TEAM TEACHING: AN EFFECTIVE APPROACH IN THE JUNIOR HIGH SCHOOL

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Abstract

This quasi-experimental ex-post facto study aimed to find out the effects of Content Specialist Team Teaching and General Teaching Approaches in Science in the K to 12 Curriculum. It seeks to compare how their performance in selected Grade 10 Science topics were affected by utilizing these approaches. Classes taught using Content Specialist Team Teaching Approach obtained a significantly higher mean score than those taught using General Teaching Approach. This proves that the Content Specialist Team Teaching Approach created a positive impact on students’ understanding and mastery of the subject content. The findings further confirmed that specialization teaching matters as far as academic achievement in Science is concerned. Junior high schools may explore the possibility of implementing the content specialist teaching of Science and encourage capacity building among teachers to equip them with up-to-date knowledge and skills, as well as enhance their confidence in imparting knowledge to their students.

Keywords: Science Education, Spiral Progression, Quasi-Experimental Expost Facto, Central Philippines
INTRODUCTION

The primary key to a nation’s growth and development is a well-educated, technologically-skilled and scientifically-inclined professional. Hence, the role of science education is very crucial for the world of work as well as in determining a country’s economic future, in a global economy (Akram Ch, Faheem, Dost, & Abdullah, 2011; Angara, 2008; Baker & Keller, 2010; International Council for Science Union, 2011; Kumar & Parveen, 2013; National Education For All, 2014; UNESCO, 2010; Wheelock College Aspire Institute, 2010). And so, the challenge of making connections between globalization and science education was explored.

In the United States, more than 50% of economic growth are derived directly from technological innovations, which are the results of fundamental research in science (DiChristina, 2014). Thus, building a scientifically literate populace is the primary goal of every nation worldwide (DepEd Order No.31 s., 2012; Gregorio, 2011; International Council for Science Union, 2011; Science and Technology Educators, 2007; Teaching and Learning Research Programme, 2006).

Numerous studies conducted about trends of Science Education reveal that many nations are facing challenges with poor student performance, lack of basic Science Specialists, pedagogy, and instructional facilities as some of the problems identified (Atagi, 2011; DepEd, 2012; Gregorio, 2011; International Council for Science Union, 2011; Jalmasco, 2014; Masters, 2012; Osborne & Dillon, 2008; Scantlebury, 2008; Teaching and Learning Research Programme, 2006; Vallely, T.J., Wilkinson, 2008).

The 2011 Trends in International Mathematics and Science Study (TIMSS) results of students’ performances in Mathematics and Science brought disappointments to some developed countries like Australia, which stagnated over the past sixteen (16) years (Masters, 2012). Also in the United States,
students tend to perform worse as they aged (Carnoy & Rothstein, 2013). The result is even more depressing for those developing countries, including the Philippines, where the performance of Filipino students, in the international standardized exams in Math and Science is among the lowest in the world (DelaCruz, 2012; DepEd, 2012). In TIMSS 1999, the Philippines ranked 36th in Second Year High School Science out of 38 countries. In 2003, the country yielded a similar upsetting result in the same study, ranked 23rd in Grade 4 Science, among 25 countries, and at the high school level, ranked 42nd in 2nd year Science, among 45 countries (National Center for Education Statistics, 2003).

Also, the National Achievement Test (NAT) results showed that Science, among other subject areas, had the lowest Mean Percentage Score (MPS) which is far below the standard target of seventy-five percent (75%) MPS. It means many Filipino students, who graduated from high school, did not achieve mastery of essential learning competencies (DepEd, 2012; NETRC, 2012). The similar disappointing result was obtained by Fourth Year High School Students, in the entire Division of Bacolod City, for the last three (3) years; from the year 2013 to 2015 (Bureau of Educational Assessment, 2015). The NAT MPS result for Science, within the Division of Bacolod City, suggests for more improvements to be made by the Department of Education or government officials to attain educational quality, despite the average annual increase of 4.4 percentage points.

