

READING COMPREHENSION SKILLS AND PERFORMANCE IN SCIENCE AMONG HIGH SCHOOL STUDENTS IN THE PHILIPPINES

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Abstract: The research work was carried out among randomly selected 666 first year student-respondents from 18 identified public and private high schools in the Division of Cotabato City, Central Mindanao, Philippines. The six elements of reading comprehension skills, i.e., understanding vocabulary in context, identifying main idea, noting details, making inference, predicting outcomes, and drawing conclusion, and students' performance in science from the two school types were described and correlated. A competency-based 50-item multiple choice achievement test for each of the reading comprehension and science learning areas was utilised as the research instrument. The test was developed based on the prescribed Table of Specifications (TOS) and aligned with learning competencies formulated under the Restructured Basic Education Curriculum (RBEC) of the Department of Education (DepEd). The study results showed that the overall students' performance in reading comprehension and science was indexed at low mastery level. Generally, four out of six reading skills such as understanding vocabulary in context, noting details, predicting outcome, and making inference made up the overall reading skills that positively correlated with science performance of students although the strength of relationship was considered weak.

Keywords: reading comprehension skills, performance in reading, performance in science

INTRODUCTION

The global importance of science and technology which dominates in every society requires an educational system that provides a venue for the development of scientific knowledge and skills. Evidently, the rapid development of this field of knowledge through scientific inventions and discoveries posts a challenge to educational institutions to contribute their part in this growing demand of scientific inquiry. In the Philippines, the study of science is mandatory in all levels of education and the state is mandated to give priority to science and technology education, training and services. Educators viewed that science

education is one of the essential tools to national development and suggested that there must be a strong commitment from the academe to attain this goal (Abdul, 2007).

Despite the country's higher literacy rate at 93.4% in 2008 as reflected in the 2009 United Nations Development (UNDP) report, Filipino students had dismal performance in mathematics and science for the last nine decades (Tubeza, 2009). Internationally, they were stuck at the bottom in the 1984 and 1994 International Science Study (Carido & Bautista, 2000), and performed poor in the 1996 Third International Mathematics and Science Survey (TIMSS) (Tenizo, 2002), and in the 1998 International Assessment of Educational Achievement (Navarra, 1997). Nationally, they showed poor mastery in science and mathematics as evidenced by the results in the 2003 to 2009 National Achievement Tests (Imam, 2010).

Other factors contributing to students' achievement in science have been subject of researches both locally and globally. In Japan, positive attitudes toward science study and class environment were influential factors to science achievement. In China, positive attitudes toward science teaching were found to be the only influential factor to science achievement (Linghong, 2001). The Department of Science and Technology (DOST) and Department of Education (DepEd) Science Education Institute (SEI) in the Philippines singled out the problem on poor reading comprehension as a principal factor in the miserable performance of students in the National Achievement Test (Rimando, 2006). In his study, Imam (2010) reported that DepEd regarded reading comprehension as the single factor which caused frustrations of students to perform better in science achievement test. Prior research has shown the importance of domain knowledge (e.g., Dochy, Segers, & Buehl, 1999), reading skill (e.g., Voss & Silfies, 1996), and reading strategy knowledge (e.g., O'Reilly & McNamara, 2002) for science comprehension. Therefore, reading comprehension is a factor to be considered in seeking to elevate the academic performance of students.

Increasing students' reading comprehension of scientific text may be one of the components involved in students' science achievement. The new challenge to focus on improving students' reading skills to address the problem is a paradigm shift. How does reading, which is a language skill, promote students' success in science? It is argued that despite the overwhelming use of today's technologies to get information, these could not replace the fundamental skill in reading which one needs to utilise to acquire knowledge. In fact, the availability of mammoth reliable materials online like e-books and e-journals increased the importance of reading (Sofsian, 2006).

