for statistical treatment from September 22, 2017, to October 9, 2017.

Statistical Treatment of Data

To determine the average (mean and combined mean)

To determine the correlation between teacher's scientific attitude and the student's scientific attitude, the Pearson correlation was used.

III. Result and Discussion

Scientific Attitudes Exhibited the Science Teachers

Ranking of Scientific Attitudes Exhibited by

Science Teachers and their Students		
Scientific Attitudes	**Science 10 Teachers**	**Grade 10 Students**
Curiosity	4	3
Open-mindedness	1	1
Questioning Attitude	5	4
Respect for Evidence	2.5	2
Believing in Cause and effect Relationship	6	5
Honesty	7	7
Humility	8	10
Patience and Determination	9	9
Resourcefulness and creativity	2.5	6
Intellectual Responsibility	10	8

The table presents the Ranking of Scientific Attitudes Exhibited by Science Teachers and their Students. Table 8 shows the scientific attitudes exhibited by Grade 10 Science Teachers, in descending order were, open-mindedness, respect for evidence, resourcefulness and creativity, curiosity, questioning attitude, believing in cause and effect relationship, honesty, humility, patience, and determination, and intellectual responsibility. Likewise, their students have the following scientific attitudes, in descending order, open-mindedness, respect for evidence, curiosity, questioning attitude, believing in cause and effect relationships, resourcefulness and creativity, honesty, intellectual responsibility, patience and determination, and humility.

As shown above, both teachers and students have the same ranking in terms o open-mindedness, honesty, patience, and determination. For most of the behavioral indicators, the distance or disparity between their rankings is closer and shows a relative relationship.

Many different researchers expose the fact that scientific attitude of teachers towards science education not only affect their performances but also influence students' success, performance, and attitude towards science courses (Altınok, 2004; Morell& Lederman, 1998; Palmer, 2001; She & Fisher, 2002; Sönmez, 2007; Washton, 1971). Concerning this point, it can be said that the classes, in which the educators develop a positive attitude towards science and science education, are more efficient, and yet, students produce a positive attitude towards the course and the teacher and their desire about continuing studies in science and their success increase (Mattern & Schau, 2002).

The least among the scientific attitudes of Science teachers is the intellectual responsibility and humility for the grade 10 students. As a student with less experience, he is prone to committing errors and may believe he has better ideas and need not consult anyone.

Ranking of Scientific Attitudes Exhibited by Male and Female Grade 10 Students

Scientific Attitudes	Male Students	Female Students
Curiosity	2	4
Open-mindedness	1	1
Questioning Attitude	4	3
Respect for Evidence	3	2
Believing in Cause and effect Relationship	5	5
Honesty	6	7
Humility	10	10
Patience and Determination	8	9
Resourcefulness and creativity	7	6
Intellectual Responsibility	9	8

The table shows the scientific attitudes exhibited by male and female Grade 10 students. The table shows a similar ranking for Open-mindedness, believing in cause and effect relationships, and humility. Open-mindedness ranked first for both males and females therefore it is the most exhibited scientific attitude by the students. However, humility ranked tenth and is, therefore, the least exhibited scientific attitude.

Noticeably, curiosity ranked second among male students and fourth among females. This means that male students demonstrate explanatory behavior and better performance more than female students do. This may be because females feel more pressure to respect interpersonal boundaries.

Gender differences indicated a weak superiority of male attitudes and achievement over females. In a meta-analysis of 18 studies, it was found that males have more positive attitudes than females (Weinburgh, 1995). This may uphold the findings that males are more curious than females. The correlation between attitude and achievement was positive for both genders but stronger for females. The impact of science enrichment programs on attitudes found more changes for females (Stake & Mares, 2001). Utilizing a structural equation model Mattern and Schau (2002) found that for males, an increase in positive attitudes toward science did not lead to greater achievement or more positive attitudes in the future. For females, the achievement was also not impacted by attitude. However, for females, previous positive attitudes toward science did indicate more positive attitudes in the future.