To further the reform thrusts within the Basic Education Sector Reform Agenda, the K to 12 Basic Education Program was launched in 2012, with the curriculum now fully implemented (DepEd, 2012). Science in the K to 12 Curriculum is taught in Spiral Progression, where concepts and skills in Life Sciences, Physics, Chemistry, as well as Earth and Space are integrated in all grade levels, with increasing levels of complexity. The integration of all science disciplines, in each grade level, will lead to a meaningful understanding of concepts and its applications to real-life situations (DepEd Order No. 31 s., 2012).
With this new curriculum in Science, teachers have the predicament of teaching Science disciplines outside their field of specialization or expertise. This apparent dilemma, faced by Science teachers, due to the students’ low achievement in Science, during the National Achievement Test, pushed the researcher to endeavor in improving the delivery of instruction, by implementing the Content Specialist Team Teaching Approach in Science Education.

A content specialist team teaching is an instructional approach in which teachers teach in their area of expertise. In this method, students have more than one teacher for the four (4) learning areas of Science; each teacher is responsible for a particular content area. A General Teaching Approach is an instructional approach, where a single teacher is responsible for all four (4) learning areas of Science for a particular group of students for the entire school year.

The expertise may be attained by the Specialist Science Teachers through college preparation, Post-Graduate Studies, training attended on the subject content and length of experience in teaching the subject. Teachers with longer years of teaching experience possess the needed competencies in teaching the subject (Ezeudu & Utazi, 2014; National Research Council, 2000) which confirm the studies of Rockoff (2004) and Yara and Catherine (2011) which revealed that teaching experience has positive effects and can be used to predict students’ performance in Mathematics.

**Objective**

To find out the effect of Content Specialist Team Teaching, and General Teaching Approaches in Science in the K to 12 Curriculum by measuring the level of academic achievement of Grade 10 Students and determine whether a significant difference in the achievements between the two groups occur.
Framework

Shulman’s (1987) scholarly works about Knowledge and Teaching, which is a foundation for new reform, focuses on the idea of instruction and emphasizes comprehension as well as reasoning, transformation, and reflection. The articulating link of these two components: Knowledge and Teaching, in understanding how a particular feature of subject matter organized, adapted and represented for instruction referred to Pedagogical Content Knowledge (PCK) the content knowledge that deals with the teaching process (Loughran, Mulhall, & Berry, 2004; Shulman, 1986).

He further considered subject matter knowledge as a fundamental part of the knowledge base for teaching and teachers are the prime sources of learners’ understanding of such knowledge and suggests that good teachers should have deeper ways to understanding the content.

PCK for Shulman (1986) provided one path for defining the nature of PCK and what it means when exemplified through effective teachers. Teachers with PCK have “an understanding of what makes the learning of specific topics easy or difficult” and have developed “ways of representing and formulating the subject that it comprehensible to others”. Builds on other forms of professional knowledge, therefore, a critical—and perhaps even the paramount— and is a constitutive element in the knowledge base of teaching (Carlson, Newsome, Gardner, & Taylor, 2013; Hill, H.C., Rowan, B., Ball, 2001; Shulman, 1986, Hill, H.C., Rowan, B., Ball, 2001; Shulman, 1986).

The framework aligns with the synthesis of cognitive research: deep learning is hierarchical, connected, and organized for easy retrieval. Experts monitor their level of understanding when learning and applying knowledge; and the transfer of knowledge from one application to another demonstrates a thorough understanding and acknowledges the situated nature of learning. With this, the researcher hoped to relate teacher
knowledge and practices more clearly to student learning (Bransford, Brown, & Cocking, 2000).

Pedagogical Content Knowledge (PCK) consists of three internal constructs namely Content Knowledge (labeled PCK-CK), Pedagogical Knowledge (PCK-PK), and Contextual Knowledge (PCK-CxK). The Content knowledge includes accuracy of subject matter content, connections within and between topics and the nature of science and use of multiple modes of representation of a subject. The pedagogical knowledge (PCK-PK) includes a rational linking of teaching strategies to student learning, eliciting prior understandings and promoting examination of their thinking. The contextual knowledge (PCK-CxK) includes understanding how student variations such as previous student conceptions, impact instructional decisions. Among the three components of PCK mentioned, confirmatory factor analysis revealed that the PCK-CK component is highly distinct followed by PCK-PK component (Gess-Newsome, J. Carlson, J., Gardner, A., & Taylor, 2010).

