International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2019): 7.583

Students' Attitudes toward Science in Relation to Science Achievement

Dr. Romel C. Robledo

Research Coordinator, Guipos National High School, Poblacion, Guipos, Zamboangadel Sur, Philippines

Abstract: ***Attitudes toward science have received substantive research, mainly because they influence students' science learning and their participation in science. This study was designed to determine the students' attitude towards science with the implementation of spiral progression approach in relation to students' achievement. This study utilized a descriptive-correlational method of research. A survey questionnaire about motivation and learning strategies was developed based on Motivational Strategies for Learning Questionnaire (MSLQ), and was administered to the public secondary junior high school students randomly chosen in the Quality Learning Circle (QUALCI) 6 of the Division of Zamboanga del Sur. Mean, standard deviation and Pearson r product moment of correlation were used in interpreting the data. Results show that students are slightly high in motivation and found to have slightly high usage rate of learning strategies in learning science. Respondents gave the lowest score to effort regulation which could be translated into their lack of focus and being prone to distractions. The analysis result of motivation scale shows that the students consider science as a difficult subject for them as revealed by the low score for self-efficacy. From the findings of this study, it is suggested that teachers and parents should actively care about students' motivation and appropriate learning strategies as these have positive effect to academic performance.***

Keywords*:* attitudes toward science, learning strategies, motivation, science achievement, spiral progression approach, zamboangadelsur

1. Introduction

Science education has been occupying a prestigious position in many countries' school curricula. Most educational systems consider this subject fundamental to transform their societies into technologically skilled ones (Yetisir, 2014). Educational systems of different countries aimed at educating individuals for a scientific literacy (Hilal, Emrah, & Barý, 2016). Although countries and school systems worldwide are emphasizing the importance of science education for technological development and global economic competition, comparative findings from standardized international student assessments point towards a huge gap in science scores between developed and developing countries (Liyanage, Bomhoff, & Lee, 2014). Hence, there is a need to explore additional ways in which science achievement can be enhanced.

Student science achievement is often referred to as a homogenous single global construct (Liou & Liu, 2015). Maximizing science achievement is a critical target of educational policy and has important implications for national and international economic and technological competitiveness. Previous research has identified both science interest and socio-economic status (SES) as robust predictors of science achievement (Tucker-Drob, Cheung, & Briley, 2014).

In the Philippines, the current state of science education particularly in the basic education level lags behind other countries in the world. The results of the Second International Science Study (SISS) and Third International Mathematics and Science Study (TIMSS) placed the Philippines in disadvantaged positions among participating nations. In the SISS, the Philippines ranked almost at the bottom of the list of seventeen (17) nations which took part in this large-scale evaluation of educational achievement. Furthermore, students' performance in National Achievement Tests shows that aside from Mathematics, Science continues to be the most difficult field of study in basic education (Cabansag, 2013).

At present, the DepEd lays high confidence on the K-12 Program in providing better quality of education that is based on spirally progressing curriculum starting with simple topics moving toward increasing complexity in order for the learners to gain mastery of concepts and skills. The Department of Education in the Philippines implemented the new K to 12 Curriculum which started in school year 2012-2013 by virtue of the Republic Act 10533 or the Enhanced Basic Education 2013 (Montebon, 2015).

Prior to the implementation of K to 12 Curriculum, Science subject was taught by discipline and by grade level where Grade 7 focused in Earth Science, Grade 8 in Biology, Grade 9 in Chemistry, and Grade 10 in Physics. Teachers have the comfort of teaching according to their field of specialization and transfer their expertise. In the new Science Curriculum, things are not anymore the same. It utilizes the recently mandated Spiral Progression Approach in instruction. The four disciplines: Earth Science, Biology, Chemistry, and Physics are now taught in one whole year but of different degrees of difficulty. In other words, a teacher is forced to teach the four disciplines in Science Subjects which is not his major or field of specialization like for instance, a Biology major teacher is now expected to teach Chemistry, Physics and Earth Science (Argote, 2016).

The 21st century has been a period of change, especially in the field of science education, as it is considered to be the cornerstone of economic development. In this perspective, teachers are considered to play key roles in achieving this goal and are expected to improve their knowledge and skills to enhance their teaching practices (Lucenario, Yangco, Punzalan, & Espinosa, 2016).

Science knowledge and education are critical for a developing country's developmental process. The Philippines, like other developing countries, places great importance on its science education and has spent a considerable amount of money on science education, as judged by its investments into the various revisions of its science curriculum, as well as its investments into science laboratories, science equipment, and in-service training for science teachers. This is because science is recognized as an indispensable feature of a modern society that plays an integral part in people's lives, both now and in the future. Yet, most science is learned in abstract and Filipinos, especially students, have found science to be difficult in a number of ways. This is unfortunate because the beliefs or opinions of students may indicate an unfavorable attitude toward science, which can influence students' performance in ways that reinforce lower achievement.

After five years of the implementation of spiral progression approach in science, the researcher is prompted to determine how the students respond to the new curriculum in terms of their attitude towards the subject and how it affects the students' science achievement.

Attitudes toward science has been the focus of study for many educational researchers and it ultimately helps to explore the aspects that can be intervened to enhance the students' attitude towards science (Hillman, Zeeman, Tilburg & List, 2016; Koksal, & Berberoglu, 2014; Martella & Marchand-Martella, 2015; Said, Summers, Abd-El-Khalick & Wang, 2016; Newell, Zientek, Tharp, Vogt & Moreno, 2015).

Many students perceive science to be a difficult subject and are minimally engaged in learning it (Ateh & Charpentier, 2014). Developing positive attitudes towards science has been an exposed goal of most of the curriculum development efforts. It was hoped that increasing interest in science would result in increased science enrolment which in turn would yield a larger science work force pool and a science literate public (Prakash, 2014).