The present study shed light on some gray area from previous research by the DepEd and DOST-SEI (2004) which generally pointed reading comprehension as a culprit without identifying any particular reading comprehension skills. Thus, this study utilised Callahan and Clark's (1988) concept underlying reading comprehension which consists of six elements such as understanding vocabulary in context, identifying main idea, noting details, making inference, predicting outcome, and drawing conclusion. These reading skills were considered as significant skills in science. The ability to read the text is one of the key aspects of teaching and learning science which involves an in depth interaction with the text (Norris & Phillips, 2003). Students need to understand the concepts presented in the text and to critically evaluate or interpret the text containing these concepts, i.e. to determine the credibility and/or usefulness of the text. This involves inferring meaning from the text and integrating it with what the student already knows resulting in the student's interpretation of the text (Phillips, 2002). A failure to learn how to read scientific text will ultimately result in a failure to understand science (Cromley, 2009). As Norris and Phillips (2003, p. 237) state:

The claim to know some scientific statement is a claim to know the process or likely process through which the statement was conceived, the degree of certainty that the field attaches to the statement, the role in reasoning the statement plays in connection with other scientific statements, and the implications of the statement's being true. If such interrelationships are missed in the reading, then the point of science is missed. The main source of both the substantive content of science and of the interrelationships within it is accurate interpretation of science text.

Previous studies provide a solid ground for the present investigation that such reading comprehension skills play a vital role to educational success (Callahan & Clark, 1988; Bender, Boon, Fore III, Spencer, & Stone, 2008; Corcoran & Mamalakis, 2009) particularly in learning content area such as science (Voss & Silfies, 1996). Moreover, studies consistently revealed that students' inability to read comprehensively is a major stumbling block which frustrates them to perform well in all disciplines especially in Mathematics and Science (Yuarata, 2002; Carnine & Carnine, 2004; Walker, Zhang, & Surber, 2008).

Reading Skills in Science

Reading ability has always been viewed as critical to academic success (Grabe & Stoller, 2002) and studies have recognised the importance of reading in academics. Most teachers agree that good reading skills are crucial for learning science concepts although science texts are often more difficult for students than other text types. Many school texts are difficult to understand because they often omit important background information and fail to make relations among

concepts in the text explicit (VanLehn, 1998). Students may have the ability to read and know the words, identify and locate information, and recall content, but may be unable to analyse, summarise, or critique the text when asked to do so. This is experienced from elementary level until the middle high school, which produces negative impact on science learning (Carnine & Carnine, 2004).

The lack of comprehension in reading science text frustrates students to learn secondary science (Cooper, 2004). It is argued that when reading skills are insufficient, a number of problems occur which lead to frustration in learning (Callahan & Clark, 1988; Bender et al., 2008). Research has demonstrated the importance of reading skill for both comprehension (e.g., Voss & Silfies, 1996) and academic achievement (e.g., Alcock et al., 2000). Thus, research recommends vocabulary development and reading activities to achieve science goals (Spencer & Guillaume, 2006; Ediger, 2009).

Experts claimed that both science and language arts, particularly reading comprehension, share cognitive processes, such as predicting, classifying, identifying cause and effect, sequencing, inferencing and summarising (Kumar & Bristor, 1999). Bowers (2000) believed that reading skills and science process skills complement each other well. For this reason, the interconnection of the skills in both subject areas make them natural partners for integration. Though used in different terms, reading skills such as identifying main ideas and details and classifying are also used similarly in science to describe the same process. For other skills like drawing conclusions, the terms and processes are the same for both subject areas. Armbruster (1992) observed that similar skills describe an attribute of good scientists and readers: getting prior knowledge, constructing hypotheses, establishing plans, assessing understanding, identifying the relative importance of information, describing patterns, comparing and contrasting, making inferences, drawing conclusions, generalising, evaluating sources, and so on.