Nevertheless, it is a cornerstone of teachers’ professional knowledge and expertise (Carlson et al., 2013; Gess-Newsome, J. Carlson, J., Gardner, A., & Taylor, 2010; Loughran, Berry, & Mulhall, 2012). Both elements - knowledge and practice - are essential (Mishra & Koehler, 2006; Quinn, Schweingruber, & Keller, 2012).

Content knowledge means the “what” of teaching or the amount and organization of knowledge per se in the mind of teachers. Pedagogical knowledge, on the other hand, means the “how” of teaching or the ability to teach, usually acquired through education coursework and personal experiences (Park & Oliver, 2008; Rowan, Miller, Schilling, & Ball, 2001; Shulman, 1986). Moreover, the knowledge of subject matter is central to the core tasks of teaching (Rollnick & Mavhunga, 2016).

Loughran et al. (2012) pointed out that the development of teaching approaches that respond to in-depth knowledge of the content is something that is built up and developed over time. When teaching outside one’s area of subject expertise, the
distinction may begin to stand out more readily because PCK cannot simply be “imported” from one subject area to another.

Teachers should give the most appropriate tools including content knowledge and skills as well as teaching methodology to be able to do their work professionally (Kumar & Parveen, 2013). According to Adeyemi (2016) and Adu & Abe (2013), the quality of education directly relates to the quality of instruction in the classrooms, and the availability of competent teachers is central in the reconstruction of the educational system.

Essential for effective Science and Mathematics education, the teachers must have a firm grasp of the important ideas in the discipline to help students learn the subject content (Banilower, Smith, Weiss, Malzahn, Campbell, & Weis, 2013; Kamamia, Ngugi, & Thinguri, 2014; SEI-DOST & UP NISMED, 2011; Brunkhorst & Lewis, 2001; Kirchhoff & Taylor, 2010).

Numerous studies revealed that teachers with the stronger content knowledge in a given subject were more likely to ask higher level cognitively-based questions, evaluate their students’ understanding better, propose more investigations, make curricular decisions and pursue unanticipated inquiries, compared with weaker content knowledge (Math-Science Partnerships, 2010; National Research Council, 2000; Quinn et al., 2012). The teachers’ full understanding of topics frequently translates into effective teaching where teachers are able to explain the central concepts better and clarifies misconceptions, which result in a positive impact on students’ learning (Jadama, 2014; Kamamia et al., 2014; Mosabala, 2014). Further, accuracy of one’s content knowledge is crucial (Mosabala, 2014).

Advocates of educational reforms around the world aimed at providing content-focused Professional Development (PD) intended to improve teachers’ content knowledge. The improvements based on the evidence from the educational production function research where results suggest that teacher’s intellectual resources significantly affect student learning (Hill, Rowan & Ball, 2001). The enhanced teacher content knowledge,
expertise, and motivation will improve classroom teaching, thus, raise student achievement (Yoon, Duncan, Lee, & Shapley, 2008; Olson, 2009).

Ardzejewska, Mcmaugh, and Coutts (2010) highlighted that primary teachers, which are generalists, can provide instruction in all key subject areas. Several studies have revealed that majority of the primary level teachers are not comfortable with generalized teaching. In fact, most teachers would rather want to specialize in the subject they majored (Ojo, Kintomide, & Ehindero, 2012).

Teachers’ subject-specific is the important factor in determining student achievement (Scantlebury, 2008; Goldhaber & Brewer, 1996). However, when teachers were teaching outside of their specialization, these teachers followed textbook chapters more carefully and encountered problems to recognize or address student misconceptions (Babayemi, 2014; Ogunsolo-Bandele, 1999).

An OFSTED (2011) survey established that the less secure teachers were about the lessons which require substantial subject matter knowledge the more they were unable to provide students with opportunities for deep learning. The survey also supports the findings of the previous three-year report that the more improved specialist match of teachers to the curriculum, the higher the achievement of students.

United Nations Education, Scientific, and Cultural Organization (UNESCO) carried out steps to equip teachers with content knowledge and pedagogy for the subjects they taught, through systematic training, to help students learn (UNESCO, 2014).