Although educationists and psychologists have tried to define the parameters of attitude towards science, different interpretations have been made for this term. That is why, many studies have focused on different parameters of 'attitude' (Osbom & Simon, 2003). Some studies focus on physical science, some on school science and some on science outside the school (Bennet, 2001). Because of the complexities attached, science educators have defined attitude towards science in different ways. Ramsden's (1998) definition of science attitude comprises cognitive, emotional and action components, which leads to develop a particular behaviour. Kind et al (2007) have defined attitude as the feeling that one has on the basis of knowledge and belief about an object, where science is an object, therefore attitude is towards science. Both the definitions are based on three broad components of attitude including cognition, affect, and behaviour (Child, 2007; Baron, 2001). Interlinks between the components could be interpreted as; a person has knowledge and beliefs and develops feelings about an object. As a result, knowledge and beliefs may lead to certain actions (Barmby et al, 2008).

Attitude is a significant predictor of students' current knowledge enhancement intention, which, in turn, positively impacts their level of current knowledge (Foong & Khoo, 2015). Learning attitude is concerned with learners' learning experiences, beliefs, values as well as a learner's educational background. The attitude of learning has great effect on the learning process and learning outcomes which determines a learner's success or failure to a great extent (Zhao, 2015). Therefore, more attention should be paid to the problem of the students' attitude toward learning.

The variation in results reported by studies regarding attitude towards science and science learning reflect that the demographic variables might have influential effect on attitudes towards science and science learning. Attitude towards science learning increases with increase in grade of the students; and female students had higher attitude towards science learning than male students. Paternal education, occupation and students' locality seems to cause no significant difference in attitudes towards science learning of students whereas maternal education and occupation cause significant difference in attitudes towards learning of science (Shah, Mahmood & Harrison, 2013).

The effect of cognitive strategies instruction on students' attitude toward learning and academic functioning of science was investigated in a study. The research method used was semi-experimental with pretest, post-test, experimental and control groups. The experimental group had seven sessions of cognitive strategies. The results of covariance analysis showed that cognitive strategies instruction has a positive effect on academic functioning of science. Also, attitude toward learning has been increased through cognitive strategies instruction (Ganbari-Taleb, Ghanbari, Yousefi, & Botlani, 2013).

Another study was aimed at predicting variables of academic achievement and science self-concept of students in third year guidance based on parents' education level and attitude towards science. Indirect influence of parental education variables, attitudes towards science and science self-concept on science advancement was reported significant. But, only the overall effect of parental education on the development of science is significant and overall effect of variables of attitudes to science and self-concept on development of science was reported insignificant. In addition, the overall indirect effect of parents' education and development of science on self-concept is significant and also attitude towards science has indirect and significant influence on science self-concept and its overall effect on self-concept is not significant. The general and indirect effect of variables of self-concept and development of science on attitude towards science was significant, while the overall impact of variable of parental education on the attitude to science was non-significant and its in- direct effect was reported to be significant. The results indicated that the variables of attitude towards science, science self-concept and achievement have moderating role (Fathi et al., 2013).

In the Islamic Republic of Iran, a project team gathered data with the assistance of Recreational and Cultural Organization of Mashhad Municipality, Organization of Mashhad Municipality and Science and Astronomy Science

Center of Mashhad Municipality, Khorasan Razavi. The study investigated the effect of science center on attitude of students who visit it. Previous research identified key variables that are fundamental to free-choice science learning. Results showed that visiting the science center improved the students' attitude towards science. Based on the criterion of attitude growth and gender difference, male's attitude was improved more than female's. Moreover, there were significant differences between students in grade 11, 10 and 9. In addition, Univariate analysis of variance (ANOVA) indicated that the grade and gender difference had significant effect on criterion of attitude growth (Daneshamooz, Alamolhodaei, Darvishian, & Daneshamooz, 2013).

Social cognitive models examining academic and career outcomes emphasize constructs such as attitude, interest, and self-efficacy as key factors affecting students' pursuit of STEM (science, technology, engineering and math) courses and careers. Findings suggest that students who perceive greater social support for math and science from parents, teachers, and friends have more positive attitudes toward math and science and a higher sense of their own competence in these subjects (Rice, Barth, Guadagno, Smith & Mccallum, 2013).

In United States, the number of students choosing science, technology, engineering or mathematics careers is declining at a time when demand for these occupations is rapidly increasing. Numerous efforts have been undertaken to reverse this trend, yet results are uncertain. One's attitude is key to many choices one makes, and this includes, for many, what career is pursued. Hence, teachers, informal science educators and researchers often wish to measure children's attitudes towards science using a pretest and a posttest to determine the effects of a curriculum, an activity or an intervention. However, measuring children's attitudes toward science has been problematic because of both the limited use of basic psychometrics in checking reliability and validity of instruments and the lack of a single construct of students' attitudes towards science being surveyed (Hillman, Zeeman, Tilburg & List, 2016).

In Minnesota, the primary recommendation of the 2010 President's Council of Advisors on Science and Technology report on K-12 education was to inspire more students so that they are motivated to study science. Scientists' visits to classrooms are intended to inspire learners and increase their interest in science, but verifications of this impact are largely qualitative. A study evaluated the impact of a longstanding Brain Awareness classroom visit program focused on increasing learners understanding of their own brains. Educational psychologists have established that neuroscience training sessions can improve academic performance and shift attitudes of students from a fixed mindset to a growth mindset. The study also determined whether short interactive Brain Awareness scientist-in-the-classroom sessions could similarly alter learners' perceptions of their own potential to learn. Student surveys probed general attitudes towards science and their knowledge of neuroscience concepts (particularly the ability of the brain to change). It was found that the impact of Brain Awareness presentations was positive and proportional to the efforts expended, demonstrating that short, scientist-in-the-classroom visits can make a positive contribution to primary school students' attitudes toward science and learning (Fitzakerley, Michlin, Paton & Dubinsky, 2013).

There appears to be a complex network of cognitive and affective factors that influence students' decisions to study science and motivate their choices to engage in science-oriented careers. Another study explored 330 Taiwanese senior high school students' awareness of their science teacher's learning leadership and how it relates to the students' attitudes toward science and positive thinking. Initial results revealed that the optimism of positive thinking is highly and positively correlated with the future participation in science and learning science in school attitudes towards science and self-concept in science. The correlation and SEM results indicate some of the associations and potential relationships amongst the motivational and affective factors studied an students' attitudes toward and intentions to study science, which will increase their likelihood of future involvement in science careers (Lu, Chen, Hong, & Yore, 2016).