Ranking of Scientific Attitudes Exhibited by Male and Female Grade 10 Science Teachers

Scientific Attitudes	Male Science Teacher	Female Science Teacher
Curiosity	3	4
Open-mindedness	1	1
Questioning Attitude	5	5
Respect for Evidence	2	3
Believing in Cause and effect Relationship	6	6
Honesty	7	7
Humility	8	9
Patience and Determination	9	8
Resourcefulness and creativity	4	2
Intellectual Responsibility	10	10

The table shows the ranking of scientific attitudes exhibited by male and female Grade 10 Science teachers. Both male and female science teachers mostly exhibited Open-mindedness and least exhibited intellectual responsibility; both have the same rankings in questioning attitude, believing in cause and effect relationships, and honesty. Looking at the result, there is no significant difference between the male and female science teachers.

It was found that there was no significant difference between the attitudes of male and female science teachers scientific attitudes. (Renu, 2004)

Ranking of Scientific Attitudes Exhibited Highly and Less by Grade 10 Science Teachers

Scientific Attitudes	Highly Scientific	Less Scientific
Curiosity	5	3.5
Open-mindedness	1	1
Questioning Attitude	6	5
Respect for Evidence	3.5	2
Believing in Cause and effect Relationship	3.5	6
Honesty	7.5	7
Humility	9	9
Patience and Determination	10	8
Resourcefulness and creativity	2	3.5
Intellectual Responsibility	7.5	10

The table shows the scientific attitudes exhibited by highly scientific science teachers whose scores ranged from one hundred forty-one (141) to hundred fifty-six (156) in the Teacher Attitude Scale and fewer scientific teachers whose

scores ranged from hundred forty (140) and below in the Teacher Attitude Scale.

Open-mindedness ranked first as the most exhibited scientific attitude for both highly and less scientific teachers. Humility, however, got the same ranking. Further, attitude *Patience and Determination* ranked tenth for highly scientific teachers and ranked eighth for less scientific teachers. For less scientific teachers respect for evidence was their second most exhibited attitude while resourcefulness and creativity for highly scientific teachers.

Highly scientific teachers tend to be more resourceful and creative whereas the less scientific teachers value respect for evidence. As shown in the result, highly scientific teachers are less patient and determined compared to the less scientific teachers.

There is no significant difference between males and females in respect of their Scientific Attitude. (Pillai, 2012)

Scientific Classification Attitude of the Respondents

Classification of Scientific Attitude of Grade 10 Teachers

Classification	Male	Female	Number of Respondents	Percentage (%)
Less Scientific	7	18	25	89
Average Scientific	0	1	1	4
Highly Scientific	0	2	2	7
Total			28	100

The table shows that two (2) of the respondents are Highly scientific teachers whose scores ranged from one hundred forty-one (141) to hundred fifty-six (156) in the Teacher Attitude Scale, one (1) Average scientific teacher whose scores ranged from one hundred forty-one (141) to hundred fifty-six (156) in the Teacher Attitude Scale and twenty-five (25) less scientific teachers whose scores ranged from hundred forty (140) and below in the Teacher Attitude Scale.

The result may suggest that what teachers need to know about science, teaching, and students is always changing; and no teacher will be an expert in all relevant domains (National Research Council, 2002, 2007, 2010). The preparations of science teachers vary in majorship namely General Science, Biology, Chemistry, and Physics. All these domains are taught by a teacher because of the unavailability of some teachers to teach a specific domain in their schools. According to Trends in International Mathematics and Science Study (TIMSS) 2003, eighth-grade science teachers reported only a moderate level of confidence in their preparation to teach science

Classification of Scientific Attitude Grade 10 Students

Classification	Male	Female	Number of Students
Less Scientific	119	176	295
Average Scientific	22	33	55
Highly Scientific	4	2	6
Total	145	211	356

The table shows that six (6) of the respondents are Highly scientific students whose scores ranged from one hundred forty-one (141) to hundred fifty-six (295) in the Student Attitude Scale, Fifty-five (55) are Average scientific students whose scores ranged from one hundred forty-one (141) to two hundred and ninety-five (156) in the Student Attitude Scale and twenty-five (25) are Less scientific teachers whose scores ranged from hundred forty (140) and below in the Student Attitude Scale.