A small number of studies have shown large correlations between reading comprehension and science achievement (e.g. Cromley, 2009; O'Reilly & McNamara, 2007). O'Reilly and McNamara (2007) reported that reading skill had moderate to high correlations with the science achievement measures. Their study also indicated that students who were both skilled and higher knowledge readers had higher course grades implying that both knowledge and reading skills are important for course grade. A study by Chege (2012) also concluded that reading comprehension is related to academic performance. However, available literatures have been in disparity as to which reading comprehension skill correlates with students' performance in science.

METHOD

Research Design

The present study utilised a correlational research design to investigate the association between the independent variable (reading comprehension skills) and the dependent variable (science performance). The performance level of first year high school students in reading comprehension skills and their science achievement test was described. Moreover, the relationship between the six elements of reading comprehension skills and performance in science of students was established.

Sample and Sampling Technique

The sample size of the study was 666 students which consisted of 337 students from nine (9) public high schools and 329 students from nine (9) private high schools in the Division of Cotabato City. Public high schools were selected using complete enumeration while private high schools were chosen through simple random sampling. Only one first year class of students was taken as sample for every school identified. All the first year students that belonged to every selected class served as respondents. Simple random sampling was used to select the first year class while complete enumeration was employed to select the student-respondents.

Research Instruments

The main research tool used in the study was a test questionnaire (competency-based test instrument) adopted from the test instruments of Imam (2009). It consisted of a 50-item multiple choice test for each of the reading comprehension and science learning areas. The reading comprehension test covered the following skills with corresponding number of items: understanding vocabulary in context (7 items), identifying main ideas (6 items), noting details (11 items), making inference (8 items), predicting outcomes (6 items) and drawing conclusion (12 items). The construction of both achievement tests in reading comprehension and science was based on Restructured Basic Education Curriculum Learning Competencies (RBEC-LC) in reading and science covering the first and second grading periods for first year students. In compliance with the DepEd guidelines and in alignment with Bloom's Taxonomy, a set of Table of Specifications (TOS) for reading comprehension skills test and another set for science test were constructed. Both sets of TOS followed three levels of difficulties in the distribution of items such as 30 items for easy, 15 items for average, and 5 items for difficult (see Appendix A and B).

The test instruments for the two learning areas were subjected to validity and reliability tests. Subject experts validated the instruments using four validation criteria such as (a) conformity with the objectives, (b) clarity and construction, (c) level of difficulty, and (d) relevance and suitability (Lynn, 1986). Test items which failed to meet the above criteria were removed. In this case, the experts rejected four items in Reading Comprehension and two items in Science. The rejected items were then changed; hence, necessary revision of the instruments was made to observe the set criteria for instrument validation.

After the validation test, the instruments were pilot tested for their reliability testing where a total of 30 students (15 from public school and another 15 from private school) participated in and were then excluded in the final administration of tests. The test instruments were administered twice to the same students with one month interval using the test-retest method. Scores of students in the first and second tests were correlated using Pearson product moment coefficient of correlation (r) to test the consistency of scores. The results showed that the scores were significantly correlated: Reading Comprehension Test ($r = .670^{**}$, $p < .05$) and Science Test ($r = .682^{**}$, $p < .05$).

RESULTS AND DISCUSSION

Level of Students' Performance in Reading Comprehension Skills

Level of students' performance in reading comprehension skills are categorised into three levels: mastery (MPS = 75% and above), near mastery (MPS= 50% to 74%), and low mastery (MPS = 49% and below). The Mean Percentage Score (MPS) is computed as: $MPS = \text{Total Raw Score} / \text{Product of } N \text{ and Total Number of Items} \times 100$.

Table 1 shows students' performance in reading comprehension. The students performed at the level of near mastery in two reading skills: getting main idea (51.23) and making inference (51.37); and low mastery in four reading skills: understanding vocabulary in context (48.88), noting details (49.09) predicting outcome (46.42), and drawing conclusion (40.79). The majority of the students (59.0 percent) had low mastery level in reading comprehension skills with a MPS of 47.37 which is equivalent to a failing mark according to the DepEd grading system. This finding revealed that students have low mastery in skills such as vocabulary and noting details which are considered as first level (easiest) reading skill by Callahan and Clark (1988). The overall performance indicated that the students have yet to meet the DepEd national target of 75% MPS in National Achievement Test (NAT).