The European Commission (2013; 2007) pointed out that the teachers’ teaching competence has substantial effects on student achievement. Effective teaching practices required appropriate subject knowledge to fill gaps in understanding and avoid debate with and among young learners about areas of the
curriculum because they did not feel confident in their grasp of a subject area (Gibson, Toole, Dennison, & Oliver, 2013).

Jadama (2014) mentioned that teaching involves the imparting of knowledge, skills, and attitude to an individual. Teachers will find extreme difficulty in answering various questions from students about a subject matter if they have little knowledge about the content.

The issue of teaching out-of-field in secondary schools as one of the contributors that affect academic performance needs to be addressed. According to Masters (2012), a strong subject knowledge, as well as knowledge about how to teach the subjects, is essential to teachers’ ability to address learning difficulties and to challenge and extend higher-achieving students.

Consequently, the ability of teachers was directly linked to students’ interest and achievement in Science (Abe, 2014; Ballard & Bates, 2008; Brunkhorst & Lewis, 2001; National Education For All, 2014; Pascual, 2014; SEI-DOST & UP NISMED, 2011; Tella, 2008; WCEFA, 1990). (Masters, 2012)

Improvement in the training, on both content and pedagogy, conducted to K to 12 Science Teachers is essential to respond to the national priority of enhanced Science Education for K to 12 students that will lead to greater student achievement (Gess-Newsome, Carlson, Gardner & Taylor, 2010; Kirchhoff & Taylor, 2010). Likewise, the use of the appropriate method is central and vital to the successful teaching and learning of Physics (Jacob Kola, 2013).

In Science and Technology (STE) programs where Science, under the K to 12 Curriculum, is taught in Spiral Progression Approach Integrating Life Sciences, Physics, Chemistry, as well as Earth and Space with increased complexity, both content knowledge and pedagogical are essential among teachers.
METHODOLOGY

This quasi-experimental ex-post facto research assigned subjects as the independent variable, based on events or qualities that happened in the past (Lammers & Badia, 2005). Two (2) groups of samples, which are the Grade 10 students from the two (2) STE Program implementing schools in the Division of Bacolod City were purposively (Calmorin & Calmorin, 1995; Davis, Scott, & Randow, 2007) selected following these considerations: (1) both are public junior high schools offering STE Program of the Department of Education (DepEd); (2) students undergo strict screening processes; (3) schools practice different approaches in teaching Science where School A uses Content-Specialist Team Teaching Approach, while School B observes General Teaching Approach in teaching Science. All students (38) from school A were able to take the test while three (3) students from school B (with 27 students enrolled) were absent during the conduct of the test.

The researcher utilized a valid (CVR = 0.99) and reliable (KR 21 = 0.75) teacher–made test to obtain the academic achievement of Grade 10 students in Science. The 60-item multiple choice test questions covered all the learning competencies namely, Earth and Space; Force, Motion and Energy; Living Things and Their Environment; and Matter.

Necessary permits were obtained from the principals and department heads prior to the conduct of the study. The process was thoroughly explained to the two groups of subjects and ethical procedures were properly observed.

Mean and standard deviation were used to establish the level of academic achievement and t-test for independent means was utilized for testing the significant differences (Vizcarra & Lubina, 2012).
RESULTS AND DISCUSSION

The level of academic achievement of Grade 10 students in Science in the K to 12 Curriculum, in School A and School B, is “High” ($\bar{x}$ = 47.47, sd = 4.75); and “High” ($\bar{x}$ = 39.46, sd = 5.12) respectively. Between the two (2) STE Program implementing schools, the higher mean score was obtained in School A, which uses the Content-Specialist Team Teaching Approach.

Table 1. Level of Academic Achievement of Grade 10 Students in Science in K to 12 Curriculum Using the Content-Specialist Team Teaching and General Teaching Approach (n = 62)

<table>
<thead>
<tr>
<th>Category</th>
<th>Teaching Approaches</th>
<th>n</th>
<th>$\bar{x}$</th>
<th>sd</th>
<th>Verbal Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>School A</td>
<td>Content-Specialist Team Teaching</td>
<td>38</td>
<td>47.47</td>
<td>4.75</td>
<td>High</td>
</tr>
<tr>
<td>School B</td>
<td>General Teaching</td>
<td>24</td>
<td>39.46</td>
<td>5.12</td>
<td>High</td>
</tr>
</tbody>
</table>

Results imply that the Grade 10 students in School A, which uses Content-Specialist Team Teaching Approach, performed better, gained a better understanding and obtained higher mastery level of the subject content in Science compared to Grade 10 Students in School B which utilized General Teaching Approach.

