

## **Original Research Article**

### **Area Of Specialization and Teaching Performance Among Secondary School Science Teachers in Content Knowledge and Its Application Within and Across Curriculum Areas**

#### **Abstract**

*The K to 12 reform and the new Philippine Professional Standard for Teachers have changed the landscape of teacher quality requirements in the Philippines. It is in this context that this study is deemed necessary to determine the area of specialization and the teaching performance of the public secondary school Science teachers in terms of science content knowledge with this new educational scheme. There were 46 respondents in this study from the Department of Education-Guihulngan City Division, Negros Oriental Philippines. Findings reveal that the science teachers' area of specialization can be categorized as Bachelor of Secondary Education (BSED) major in General Science, BS in Scientific Field (Nursing, Biology, and Chemical Engineering) and the Non-Science Field (English, TLE, Social Science). It indicates that majority of them lack the needed educational qualification to teach all science disciplines in the K12 curriculum. Furthermore, it shows that the BSED-General Science teachers with outstanding rating perform better than the B.S. in Scientific Field group and the non-science teachers with very good and good performance ratings respectively. It is an indication of lack of science content knowledge among the non-science teachers. Furthermore, the result discloses that the area of specialization is a determining factor in their teaching performance. It revealed that among the three groups of respondents, the general science teachers appear to be the most efficient. They are followed by those in the B.S. in Scientific field, and the non-science teachers came out to be the lowest. Hence, it clearly suggests that the BSED-General Science teachers are the most qualified to teach science since they have the sufficient educational preparations. The B.S.in Scientific Field teachers need to undergo more training and enroll in graduate studies to master all the science areas in the K12 curriculum. While the non-science teachers are discouraged to handle science subjects since they lack the necessary educational preparation to teach science.*

*Keywords: area of specialization, teaching performance, content knowledge, science teachers*

#### **INTRODUCTION**

In the Philippines, the new science program of the K to 12 reform policy now has many innovations. One of which is the decongestion of the competencies and arrangement in spiral progression manner. In the old curriculum, a specific discipline is being offered per grade level. First year will take up general science, the second year will deal with biology, the third year will study chemistry, and the seniors will master

physics. But in the new science program, the different disciplines in science have been incorporated in every level (Montebon, 2014).

Hence, the spiral progression approach was recognized to be difficult not only to students but also to science teachers (National Academy of Science and Technology, 2016). Recent studies show that science teachers were still adapting to the new curriculum, they needed more time and trainings to master all the fields and to learn new teaching strategies because it is difficult to teach something, in which one does not have the necessary mastery. They can't teach other branches of science without the in-depth discussion because it is not their specialization (Resurrection & Adanza, 2015).

Another challenge in the implementation of the K-12 program is the shortage of science teachers to handle the k12 science subjects in the country (Ambag,2018).To solve this problem, the K-to-12 law or Republic Act 10533 allows new graduates or new hires to teach in elementary and secondary education in subjects where there is a shortage of qualified teachers provided that they pass the Licensure Examination for Teachers within five years or they will teach on part-time basis (Uy,2016) Consequently, the Department of Education (DepEd) opened its doors to hire professionals from other fields to address the challenge of filling more than 30,000 teaching vacancies for senior high school (SHS) in 2017.

The changes brought about by the K to 12 reform policy and the changing character of the 21st century propelled the adoption of the Philippine Professional Standards for Teachers (PPST) in 2017 to further improve teacher quality in the country (Mateo,2018).The PPST outlines the required skills and competencies that Filipino teachers much have to enable them to cope with the emerging global frameworks (PTV News, 2018).

Moreover, the PPST describes the breadth of 7 Domains that are required by teachers to become effective educators in the 21st century such as content knowledge and pedagogy, learning environment, diversity of learners, curriculum and pedagogy, assessment and reporting, community linkages and professional engagement, and personal growth and professional development (Department of Education, 2018).

However, this present study focuses on the science teacher's teaching performance in terms of content knowledge and its application within and across curriculum areas under the first domain of PPST which is the content knowledge and pedagogy.

Content knowledge is defined as the disciplinary conceptual knowledge of the teacher. Good subject knowledge involves understanding the substance, content, structure and organization of the science subject itself. (SEI-DOST & UP NISMED. 2011).This is an important characteristic for quality teachers having good subject matter knowledge (Ingressol as cited in Papanastasiou, 1999). Consequently, when teachers have a good subject matter knowledge, then they are able to help students understand the core ideas of various topics, create useful cognitive maps, as well as enable the students to connect each topic with everyday life examples and facts (Darling-Hammond, 1999)

Further, Fennena and Franke (2006) opined that the perception of teachers for effective teaching of any subject depends to a large extent on the teachers' understanding of the nature of the subject matter and that perception of proper teaching is a consequence of a teacher being able to pass-on the content of the subject matter.