Meanwhile, in a study, 41 seventh-grade science fair contestants from three schools participated in focus group sessions to qualitatively assess their interest in STEM careers and coursework and their understanding of science inquiry. Science fair participation increased the student understanding of science inquiry, and positively influenced the attitudes of the majority of students in the study toward STEM courses and careers. The strengths of the science fair programs were a focus on science inquiry as well as student choice in choosing and carrying out projects. However, for a subgroup of students, the stress level they experienced as they worked on their projects resulted in negative attitudes toward STEM fields. The length and complexity of the science fair process was of concern for many students, but especially so for this sub-group. It is possible that an undertaking of the length and complexity of a typical science fair project is not appropriate for all students in this age group. Alternatives for students include carrying out several shorter projects, rather than one large project, or working with partners or small groups. These strategies could serve the larger goals of increasing student science inquiry understanding and increasing positive student attitudes toward STEM fields in a more age-appropriate manner (Schmidt & Kelter, 2017).

High-quality after-school programs devoted to science have the potential to enhance students' science knowledge and attitudes, which may impact their decisions about pursuing science-related careers. Because of the unique nature of these informal learning environments, an understanding of the relationships among aspects of students' content knowledge acquisition and attitudes toward science may aid in the development of effective science- related interventions. Findings, in a study, suggest that future after-school programs focusing on aspects of attitudes toward science most closely associated with gains in content knowledge might improve students' enthusiasm and academic preparedness for additional science course work by improving student attitudes toward their perceptions of their self-directed effort (Newell, Zientek, Tharp, Vogt & Moreno, 2015).

In Turkey, a study investigated the effectiveness of guided-inquiry approach in science classes over existing science and technology curriculum in developing content-based science achievement, science process skills, and attitude toward science of grade 6 students. Non-equivalent control group quasi-experimental design was used to investigate the treatment effect. The results indicated the positive effect of guided-inquiry approach on the Turkish students' cognitive as well as affective characteristics. The guided inquiry enhanced the experimental group students' understandings of the science concepts as well as the inquiry skills more than the control group students. Similarly, the experimental group students improved their attitudes toward science more than the control group students as a result of treatment. The guided inquiry seems a transition between traditional teaching method and student-centred activities in the Turkish schools (Koksal & Berberoglu, 2014).

A study explored the gender, grade level and ethnicity differential in attitudes towards science. Using a 3-point Likert scale 8-item one-dimensional Attitudes Towards Science Questionnaire with appropriate validity and reliability, the questionnaire was administered to 84 respondents from two national primary schools in Temerloh District in Pahang comprising 29, 25 and 30 primary students from years 4, 5 and 6 respectively. The dataset was analysed using a two-way (gender and grade level) factorial ANOVA and an independent samples t-test for ethnicity. The findings indicated that while there were no significant two-way interactional effect and main gender effect, the grade level effect was significant in which Year 5 and 6 students were having more positive attitudes than Year 4 students. Additionally, the Malay students have a markedly higher level of attitudes towards science as compared to the Aboriginal students. The results are discussed in the context of science teaching and research (Ong, Mesman & Yeam, 2014).

Another study examined the student attitudes toward science, technology, engineering, and mathematics (STEM) project-based learning (PBL). The initial survey consisted of 51 items, which were created by the authors and adapted/ adjusted from previous studies. Exploratory factor analysis and confirmatory factor analysis were employed to examine the psychometric properties of the instrument, specifically reliability and validity for student attitudes toward STEM PBL. As a result, five factors and 25 items were extracted. The five factors were "self regulated learning," "collaborative learning environment," "interdisciplinary learning environment," "technology-based learning," and "hands-on activity." Using the developed instrument, 785 Korean middle grade students were surveyed and showed a positive attitude toward five factors of STEM PBL. Given the valid and reliable (0.766-0.861) scores in this study, the developed survey might be used in investigating student attitude toward STEM PBL in other areas. However, others should examine the English translation for its psychometric properties before using it for research. In addition, educators might refer to the information on student attitude toward STEM PBL in designing STEM integrated lessons (Han & Carpenter, 2014).

In Qatar, a study assessed students' attitudes toward science. A cross-sectional, nationwide probability sample representing all students enrolled in grades 3 through 12 in the various types of schools in Qatar completed the 'Arabic Speaking Students' Attitudes toward Science Survey' (ASSASS). Findings from this study suggest that participants' attitudes toward science decrease with age, and that these attitudes and related preferences are influenced by students' nationality and the type of school they attend. Equally important, the often-reported advantages for male over female precollege students in terms of attitudes toward science were much less prominent in the present study (Said, Summers, Abd-El-Khalick & Wang, 2016).

Another study investigated the effects of a science and society intervention on elementary school students' argumentation skills and their attitudes toward science. The data showed that after the intervention, the quality of the experimental group students' arguments and their attitudes toward science were significantly higher than their comparison group counterparts. In addition, the experimental group boys made significantly greater progress in the quality of their argumentation from the pretest to post test than the girls; and low achievers made the most significant progress in their attitudes toward science and quality of argumentation. Interviews and observations indicated that their understandings of explanation and argumentation changed over the intervention. This indicated that a science and society intervention can enhance both the ability of students to develop strong arguments and their attitudes toward science (Hong, Lin, Wang, Chen, & Yang, 2013).

A study focuses on the family and examines to what extent parents' attitudes towards science (how much they value science and the importance they place on it) can influence their children's science achievement. The findings indicate that parents' attitudes towards science have a positive and statistically significant effect on science achievement, after controlling for other important student- and school-level variables. Moreover, students from poor backgrounds appear to benefit from more positive parental science attitudes as much as students from high socioeconomic status, such that equality of student achievement is not affected (Liyanage, Bomhoff & Lee, 2014).

Among the attitudinal factors, enjoyment of science and self-efficacy in science play important roles in scientific achievements. Most of the parental factors, on the other hand, are not having significant impacts on achievement after student attitudes are taken into account, with only parents' value of science having a small effect. School student intake is found to be a strong predictor of school average achievement, as well as a major mediator of the effects of school enrollment size and school socio-economic status (Lam & Lau, 2014).