Classes supervised by content-specialist teachers performed better in specific content areas and teacher subject-specific knowledge, in Science, had a significant impact on student test scores than the general science teacher (Reid, 2012; Goldhaber & Brewer, 1996). In consequence, students obtained poor mastery level in the subject matter outside the expertise of the generalist teacher, thus, decreasing the students’ academic achievement.

Also, the result of this study affirms previous findings by Bonney et al. (2015) and Scantlebury (2008) that teachers who
are highly knowledgeable in the subject matter content they taught the higher will be the pupils’ performance. Similarly, this study substantiates previously cited researches, that quality of teaching provided by quality Science Teachers for their students is directly linked to students’ interest and achievement in Science (Abe, 2014; Ballard & Bates, 2008; Brunkhorst & Lewis, 2001; Goldhaber & Brewer, 1996; National Education For All, 2014; SEI-DOST & UP NISMED, 2011; WCEFA, 1990).

Moreover, this finding confirms the study by Jadama (2014) that teacher’s subject matter knowledge has a positive impact on teaching and learning process in schools, which consequently affects students’ understanding of the subject content. On a similar study conducted, that teachers’ Science content knowledge made a difference in their professional practice and their students’ achievement (Math-Science Partnerships, 2010).

Teachers’ knowledge, as one of the key qualification, of the subject being taught, have consistently shown to produce substantial positive effects on student learning (Goe, 2007; Goe, Ph, & Stickler, 2008; Tella, 2008). Furthermore, teachers with more significant content knowledge produce better student achievement compared with less competent teachers.

Table 2. Comparative Analysis in the Level of Academic Achievement between Content Specialist Team Teaching Approach and General Teaching Approach

<table>
<thead>
<tr>
<th>School</th>
<th>Teaching Approach</th>
<th>$x$</th>
<th>sd</th>
<th>$p$-value</th>
<th>Significance @ $\alpha = 0.05$</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>School A</td>
<td>Content Specialist Team Teaching</td>
<td>47.37</td>
<td>4.75</td>
<td>0.000</td>
<td>Significant</td>
<td>Reject the Null Hypothesis</td>
</tr>
<tr>
<td>School B</td>
<td>General Teaching</td>
<td>39.46</td>
<td>5.12</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A significant difference in the academic achievement of Grade 10 Students in Science in the K to 12 Curriculum exists
when using either the Content Specialist Team Teaching Approach or General Teaching Approach. Hence, rejects the statement of the hypothesis that there is no significant difference in the academic achievement of Grade 10 Students in Science in the K to 12 Curriculum when either the Content-Specialist Team Teaching Approach or General Teaching Approach used. This result shows how Content-Specialist Team Teaching Approach directly and positively affects the teaching and learning process in the classroom.

This finding goes along with the studies of Wolabi and Adedayo (2012) and Bonney et al. (2015) that there is a relationship between teachers’ knowledge in the subject matter content and pupils’ performance. The more knowledge the teachers have in the subject matter content the higher is the pupils’ performance, and consistently a strong predictor of student performance (Abe, 2014; Darling-hammond, 2000; Sadoulet, Lai, & De Janvry, 2009). However, it contradicts the findings of the study of Musau and Abere (2015) where teacher qualification and experience did not significantly influence students’ academic performance in Science, Mathematics, and Technology subjects.

Teachers’ proficiency and performance are major determinants of student achievement in school (Bietenbeck, 2015; Howard, 1969; National Education For All, 2014; Villaverde, 2014; Yusuf and Dada, 2016).

Correspondingly, various studies concluded that teachers with greater content knowledge in a given subject resulted in a positive impact on students’ learning (Jadama, 2014; Kamamia et al., 2014; Mosabala, 2014; National Research Council, 2000; Yoon et al., 2008; Ashley, 2005).