Table 1. Level of reading comprehension skills of students (N = 666)

	Performance Level in Six Reading Comprehension Skills						Overall
	UVC	GMI	ND	MI	PO	DC	
Mastery	6.8	12.9	11.4	18.8	15.2	4.1	3.2
Near Mastery	42.8	54.5	34.1	44.4	35.9	30.2	37.8
Low Mastery	50.5	32.6	54.5	36.8	48.9	65.8	59.0
MPS	48.88	51.23	49.09	51.37	46.42	40.79	47.37

Note: Mastery – 75% and above MPS; Near Mastery – 50% to 74% MPS; Low Mastery – 49% and below MPS; UVC = Understanding Vocabulary in Context, GMI = Getting Main Idea; ND = Noting Details; MI = Making Inference; PO = Predicting Outcome; DC = Drawing Conclusion; MPS = Mean Percentage Score

In terms of reading performance, former DepEd undersecretary Juan Miguel Luz observed that 71.19% of elementary graduates in the capital (Metro Manila) fell under “frustrated” readers and “instructional” readers which are below the necessary reading level at the end of the elementary grade level. Another crucial aspect to consider in this poor students’ performance is the teacher factor. In this case, one can reflect on the result of the 2003 Self-Assessment Test in English given to all English, Mathematics and Science public secondary school teachers nationwide which demonstrated that only one-fifth (19%) passed with a score of at least 75% correct (Luz, 2007).

Level of Students’ Performance in Science

The poor performance of Filipino students has been well documented (Bernardo, Limjap, Prudente, & Roleda, 2008). Table 2 shows students’ performance level based on their overall generated MPS in the science achievement test. The results showed that 74.6 % of the students obtained low mastery level in Science with MPS = 40.25%. The result is consistent with the 2002 Science NAT result of the first year students where they scored an MPS of 34.65. In 2005–2006 Science NAT, similar low mastery level was obtained by the fourth year male (MPS = 38.06%) and female students (38.13%). This indicates that students’ performance in science is not improving significantly despite all-out support of government and non-government organisations to change the status of Philippine science education. This result is also reflective of the science performance of Filipino students in international competitions (Carido & Bautista, 2000; Tenizo, 2002). This further signifies that reading comprehension of scientific text, scientific literacy, may be one of the critical components for science achievement.

Table 2. Level of students’ performance in Science (N = 666)

Mastery	Near Mastery	Low Mastery	MPS
3.3	22.1	74.6	40.25

Note: Mastery – 75% and above MPS; Near Mastery – 50% to 74% MPS; Low Mastery – 49% and below MPS

Correlation between Reading Comprehension Skills and Students’ Performance in Science

Table 3 provides data on the relationship between and among the elements of reading comprehension skills and students’ performance in Science. As shown in the Table, four out of six reading skills such as understanding vocabulary in context ($r = .105^{**}$, $p < .05$), noting details ($r = .104^{**}$, $p < .05$), making inference ($r = .094^{**}$, $p < .05$), and predicting outcome ($r = .088^{**}$, $p < .05$) are significantly and positively correlated to students’ performance in science. This result supports claim by experts that skills such as inferencing and sequencing are common cognitive processes shared by science and language arts particularly reading comprehension (Kumar & Bristor, 1999). Also, vocabulary development was identified as inherent part of becoming a good reader in science (Ediger, 2009). However, it can be gleaned from the result that these reading skills associated with science do not strongly influence students’ performance in science. Though Armbruster (1992) observed that drawing conclusions is a skill shared by good scientists and readers, the result implies that this skill may be applied differently in reading and science.