Students' attitudes towards natural science constitute an important area in science education as fewer students are interested in natural science and they do not choose corresponding science disciplines in postsecondary education. Some degree of relationship exists between students' attitudes towards science and corresponding variables: science interests, genders, grades, and parents' educational levels. In conclusion, the current study revealed participants' interests in various science branches and their relationships with factors such as genders, grades, and parents' educational levels and occupations. Students at high school level showed a relatively high interest level in all disciplines of science (Akarsu & Kariper, 2013).

Student success and/or failures are in large part determined by how well teachers provide effective instruction to their students (Martella & Marchand-Martella, 2015). Effective instruction increases student success and, in turn, positively influenced student's attitude. Effective instruction includes: scaffolded instruction, structure and organization, differentiated instruction, opportunities to respond (OTR), positive and corrective feedback, and motivational systems (Martella , 2012; Vaughn & Bos, 2012).

Students' motivational beliefs in science learning are viewed as psychological states supporting their learning processes, as well as being a key determinant of science achievement, course taking and a future career in the fields of science, technology, engineering and mathematics (STEM) (Liou & Liu, 2015).

Enjoyment of science and self-efficacy in science play important roles in scientific achievements (Lam & Lau, 2014). Students' motivational beliefs in science learning are viewed as psychological states supporting their learning processes, as well as being a key determinant of science achievement, course taking and a future career in the fields of science, technology, engineering and mathematics (STEM) (Liou & Liu, 2015). Students' attitudes towards natural science constitute an important area in science education as fewer students are interested in natural science and they do not choose corresponding science disciplines in postsecondary education (Akarsu & Kariper, 2013).

The importance of students' motivational beliefs in science learning cannot be overstated. Numerous studies (DeWitt et al., 2013; Krapp and Prenzel 2011; Olsen et al., 2011; Singh et al., 2002) have shown that students' motivational factors predict academic achievement, aspirations, college major selection, career choice, and lifelong learning in STEM (Liou & Liu, 2015).

Hence, student success and/or failures are in large part determined by how well teachers provide effective instruction to their students (Martella & Marchand-Martella, 2015). Effective instruction increases student success and, in turn, positively influenced student's attitude (Martella, 2012; Vaughn & Bos, 2012).

During the recent decades, educational specialists have paid more attention to effective factors on academic achievement and attitude toward learning. The complication of learning in human beings and the difficulties of science conceptions and skills, in one hand, and some teachers' inefficiency, the ambiguity of educational purposes and other factors such as learners' interest and motivation and also students' inability have caused learners' unsuccess in acceptable results and their hatred to science lesson.

Thus, students' attitude, interest and learning strategies toward learning and educational subjects are of special importance. This paper is an attempt to determine the students' attitude towards science and its relation to science achievement with the implementation of spiral progression approach in science.

Objectives of the Study

This study determined the students' attitudes toward science in relation to their achievement in the Quality Learning Circle (QUALCI) 6 in the Division of Zamboanga del Sur. The specific objectives were to:

1) Determine the students' attitudes toward science;
2) Determine the students' science achievement; and
3) Relate the students' attitudes toward science to students' science achievement.

2. Methods

2.1 Research Design

This study utilized a descriptive correlational method of research. A predictive correlational research design was used as a means to determine the degree of association or relationship between the variables. Descriptive correlational research is concerned with the description of data, their characteristics and correlations (Creswell, 2005). In this study, the goal was the acquisition of factual, accurate and systematic data on the students' attitude towards science that can be used in averages, frequencies and similar statistical calculations. A correlational analysis was utilized in order to determine the relationship between students' attitude towards science and students' achievement.

2.2 Research Setting

This study was conducted in the public secondary schools of Quality Learning Circle (QUALCI) 6 in the Division of Zamboanga del Sur, specifically in the five districts that compose the Quality Learning Circle (QUALCI) 6 in the said division, namely: Guipos, Dinas, Pitogo, Dimataling and Tabina. QUALCI 6 was chosen as the research setting in this study because the students' performance in National Achievement Tests of the said QUALCI lags behind other QUALCIs in the division. In the past years, QUALCI 6 has ranked almost at the bottom of the list of all QUALCIs in the annual Division Science Quest and Fair. Hence, there is a need to investigate the students' attitude towards science in relation to science achievement.

2.3 Respondents

The respondents of the study were the science students of QUALCI 6 in the Division of Zamboanga del Sur. This study utilized a mathematical formula, which is based on sampling theory, for determining sample size. In this regard, a Raosoft sample size calculator is used to calculate the sample size at a margin error of 5%. As a result, a recommended sample size of 250 was taken from the population. The advantage with proportional stratified sampling is that it makes possible the representativeness of a particular segment of the population (Singleton & Straits, 2010).

2.4 Instruments

The following were the research instruments used in gathering the data:

A. Motivated Strategies for Learning Questionnaire (MSLQ).This is a researcher-made questionnaire, insights taken from the study of Pintrich and DeGroot (1990). Motivated Strategies for Learning Questionnaire (in short, MSLQ) contains two sub-scales: Motivation and learning strategies. Motivation scale composes 31 items that assess students' learning motivation. Motivation scales include three components: Value, expectancy, and affect. The component of value contains three elements: Intrinsic goal orientation (4 items), extrinsic goal orientation (4 items), and task value (6 items). Intrinsic goal orientation focuses on the inner reasons why students participate in a task, like: Curiosity, self-development, or satisfaction (ex. The most satisfying thing for me in the course is trying to understand the content as thoroughly as possible.). Extrinsic goal orientation concerns about the outer reasons why students participate in a task, like: money, grades, or praises from others (ex. I want to do well in this class because it is important to show my ability to my family, friends, employer, or others.). Task value refers to the student's perception or the awareness about the material or task in terms of usefulness, importance, or applicability (ex.

I think I will be able to use what I learn in this course in other courses).