Further, Ifiok (2005) also opined that a lack of required background and orientation relevant to curriculum, on the part of the teacher, leads to poor attitudes towards the implementation of a new curriculum, on matter how expertly the pages of the curriculum were designed and put together.

To acquire high level of content knowledge in science is to possess the necessary educational qualification and area of specialization. It is common knowledge that a teacher cannot give what he does not have. Some works like those of Emeh and Eukoha (as cited in Emmanue & Ambe, 2014) provided theoretical support for the importance of area of specialization and teachers effectiveness. In the Philippines, a teacher must be a Bachelor of Science in Secondary Education (BSED) major in General Science to be able to teach all the science areas in the K-12 Science curriculum. However, due to shortage of teachers, graduates from other fields such as Nursing and Pharmacy were hired to teach science subjects.

It is in this context that this study is undertaken to determine how equipped the teachers hurdle the challenges imposed by the new educational scheme. Braskamp and Brandenburg (1984) indicated that teachers are in the best position to judge what and how they teach. In this study, the science teachers are the primary sources of data.

Further, this study determines the area of specialization of the science teachers and their teaching performance in terms of content knowledge and its application within and across curriculum areas. It also aims to identify which groups of science teachers based on their area of specialization perform better in their teaching performance. The results of this study can be used as basis in the adoption of new recruitment policy for science teachers in the Philippines.

## **METHODOLOGY**

This study utilized the descriptive correlational design. The respondents of this study were the entire public secondary school science teachers in the Division of Guihulngan City, Negros Oriental. They were grouped based on their area of specialization as BSED-General Science group, BS in Scientific Field group, and the non-science group. There were 46 respondents of this study.

A researcher-made questionnaire was used as the data gathering tool. It was subjected to validity and reliability testing. The research instrument is formulated based on the Philippine Professional Standard for Teachers Modules by the Department of Education –Teacher Education Council, Results-Based Performance Management System Manual (RPMS) by the Department of Education, and the Proficient Teacher Report Document by New South Wales Education Standard Authority. The data collected were analyzed using frequency, Percentage, Weighted Mean, and Chi-Square test of independence.

## **RESULTS ND DISCUSSION**

Table 1 on the next page shows the distribution of respondents in terms of area of specialization

**Table 1 Distribution of respondents in terms of area of specialization (N=46)**

Area of Specialization	Frequency	Percentage
<b>BSED-General Science</b>	21	45.65
<b>BS in Scientific Field</b>		
BS Nursing	17	36.97
BS Biology	1	2.17
BS Chemical Engineering	1	2.17
BS Pharmacy	1	2.17
Total	20	43.48
<b>Non-Science Major</b>		
BSED TLE	3	6.53
BSED-Social Science	1	2.17
BSED English	1	2.17
Total	5	10.87
<b>Grand Total</b>	46	100

The table above manifests that a good number of the respondents (45.65%) holding Bachelor of Secondary Education major in General Science possess the needed educational qualification for a science teacher who can teach all curriculum areas in science. This is beneficial not only to the school and the teachers concerned, but more especially to the students who are the recipients of the teachers' expertise. It should also be noted that a sheer number of them (43.48%) are holders of Bachelor of Science in various Scientific Fields such as Nursing, Pharmacy, Biology, and Chemical Engineering. In other words, they are specialists in their respective fields of endeavor. Although they have both extensive and intensive knowledge in their respective areas, however, this is also a downside in the sense that this limits them in teaching other subjects in the science curriculum considering the spiral approach implemented by DepEd. Moreover, a small percentage (11%) of the science teachers are non-science degree holders whose specializations are English, Social Science, and TLE. In other words, there is mismatch between the expertise held by these teachers and the curriculum that they are made to teach. This also defeats the purpose of having additional two years in the basic education which is primarily to make our graduates at par with the graduates in other schools across the globe in the same level of education.

Table 2 Content Knowledge and Its Application Within and in Across Curriculum Areas (N=46)