The finding of this study concurs with the results of the investigations conducted that teachers’ content knowledge and practice is an important factor which lead to greater student achievement (Goldhaber & Brewer, 1996; Scantleburry, 2008; Carlson, Gardner & Taylor, 2010). The result also supports the
claim of Ashley (2005) that the teaching of the lesson by content specialists was even stronger than the instruction of the main lesson by generalists and good teachers’ content knowledge translate into effective teaching strategies (Math-Science Partnerships, 2010; Mosabala, 2014). (Bonney, Amoah, Micah, Ahiamenyo, & Lemaire, 2015). Also, the coursework in specific academic content a teacher is assigned to teach can promote teacher quality and student achievement in some subjects and grade levels (Hightower, Lloyd, & Swanson, 2011). In science, a constantly developing domain, science teachers with advanced education in their field of teaching may be at a greater advantage (Zuzovsky & Aviv, 2005).

This study also affirms the various related studies, concerning the direct impact of teacher content knowledge on the learning process and academic achievement of students (Adeyemi, 2016; Ballard & Bates, 2008). Likely, content specialist team teaching had positive academic and social results when the two teachers involved professionally attuned to making it work to benefit the needs of the students involved (Reid, 2012). Monk (1994) concluded that teachers’ content preparation, measured by coursework in the subject field highly correlated to student achievement in Math and Science.

Majority of educators agree with the fact that holding teachers accountable is imperative for students’ learning to take place and the presence of subject matter specialist teachers will result in better learning outcomes. Adeyemi’s (2016) study confirmed that knowledge of the subject is directly proportional to the students’ academic achievement scores and the availability of qualified teachers will result in better learning outcomes. Various studies previously conducted claimed that teachers who hold a degree in the subject areas they teach, especially in Math and Science, positively impact student performance in those areas (Meroni, Vera-Toscano, & Costa, 2015). Furthermore, several studies indicated that teacher completion of an undergraduate or graduate major in Mathematics, in particular, is associated with higher student achievement in high school and middle school. A
similar trend is observed in Science (Aaronson et al., 2007; Frome, Lasater, & Cooney, 2005; Monk, 1994).

If content specialist teachers can be grouped into a team to better facilitate the teaching of Science in the K to 12 Curriculum we would be able to materialize further the objectives set forth by the Department of Education, with regards to the Enhanced Basic Education Act of 2013. The Act intends to inject and develop its curriculum for its student to get used to 21st Century changes nationwide and across the globe. The Department of Education believes that these competencies are necessary for creating more able and productive members of society. Competent teachers, who are laboring under an appropriate teaching method, can result in incompetent students, who are not prepared to face the challenges of the future.

Lastly, the precise identification of the differences, in the particular test results, between Grade 10 Students, who were under the Content-Specialist Team Teaching Approach and those, who were under the General Teaching Approach, showed how both approaches affected the performances of both groups of students, respectively. This clear identification of the significant difference can be the basis to support the objectives of the K to 12 Program, regarding enhancing and fortifying the “learning and innovation skills” of students, with regards to Science (DepEd, 2012).

**CONCLUSIONS**

Academic achievement is the outcome of education and a determinant of success or failure of students to acquire knowledge. Relevant to this, the following conclusions are drawn based on the findings of this study:

School A Grade 10 students, who were under the Content-Specialist Team Teaching Approach, achieved higher academic achievement than in School B Grade 10 students, who were under the General Teaching Approach. The empirical evidence in
this study concludes that Content-Specialist Team Teaching Approach is better than the General Teaching Approach.

The academic achievement between Grade 10 Students from two (2) different STE Program implementing schools differed significantly when either the Content-Specialist Team Teaching Approach or General Teaching Approach used. This finding revealed that Content-Specialist Team Teaching Approach did greater effect on the teaching and learning process, which turned out to students’ high academic achievement than the General Teaching Approach. Also, this finding proved that the Content-Specialist Team Teaching Approach created a positive impact on students’ understanding and mastery of subject content, consequently showed a definite improvement in their academic achievement than the General Teaching Approach. This finding further confirmed that specialization teaching matter as far as academic achievement in Science is concerned.

The results of this study disclosed that Content-Specialist Team Teaching Approach is a better approach in Science instruction in the K to 12 Curriculum, which merits a good recommendation.

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