The component of expectancy contains two elements: Control beliefs (4 items), and self-efficacy for learning and performance (8 items). Control beliefs refer to the students' belief that their effort would lead to positive result (ex. If I study in an appropriate way, then I will be able to learn the material in this course). Self-efficacy for learning and performance refers to the judgment about one's ability to complete the task and the confidence in one's skills to accomplish the mission (ex. I believe I will receive an excellent grade in this course.). The component of Affective contains one element: Test anxiety (5 items). Test anxiety refers to the negative emotion related to taking exam (ex. I have an uneasy, upset feeling when I take an exam.). The Cronbach α of the six components in motivation scale ranged from .62 ~ .93, and it showed that the scale have good reliability. Confirmatory factor analysis was used to establish the construct validity of the motivation scale. The Lambda-ksi estimates of the 31 items in motivation scale ranged from .38 ~ .89. Due to the wide range of courses and domains, the result is acceptable, even though the Lambda-ksi estimates of 4 items were lower than .50.

Learning strategies scale consists of 50 items that assess students' learning strategies. Learning strategies include two components: Cognitive and meta-cognitive strategies, and resource management. The component of cognitive and meta-cognitive strategies contains five elements: Rehearsal (4 items), elaboration (6 items), organization (4 items), critical thinking (5 items), and meta-cognitive self-regulation (12 items). Rehearsal strategies involve reciting or naming the learning materials (ex. When I study for this class, I practice saying the material to myself over and over.). Elaboration strategies include summarizing, generative note-taking, or paraphrasing (ex. When reading for this class, I try to relate the material to what I already know.). Organization strategies include clustering, or outlining (ex. I make simple charts, diagrams, or tables to help me to organize course material.) Critical thinking refers to the strategies to make purposeful or reflective judgment or decisions by analyzing the information observed (ex. I try to play around with idea of my own related to what I am learning in this course.). Meta-cognitive self-regulation strategies contain planning, monitoring and regulating (ex. If course materials are difficult to understand, I change the way I read the material.)

The component of resource management includes four elements: Time and study environment (8 items), effort regulation (4 items), Peer learning (3 items), and help seeking (4 items). Time and study environment strategies include scheduling, planning and managing one's time (ex. I attend the class regularly.). Effort regulation reflects the commitment to completing one's goal (ex. Even when course materials are dull and uninteresting, I manage to keep working until I finish.). Peer learning refers to the strategies to cooperate with others to complete the task (ex. I try to work with other students from this class to complete the course assignment.). Help seeking refer to the strategies to manage and use the support from others (ex. I ask the instructors to clarify the concepts I don't understand well.). The Cronbach α of the nine components in motivation scale ranged from .52 ~ .80, and it showed that the scale has good reliability. Confirmatory factor analysis was used to establish the construct validity of the learning strategies scale. The Lambda-ksi estimates of the 50 items in learning strategies scale ranged from .17 ~ .90. Due to the wide range of courses and domains, the result is acceptable, even though the Lambda-ksi estimates of 9 items were lower than .50.

The seven-point Likert-type response format was used in this study with values ranging from 1 "Not at all true of me" to 7 "Very true of me." Below is the continuum used in the interpretation of data gathered.

Responses	Continuum	Interpretation
7 - Very True (VT)	6.16-7.00	Very High (VH)
6 - True (T)	5.30-6.15	High (H)
5 - Sometimes True (ST)	4.44-5.29	Slightly High (SH)
4 - Undecided (U)	3.584-4.43	Moderate (M)
3 - Sometimes (S)	2.72-3.57	Slightly Weak (SW)
2 - Not true (NT)	1.86-2.71	Weak (W)
1 - Not at all true (NAAT)	1.00-1.85	Very Weak (VW)

B. Student's Science Achievement. To determine the student's achievement in science, the student's ratings for two grading periods were utilized. The computation of grades was based on DepEd Order No. 8, s.2015.

Ratings	Interpretation
90-100	Outstanding (O)
85-89	Very Satisfactory (VS)
80-84	Satisfactory (S)
76-79	Fairly Satisfactory (FS)
75 and below	Did not meet Expectations (DE)

Data Collection

The survey questionnaire which is undoubtedly most common source of data in research was used in this study (Creswell, 2009; Locke, Silverman, & Spirduso, 2010; Marshall & Rossman, 1999). Collection of data was systematically observed in the conduct of this investigation. Series of conferences took place with the panel in order that the strategies needed to carry out this research were achieved. Upon accomplishing all the protocols, the researcher distributed and administered the survey questionnaires to the respondents to determine their attitude towards science and its relation to science achievement. The instructions were explained thoroughly by the researcher and after having a common understanding of the tool, the respondents were given an hour to accomplish the questionnaire. Other important research activities like tallying of responses, organizations of data, analysis and interpretation of research data were followed.

Ethical Considerations

To uphold the ethical aspect of the study, the researcher kept an eye on the elements of ethical consideration. The researcher obtained an informed consent, participation was voluntary and no penalties were involved in refusal to participate. Confidentiality of data and anonymity of respondents was the top priority. They were briefed about the study objectives. The principle of beneficence was also taken into consideration. It was stressed-out that the respondents will experience no harm during the conduct of the study. Respondents were given freedom to answer the items presented. All possible measures were taken into consideration to protect the respondents from potential damage during the research or after circulation of the results.

Data Analysis

The following statistical tests were used in interpreting the data of this study:

Mean and Standard Deviation: These descriptive statistical tools were used in the 4-point rating scale to determine the students' attitude towards science and students' science achievement. Computation was performed by getting the product of the weight of the scale and the frequency of each scale divided by the total respondents.

Pearson r Product Moment of Correlation: This statistical tool was used to establish the relationship between the students' attitude toward science and their science achievement.

3. Results and Discussion

Students' Attitudes toward Science

Attitudes toward science refers to students' real condition of learning science under the new curriculum which follows the spiral progression approach from the aspect of motivation and learning strategies (Table 1).

Participants' responses to the Motivated Strategies Learning Questionnaire (MSLQ) are presented in Table 1. Results revealed that students are slightly high in motivation in science (overall mean of 4.952). *Extrinsic Goal Orientation* was evidenced the most by the students (mean of 5.42) while *Self-efficacy for Learning* was evidenced the least (mean of 4.51). This means that most of the students have perceived themselves to be participating in a science task for reasons such as grades, rewards, performance, evaluation by others, and competition. Extrinsic motivation can significantly predict how much effort students put into their subject. However, extrinsic motivation is a negative predictor for perceived personal and social gains. Although students who have higher extrinsic motivation tend to put more effort into course learning in order to get higher grades, they might ignore the importance of self-understanding and cooperation with others (Tzu, 2013).