Table 3. Correlation coefficient of reading comprehension skills and students’ science performance (N = 666)

Reading comprehension skills	<i>r</i> coefficient	Sig.
Understanding vocabulary in context	.105**	.006
Getting main idea	-.021	.585
Noting details	.104**	.007
Making inference	.094*	.015
Predicating outcome	.088*	.024
Drawing conclusion	.060	.120
Overall <i>r</i> coefficient	.108**	.005

** Correlation is significant at 0.01 level (2-tailed)

* Correlation is significant at 0.05 level (2-tailed)

The overall students’ performance in reading comprehension skills is significantly and positively correlated to their performance in science ($r = .108^{**}$, $p < .05$). Although this finding supports previous researches (e.g.

Imam, 2009) and literatures (e.g. Carnine & Carnine, 2004; Cooper, 2004; Bender et al., 2008) which emphasised the important role of reading skills in science, the weak relationship established by the present study indicates that reading comprehensions skills is not enough to explain the students' performance in science.

CONCLUSION

Students need to develop scientific literacy in order to participate fully as citizens, community members, and in the globalised economy. Scientific literacy dictates that students should have the reading ability to evaluate the print-based information presented to them. Yet the level of performance in reading comprehension skills and performance in science of first year students in both public and private high schools in Cotabato City, Philippines are poor as indicated by their low mastery rating in the two learning areas. Students seemed to be struggling with both the content of science as well as the skills needed to be a proficient reader. With respect to the overall association between elements of reading comprehension skills and performance in science, it establishes a significant positive correlation but such relationship is negligible. As a whole, the poor performance of Filipino students in science which contributed to bad image of Philippine education both local and abroad can be well expounded by other relevant factors outside the scope of six reading comprehension skills. Thus, the government and other concerned agencies can initiate some bold steps towards improving both reading and science achievements of students by considering the following initiatives:

First, the high school students' low performance in science as indicated in the present investigation findings may call for serious policy implications for the Department of Education (DepED) and other education stakeholders. In this case, the DepEd should continuously examine and apply a dynamic and relevant curriculum to address the pressing needs and problems of high schools regarding science education. It should formulate and adopt a long-term and short term work plans as bases of school administrators in their design and execution of school-based plans to reach desired NAT performance level of students in science.

Second, enhancement of the level of performance in reading comprehension skills particularly understanding vocabulary in context, noting details, predicting outcome, and drawing conclusion needs to be done. As much as possible, all elements of reading skills should be developed well in the first year high school students to achieve the DepEd target mastery level of performance. School heads should monitor science teachers on integration or application of reading skills in

teaching and learning processes because acquisition of these skills will generally help effect better learning in science.

Third, to facilitate proper acquisition of skills essential to reading comprehension as well as to ensure application of such skills in science education, teachers should be made aware of the powerful relationship between meaningful science learning and reading comprehension through professional development on pedagogy, reading instruction and science content. Research findings (e.g. Guthrie, Wigfield, & Perencivich, 2004) clearly indicate the positive effect of integrating science with reading comprehension on student outcomes in both science and reading.

Fourth, English and science teachers should strengthen their delivery of instruction and conduct remedial teaching or follow up sessions whenever necessary. Students should be given in-depth instruction in science and reading including opportunities for hands-on activities, writing and discussion of science ideas and concepts as well as directed reading in the content area related to specifically to the science concepts being learned.

Fifth, the high schools should conduct periodic monitoring and assessment of those students with low mastery in reading comprehension and poor achievement in science. In this way, the schools, along with teachers, parents and other external stakeholders, could give appropriate response to remedy the gaps or difficulties that contribute to the students' low or near mastery level of performance in the reading skills and unsatisfactory performance in science.

Lastly, the DepEd with the support of school administrators and funding institutions should commission a separate study to determine strong significant determinants of students' performance in science that would guide DepEd officials, policy makers, school managers and teachers in changing the future of science learning and achievement in the Philippines.

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