Teaching Competencies	B.S. in Scientific Field		Non-Science		BSED-General Science		Overall	
	WX	VD	WX	VD	WX	VD	WX	VD
1.Engages students through substantive, meaningful and connected activities to deepen their understanding of content knowledge	4.24	O	3.40	VG	4.43	O	4.02	VG
2. Shows the connection and coherence between information acquired by students and their daily life applications.	4.19	VG	3.40	VG	4.29	O	3.96	VG
3.Traces and uses examples to show how science ideas evolved and change over time to ensure that students understand that science is dynamic	4.24	O	3.00	G	4.33	O	3.86	VG
4. Demonstrates links across science disciplines and with other subject areas.	3.95	VG	3.20	G	4.33	O	3.83	VG
5.Uses varied viewpoints, explanations, theories, ways of knowing, and methods of inquiry in teaching science concepts;	3.76	VG	3.20	G	4.43	O	3.80	VG
6.Articulates science content clearly and avoids incorrect content, inappropriate content, and misinformation	3.76	VG	3.20	G	4.19	VG	3.72	VG
7.Develops and delivers logical lesson sequences that reflect curriculum requirements and are constructed to develop understanding of content	3.81	VG	3.00	G	4.24	O	3.68	VG
8. Answers accurately content based questions from students	3.71	VG	3.00	G	4.23	O	3.65	VG
9. Identifies and addresses science misconceptions of students and in textbooks	3.81	VG	2.80	G	4.29	O	3.63	VG
<b>Aggregate</b>	<b>3.94</b>	<b>VG</b>	<b>3.13</b>	<b>G</b>	<b>4.33</b>	<b>O</b>	<b>3.80</b>	<b>VG</b>

*Legend: VD=Verbal Description WX = Weighted Mean: 1.00-1.79=Poor (P); 1.80-2.59=Fair (F); 2.60-3.39= Good (G); 3.40-4.19=Very Good (VG); 4.20-5.00=Outstanding (O)*

In terms of content knowledge and its application within and across curriculum areas, the respondents have manifested a very good teaching performance. This is shown in the over-all aggregate mean in table 2 which is 3.80. Further, it shows that the BSED- General Science group exhibited an outstanding teaching performance and the B.S. in Scientific Field group demonstrated a very good teaching performance. While the non-science teachers got only a good rating which is an indication of lack of expertise in this area as it is only at midpoint in the five point scale used in the research instrument.

**Table 3 Relationship Between Area of Specialization and Teaching Performance of the Respondents (N=46)**

Variables	Coefficient of Correlation	df	Tabular Value	Remarks
Area of Specialization and Content Knowledge and Its Application Within and in Across Curriculum Areas	$\chi^2 = 47.7$	4	9.49	Related

Legend:  $\chi^2$  =Chi Square df=degrees of freedom

Another variable which has been explored and associated with teaching performance was the area of specialization. On the entirety, the two variables are associated considering that the computed chi square value is higher than its corresponding tabular value. Concretely, area of specialization has established an association with content knowledge and its application within and across curriculum areas, research based knowledge and principles of teaching and learning, strategies that promote literacy and numeracy skills and strategies that develop critical and creative thinking skills. Scrutinizing the distribution on respondents in the context of area of specialization and teaching performance, the contingency table revealed a consistent information that among the three groups of teacher respondents, the general science teachers appear to be the most efficient. They are followed by those in the specific field the non-science teachers which came out to be the lowest.

This is a point of concern for all the stakeholders. Although the non-science teachers comprise the least number among the respondents, however, considering the number of students each teacher handles every school year and multiplying it with the number of years that these teachers will still be in active service, the outcome will not be negligible. This conveys the notion that in-service training is indispensable to help both the specific field and non-science teachers get out of the vicious condition of inadequacy of knowledge and skills which at the end boils down to short changing the clientele in entire educational system – the students. This also gives a heads up on the DepEd personnel in charge in the hiring of teachers. In selecting among the applicants, alignment of their expertise with the subjects they are going to teach should not be taken lightly. In agreement with the current finding is of Ezeudu & Utazi (2014) whose result indicates that area of specialization influences the teachers' level of competence in teaching in the secondary schools. The foregoing discussion points to the rejection of the null hypothesis.

### Conclusion

The area of specialization of majority of the science teachers is not General Science but in the related scientific fields such as Nursing and Pharmacy, and some are non-science fields such as English and Social Science. It suggests that most science teachers lack the necessary educational qualifications to teach all science subjects in the K12 curriculum. Further, the BSED- General Science group exhibited an outstanding teaching performance and the B.S. in Scientific Field group demonstrated a

very good teaching performance. While the non-science teachers got only a good rating which is an indication of lack of science content knowledge. Concretely, the area of specialization has established an association with teaching performance of respondents in terms of content knowledge and its application within and across curriculum areas. Scrutinizing the distribution on respondents in the context of area of specialization and teaching performance, the contingency table revealed a consistent information that among the three groups of teacher respondents, the general science teachers appear to be the most efficient. They are followed by those in the specific field the non-science teachers which came out to be the lowest.

## Recommendation

Science teachers whose area of specialization is not General Science but in the scientific field such as Nursing and Pharmacy may attend seminars and workshops pertinent to science teaching for them to enhance their science content knowledge. They can also enroll in graduate studies so that they can address the students' science misconceptions appropriately. Further, the assignment of science subjects to non-science teachers should be discouraged for they lack the science content knowledge. If possible, they should not be allowed to teach science due to their inefficiencies.

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