Instructors and school administrators need to be more careful to ensure that the learning environment doesn't excessively emphasize grades and competition. Meanwhile, only few students have expectancy for success and self-efficacy in science. This implies that students have less expectancy for success to their performance, which relates specifically to task performance in the subject. Students have less self-appraisal of their ability to master a task. This includes students' judgments about one's ability to accomplish a task as well as one's confidence in one's skills to perform that task.

On the other hand, results also revealed that students have slightly high usage rate of learning strategies (overall mean of 4.727). Among the nine categories of MSLQ Learning strategies, *Time and Study Environment*, *Elaboration*, and *Help Seeking* were utilized the most by the students (means of 4.95, 4.4.94, and 4.93, resp.) while *Effort regulation* was utilized the least (mean of 4.38). This means that most of the students are able to manage and regulate their time and their study environments. Students were more likely to attend class regularly and study in a place where they could concentrate, make good use of their study time, set aside a regular place to study, keep up with weekly assignments, allow other activities to interfere with studying, or rarely find time to review before exams.

Most of the students have also used elaboration as a strategy to help them store information into long-term memory by building internal connections between items to be learned which includes paraphrasing, summarizing, creating analogies, and generative note-taking. Elaboration does require students to make connection between what is already known and what has been introduced (Donker, 2013). Elaboration does not only helps make the new information more understandable and memorable but also helps to generate a useable data base for higher order thinking and application (Ma, 2013). These help them integrate and connect new information with prior knowledge.

Another aspect of the environment that most of the students have manifested is the support of others. This includes both peers and instructors. However, students have less self-regulation which includes ability to control their effort and attention in the face of distractions and uninteresting tasks. Students felt so lazy and bored when studying that they quit before finishing, worked hard to do well when they don't like the activity, gave up or only study easy parts when work is difficult, or managed to keep working until they're finished even when material is dull and uninteresting. This implies that students need to learn more on effort management which can also mean self-management, which reflects a commitment to completing one's study goals, even when there are difficulties or distractions.

This study implies that students learn the new knowledge in different ways, pace, and amount. The examination of the factors influencing learning is critical for increasing and enriching students' learning. Due to differences in individuals and contextual features, learners go through diverse ways while they are learning. To help students develop deep motives and strategies, to support their learning, and make changes in their approaches, first, science educators have to examine the existent motives and strategies. Teachers who understand student motivation can greatly enhance the classroom experience and student performance. Because motivation leads to engagement, motivation is where teachers need to begin. Learning science, just like anything else, require an investment by the learner to improve. So motivation to engage is the first step on the road to improving literacy habits and skills. Understanding students' needs for choice, autonomy, purpose, voice, competence, encouragement, and acceptance can provide insight into some of the conditions needed to get students involved with academic literacy tasks.

Table 1: Students' Attitudes toward Science

Scales	*Sub-scales*	*Mean*	*StDev*
Motivation Scales	Intrinsic Goal Orientation	4.8733	1.1501
	Extrinsic Goal Orientation	5.4200	1.1356
	Task Value	5.0872	1.1488
	Control of Learning Beliefs	5.1767	1.2139
	Self-Efficacy for Learning	4.5108	1.1236
	Test Anxiety	4.645	1.274
	Over-all	4.952	1.1743
Learning Strategy Scales	Rehearsal	4.815	1.414
	Elaboration	4.9387	1.1981
	Organization	4.772	1.336
	Critical Thinking	4.585	1.262
	Metacognitive Self-Regulation	4.6356	1.0122
	Time and Study Environment	4.9542	1.1375
	Effort Regulation	4.378	1.326
	Peer Learning	4.571	1.274
	Help Seeking	4.927	1.270
	Over-all	4.727	1.248

Note: Minimum and maximum scores are based on 7-point Likert scale (1: Not at all and 7: Very true of me).

Students' Science Achievement

Data on students' science achievement are presented in Table 2. It shows that with the implementation of spiral progression approach in science, students' academic performance is *Very Satisfactory* (M=86.027) and qualitatively interpreted as highly effective. It implies that for two quarters, students have developed the fundamental knowledge and skills and core understandings in science, and can transfer them independently through authentic performance tasks. Classroom assessment is an integral part of curriculum implementation. It allows the teachers to track and measure learners' progress and to adjust instruction accordingly. In a grading period, students have to undergo one Quarterly Assessment (20 percent) but there should be instances for students to produce Written Works (40percent) and to demonstrate what they know and can do through Performance Task (40 percent). There is no required number of Written Work and Performance Task, but these must be spread out over the quarter and used to assess learners' skills after each unit has been taught (DepEd Order No. 8, s.2015).

Table 2: Students' Science Achievement

Variable	Mean	StDev	Minimum	Maximum
1st Quarter	85.707	3.739	76.000	93.000
2nd Quarter	86.347	3.772	77.000	94.000
Average	86.027	3.617	77.000	93.500

Scale: 90 and above (Outstanding); 85-89 (Very Satisfactory); 80-84 (Satisfactory); 75-79 (Fairly Satisfactory) and 74 and below (Did Not Meet Expectations)

Test of Significant Relationship between Students' Attitudes toward Science and Students' Science Achievement

Revealed in Table 3 are the data on the test of relationship between the students' attitude toward science and students' science achievement.

When considering the six categories of MSLQ Motivation, results produced a high significant relationship between intrinsic goal orientation and students' science achievement; extrinsic goal orientation and students' science achievement; task value and students' science achievement; control of learning beliefs and students' science achievement; and self-efficacy for learning and students' science achievement. In addition, test anxiety and students' science achievement also manifested a significant relationship. Past studies have shown that higher motivation indeed results in higher academic achievement (Bruinsma, 2014). Students who value the subject and are interested in the subject are more likely to report a deep information processing approach so that they usually have higher academic achievement.