Students' declining science interest in middle school is often attributed to psychological factors like shifts in motivational values, a decrease in self-efficacy, or doubts about the utility of schooling in general (Heidi B. Carlone et al., 2014). Gautam (2002) conducted a study on scientific attitude about an interest in science. The objective of the study was to find out whether students with high, average, and low interest in science differ in their scientific attitudes. He concluded that students with a high level of interest in science exhibit superior scientific attitudes than their counterparts with low-level interest in science. And there was a difference in the scientific attitude of students with a high, low, and average interest in science.

In science, boys outperformed girls in almost all countries by Grade 8. Results from the 2015 TIMSS assessment were much more mixed. In about half the countries tested, there were no (statistical) differences in gender performance in mathematics and science. Boys, however, still outperformed girls in mathematics and science in the majority of the remaining countries.

IV. Conclusion

Highly scientific Teachers exhibit the following scientific attitudes in descending order: open-mindedness, resourcefulness, and creativity, respect for evidence, believing in cause and effect relationships, curiosity, questioning attitude, honesty, intellectual responsibility, humility, and patience and determination. Less scientific Teachers exhibit the following scientific attitudes in descending order: open-mindedness, respect for evidence, resourcefulness and creativity, curiosity, questioning attitude, and believing in cause and effect relationship.

The scientific attitudes exhibited by Grade 10 Science Teachers, in descending order were: open-mindedness, respect for evidence, resourcefulness and creativity, curiosity, questioning attitude, believing in cause and effect relationships, honesty, humility, patience and determination, and intellectual responsibility.

The students have the following scientific attitudes, in descending order: open-mindedness, respect for evidence, curiosity, questioning attitude, believing in cause and effect relationships, resourcefulness and creativity, honesty, intellectual responsibility, patience and determination, and humility.

There is no significant relationship between the scientific attitudes of teachers and the scientific attitudes of the students in the following behavioral indicators: open-mindedness, respect for evidence, curiosity, questioning attitude, believing in cause and effect relationship, resourcefulness and creativity, honesty, patience, and determination. The relationship between teacher and student's intellectual responsibility and humility is significant.

REFERENCES

Adora, Ma. Concepcion A. (1992). Relationship of Scientific Attitudes of the Science Achievement of Fourth Year Science Club Members and Non-Members. Laguna

Bang EunJin and Barker, Dale. (2013) Gender Differences in Korean High School Students' Science Achievements and Attitudes towards Science in Three Different School Settings. School of Education, Iowa State University, Ames, U.S.A.

Barberos, Maria Theresa, Gozalo, Arnold, Padayogdog, Euberta (2010)The Effects of the Teachers' Teaching Style on Students' Motivation Action research.

Crisol, Lourd Greggory and Alamillo, John Brian (2014). A Comparative Study of the Attitudes between the Students and Teachers of Two Public Elementary Schools in Northern Mindanao toward the K to 12 Curriculum Shift.

Dompiles, Donna J.(2015) Attitudes of Students and Teachers along with Science Education Environment. Baguio City.

Dongallo, Eric O. (2013). Scientific Attitudes in Science Laboratory Activities of Grade Six students of Nuestra Senora de Aranzazu Parochial School. Malolos, Bulacan

Gautama, V. (2002). A Study on Scientific Attitude out Interest in Science, Patna University, Department of Education.

Lacap, Marjorie P. (2015).The scientific Attitude of Students Major In Science in the New Teacher Education Curriculum. Pangasinan State University, Bayambang Campus, Philippines

Markle, Ross and Banion, Terry (2014) Assessing Affective Factors to Improve Retention and Completion. Arizona

Miller, Patricia H., Slawinski, Blessing Jennifer and Schwartz, Stephanie. (2016) Gender Differences in High-school Students' Views about Science.

Mullis, Ina V.S. (2013). TIMMS 2003 International Science Report: Findings from IEA's Trends in Mathematics and Science Study at Fourth and Eighth Grades.

Osborne, Jonathan (2003). Attitudes towards science: a review of the literature and its implications.

Rani, George and David Kaplan (2006).A Structural Model of Parent and Teacher Influence on Science Attitude of Eighth Graders.

Renu, Bala (2004). Scientific Attitude amongst the Science and Non-science Pupil Teachers: A Comparative Analysis.

Salmorin, Lolita M. (1983). The Scientific Attitude of Science Teachers and Its Relationship with The Attitude of their Students. Manila