On the other hand, among the nine categories of MSLQ Learning strategies, results produced a high significant relationship between rehearsal and students' science achievement; organization and students' science achievement; critical thinking and students' science achievement; metacognitive and students' science achievement; effort regulation and students' science achievement; peer learning and students' science achievement; and help seeking and students' science achievement. There was also a significant relationship manifested between time and study environment and students' science achievement. This finding is supported by a study on the use of self-regulated learning measure questionnaires as a predictor of academic success which shows that appropriately utilizing self-regulation skills and strategies can lead to improved academic performance and learner success (Bruso & Stefaniak, 2016). While, no significant relationship was manifested between elaboration and students' science achievement. Pintrich (1999) stated that although elaboration as a strategy is important in terms of academic performance, it mostly includes simple memory tasks (or rote memorization), and comprehension of a written text to some extent.

Table 3: Test of Relationship between Students' Attitudes toward Science and Students' Science Achievement

Scales	*Sub-scales r- value p-value*	*r-value*	*p-value*
Motivation Scales	Intrinsic Goal Orientation and SSA	0.454	0.000**
	Extrinsic Goal Orientation and SSA	0.336	0.000**
	Task Value and SSA	0.300	0.000**
	Control of Learning Beliefs and SSA	0.405	0.000**
	Self-Efficacy for Learning and SSA	0.327	0.000**
	Test Anxiety and SSA	0.170	0.038*
Learning Strategy Scales	Rehearsal and SSA	0.298	0.000**
	Elaboration and SSA	0.153	0.062
	Organization and SSA	0.267	0.001**
	Critical Thinking and SSA	0.270	0.001**
	Metacognitive Self-Regulation & SSA	0.318	0.000**
	Time and Study Environment & SSA	0.175	0.033*
	Effort Regulation and SSA	0.229	0.005**
	Peer Learning and SSA	0.294	0.000**
	Help Seeking and SSA	0.316	0.000**

*Note: ** 0.00-0.01- Highly Significant, *0.02-0.05- Significant, 0.05 and above-Not Significant*

4. Conclusion and Recommendations

This study is focused on students' real condition of learning science under the new curriculum which follows the spiral progression approach from the aspect of motivation and learning strategies. Results show that students are slightly high in motivation and found to have slightly high usage rate of learning strategies in learning science. Respondents gave the lowest score to effort regulation which could be translated into their lack of focus and being prone to distractions.

Therefore, a suggestion is proposed that the teachers and parents need to teach students how to control themselves in the face of distractions. They are encouraged to instil the value of effort management to academic success because it not only signifies goal commitment, but also regulates the continued use of learning strategies. The analysis result of motivation scale shows that the students consider science as a difficult subject for them as revealed by the low score for self-efficacy. Although students viewed science as a difficult subject, they also believe that if they will be given rewards, they will have good performance in science. Moreover, they think they are the only ones who have to be responsible to the learning results. Furthermore, they did not give up learning science because they strive hard to manage their time and study environment, use elaboration and keep seeking others help to improve their performance. This study suggests for teachers and parents to actively care about students' motivation and appropriate learning strategies as these have positive effect to academic performance.

References

[1] Abd-El-Khalick, F., Summers, R., Said, Z., Wang, S., & Culbertson, M. (2015). Development and large-scale validation of an instrument to assess arabic- speaking students' attitudes toward science. International Journal of Science Education, 37(16), 2637. Retrieved from https://search.proquest.com/docview/1734737032?accountid=149218

[2] Akarsu, B., & Kariper, A. (2013).Upper secondary school pupils' attitudes towards natural science. European Journal of Physics Education, 4(1) Retrieved from https://search.proquest.com/docview/1553388214?accountid=149218

[3] Benner, G. J., Kutash, K., Nelson, J. R., & Fisher, M. B. (2013).Closing the achievement gap of youth with emotional and behavioral disorders through multi-tiered systems of support. Education & Treatment of Children, 36(3), 15-29. Retrieved from https://search.proquest.com/docview/1445136631?accountid=149218

[4] Bruinsma, M. (2014).Motivation, Cognitive Processing and Achievement in Higher Education. *Learning and Instruction*, *14(6)*, 549-568. Retrieved from https://search.proquest.com/docview/7352846382?accountid=149218

[5] Bruso, Jackie L. & Stefaniak, Jill E. (2016) The Use of Self-Regulated Learning Measure Questionnaires as a Predictor of Academic Success, Association for Educational Communications & Technology 60:577–584 DOI 10.1007/s11528-016-0096-6

[6] Daneshamooz, S., Alamolhodaei, H., Darvishian, S., & Daneshamooz, S. (2013). Science center and attitude. Educational Research and Reviews, 8(19), 1875-1881.doi:http://dx.doi.org/10.5897/ERR2013.1471

[7] Donker, A. S. (2013). Effectiveness of learning strategy instruction on academic performance: A metaanalysis. *Educational Research Review*, *11*, 1-26. Retrieved from https://search.proquest.com/docview/1824763928?accountid=149218

[8] Fathi, A., Teimori, N., Malekirad, A. A., Azar, E. F., Poorbaghban, H., Mohamadi, K. A., & Shahdosti, L. (2013). Predicting variables of academic achievement and science self-concept of students in third year guidance school based on parents' education level and attitude towards science. European Online Journal of Natural and Social Sciences, 2(2), 417-425. Retrieved from https://search.proquest.com/docview/1679254697?accountid=149218

[9] Fitzakerley, J. L., Michlin, M. L., Paton, J., & Dubinsky, J. M. (2013). Neuroscientistsclassroom visits positively impact student attitudes. PLoS One, 8(12), e84035.doi:http://dx.doi.org/10.1371/journal.pone.0084035

[10] Foong, S., & Khoo, C. (2015). Attitude, learning environment and current knowledge enhancement of accounting students in malaysia. *Journal of Accounting in Emerging Economies*, *5*(2), 202-221. Retrieved from https://search.proquest.com/docview/1672050538?accountid=149218

[11] Ganbari-Taleb, M., Ghanbari, A., Yousefi, Z., & Botlani, S. (2013). Cognitive Strategies Instruction: Attitudes Toward Learning And Academic Functioning In Science. Bulgarian Journal of Science and Education Policy, 7(1), 104-120. Retrieved from

https://search.proquest.com/docview/1435832696?accountid=149218

[12] Grabau, L. J., & Ma, X. (2017). Science engagement and science achievement in the context of science instruction: A multilevel analysis of U.S. students and schools.*International Journal of Science Education, 39*(8), 1045-1068. doi:http://dx.doi.org/10.1080/09500693.2017.1313468

[13] Han, S., & Carpenter, D. (2014). Construct Validation Of Student Attitude Toward Science, Technology, Engineering, And Mathematics Project-Based Learning: The case of korean middle grade students. Middle Grades Research Journal, 9(3), 27-41. Retrieved from https://search.proquest.com/docview/1660316585?accountid=149218

[14] Hillman, S. J., Zeeman, S. I., Tilburg, C. E., & List, H. E. (2016). My attitudes toward science (MATS): The development of a multidimensional instrument measuring students' science attitudes. Learning Environments Research,19(2), 203-219.doi:http://dx.doi.org/10.1007/s10984-016-9205-x

[15] Hong, Z., Lin, H., Wang, H., Chen, H., & Yang, K. (2013).Promoting and scaffolding elementary school students' attitudes toward science and argumentation through a science and society intervention. International Journal of Science Education, 35(10), 1625. Retrieved from https://search.proquest.com/docview/1376558460?accountid=149218

[16] Howell, L. (2010). Computer-assisted instruction in an urban school setting: students' attitudes toward science (Order No. 3446666). Available from ProQuest Central. (856582307). Retrieved from https://search.proquest.com/docview/856582307?accountid=149218

[17] Koksal, E. A., & Berberoglu, G. (2014). The effect of guided-inquiry instruction on 6th grade turkish students' achievement, science process skills, and attitudes toward science. International Journal of Science Education, 36(1), 66. Retrieved from https://search.proquest.com/docview/1464789321?accountid=149218

[18] Lam, T. Y. P., & Lau, K. C. (2014). Examining factors affecting science achievement of hongkong in PISA 2006 using hierarchical linear modeling. *International Journal of Science Education, 36*(15), 2463. Retrieved from https://search.proquest.com/docview/1553753428?accountid=149218

[19] Liou, P., & Liu, E. Z. (2015). An analysis of the relationships between taiwanese eighth and fourth graders' motivational beliefs and science achievement in TIMSS 2011. *Asia Pacific Education Review, 16*(3), 433-445. doi:http://dx.doi.org/10.1007/s12564-015-9381-x

[20] LiyanageDevangi, H. P., Bomhoff, E. J., & Lee, G. H. Y. (2014). *Parents' attitudes towards science and their children's science achievement*. St. Louis: Federal Reserve Bank of St Louis. Retrieved from https://search.proquest.com/docview/1698786259?accountid=149218

[21] Lu, Y., Chen, H., Hong, Z., & Yore, L. D. (2016).Students' awareness of science teachers' leadership, attitudes toward science, and positive thinking.International Journal of Science Education, 38(13), 2174-2196. doi:http://dx.doi.org/10.1080/09500693.2016.1230792

[22] Ma, L. (2013). *Learning strategies and their effects on mathematics achievement among immigrant and native students* (Order No. 3471555).Available from ProQuest Central. (885868168). Retrieved from https://search.proquest.com/docview/885868168?accountid=149218

[23] Martella, R. C., & Marchand-Martella, N. (2015).Improving classroom behavior through effective instruction: An illustrative program example using SRA FLEX literacy. Education & Treatment of Children, 38(2), 241-271. Retrieved from https://search.proquest.com/docview/1687611469?accountid=149218

[24] Martella, R. C., Nelson, J. R., Marchand-Martella, N. E., & O'Reilly, M. (2012). Comprehensive behavior management: Individualized, classroom, and schoolwide approaches. Los Angeles, CA: Sage. Retrieved from https://search.proquest.com/docview/1445136631?accountid=149218

[25] Newell, A. D., Zientek, L. R., Tharp, B. Z., Vogt, G. L., & Moreno, N. P. (2015). Students' attitudes toward science as predictors of gains on student content knowledge: Benefits of an after-school program. School Science and Mathematics, 115(5), 216. Retrieved from https://search.proquest.com/docview/1685873900?accountid=149218

[26] Ong, E. T., Mesman, N., & Yeam, K. P. (2014). Exploring Attitudes Towards Science Among Malay And Aboriginal Primary Students. Journal of Turkish Science Education, 11(3) Retrieved from https://search.proquest.com/docview/1658673832?accountid=149218

[27] Prakash, S. (2014). Development and standardization of attitude towards science scale for student teachers. *Educational Quest*, *5*(1), 33-35. Retrieved from https://search.proquest.com/docview/1671194150?accountid=149218

[28] Rice, L., Barth, J. M., Guadagno, R. E., Smith, G. P., A., & Mccallum, D. M. (2013). The role of social support in students' perceived abilities and attitudes toward math and science. Journal of Youth and Adolescence, 42(7), 1028-40. doi:http://dx.doi.org/10.1007/s10964-012-9801-8

[29] Said, Z., Summers, R., Abd-El-Khalick, F., & Wang, S. (2016). Attitudes toward science among grades 3 through 12 arab students in qatar: Findings from a cross-sectional national study. International Journal of Science Education,38(4), 621-643. doi:http://dx.doi.org/10.1080/09500693.2016.1156184

[30] Schmidt, K. M., & Kelter, P. (2017). Science fairs: A qualitative study of their impact on student science inquiry learning and attitudes toward STEM. Science Educator, 25(2), 126-132. Retrieved from https://search.proquest.com/docview/1865491855?accountid=149218

[31] Shah, Z. A., Mahmood, N., & Harrison, C. (2013). Attitude Towards Science Learning: An Exploration Of Pakistani Students. Journal of Turkish Science

Education, 10(2) Retrieved from https://search.proquest.com/docview/1659748148?accountid=149218

[32] Vaughn, S., & Bos, C. S. (2012). Strategies for teaching students with learning and behavior problems (9th ed.). Boston, MA: Pearson. Retrieved from https://search.proquest.com/docview/1492753631?accountid=149218

[33] Zhao, L. (2015). The influence of learners' motivation and attitudes on second languageteaching *. *Theory and Practice in Language Studies*, *5*(11), 2333- 2339. Retrieved from https://search.proquest.com/docview/1737513722?accountid=149218