

Assessment of Mathematics Teachers in a Public and a Private School: Implications to the Quality of Teaching Secondary Mathematics

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To cite this article:

Riel Reuben O. Sogillo, Wardah D. Guimba, Jerryk C. Alico. Assessment of Mathematics Teachers in a Public and a Private School: Implications to the Quality of Teaching Secondary Mathematics. *Advances in Sciences and Humanities*. Vol. 2, No. 2, 2016, pp. 7-16. doi: 10.11648/j.ash.20160202.11

Received: August 26, 2016; **Accepted:** October 28, 2016; **Published:** November 21, 2016

Abstract: Mathematics teachers' quality continues as an enduring concern until now. This study attempts to address this concern by considering private and public schools. It measured the quality of Mathematics teachers using three indicators: teaching methods, teaching competencies, and students' Mathematics performance. It used two schools in Nasipit, Agusan del Norte, Philippines, namely, Nasipit National Vocational School (NNVS)—a public school—and St. Michael's College of Caraga (SMCC)—a private school. The data were gathered using survey questionnaire, a researchers-made teaching methods inventory, and the Competency-Based Performance Appraisal System for Teachers Form (CBPAST) used by the Department of Education. Data revealed that teachers from NNVS and SMCC practiced frequently the teaching methods identified in the questionnaire. Their teaching competencies were high in all domains. These imply that the teachers of both schools possess the skill to teach with quality. Furthermore, data revealed that NNVS teachers' and SMCC teachers' extent of practice of teaching methods has no significant difference. Their levels of teaching competencies were also comparable. As to students' performance, t-test showed a significant difference between their grades which further showed that SMCC students performed better (Fair) than NNVS students (Poor). This could be due to other moderating variables on the side of the NNVS students that affected their performance. The findings suggest teachers should continually improve their teaching methods, more preferably focusing on all learning domains. They should provide rooms for their own holistic development as Mathematics teachers. A deeper scrutiny of this issue would be interesting with larger samples and extensive analyses.

Keywords: Teaching Secondary Mathematics, Teaching Competencies, Teaching Methods, Public and Private Schools, Mathematics Performance

1. Introduction

Teaching is an active process in which one shares information with others to make behavioral changes. Some researchers consider teaching as a profession that requires mastery of a specific body of knowledge (Seiler, Ken, & Alexander, 2009). Along with teaching is learning, which refers to the process of assimilating information with a resultant change in behavior. The teaching-learning process is a planned interaction that promotes behavioral change that is

not a result of maturation or coincidence (Banks, 2000).

Teaching and learning activities solidify parts or the process of the curriculum where the questions of "what should be taught?" and "how do they learn?" are answered. This stage is largely the planning of how learning will take place. Variables such as learning environment, methods and techniques of teaching are employed in this stage. The quality of teaching-learning process is defined as the extent

to which the way materials to be learnt are presented, explained and devised are appropriate to student's learning (Demirel, 2010).

Teaching and learning mathematics are complex tasks. Similarly, measuring the quality of Mathematics teachers is not an easy task. Many components should be analyzed in order to come up with the necessary conclusion. Thinking of evaluating teachers' quality could lead to identifying components such as teaching methods, teaching competencies, and students' performance. Teaching methods is a determiner since they reflect teachers' capability to deliver lessons and to make students understand them. Teaching competencies are greatly important since these are based on the expectations and standards that experts set for teachers. In the Philippines, seven domains are identified to compose the National Competency-Based Teacher Standards (NCBTS). These are Social Regard for Learning, Learning Environment, Personal, Social Growth and Professional Development, Curriculum Content and Pedagogy, Diversity of Learners, Planning, Assessing and Reporting, and Community Linkages. To evaluate teacher competency according to the NCBTS, the country's Department of Education uses the Competency-Based Performance Appraisal System for Teachers, based on the seven domains of the NCBTS.

According to Prokop, Tuncer and Chuda (2007), the quality of education that teachers provide to students is highly dependent upon what teachers do in the classroom. Thus, it only shows that teachers play an important role in achieving and maintaining quality education. The role of professional development in assuring quality teaching for experienced teachers is critical (National Staff Development Council, 2005). Teachers should have sufficient knowledge on how students learn mathematics and how it should be taught best. Changing the way teachers teach is a continuing professional concern. Efforts should be taken now to inculcate Mathematics lesson away from traditional methods to a more effective approach.

This study attempted to assess the quality of Mathematics teachers, considering a public and a private school, namely, Nasipit National Vocational School (NNVS) and Saint Michaels College of Caraga (SMCC) for the school year 2012-2013. The following were considered as variables under study: (i) teaching methods, (ii) teaching competencies, and (iii) students' mathematics performance. There has been dearth of researches dealing with the quality of Mathematics teachers in the Caraga Region in the Philippines. It is in this premise that the researchers took the initiative of looking into the quality of teachers, particularly in the two (2) known competitive schools under study. The results and findings of the study will shed light on enhancing the quality of teaching Mathematics, thereby promoting quality education in the region.

2. Literature Review

According to Demirel (2010), planning the process of

effective teaching-learning depends on teachers equipped with various qualifications. Methods practiced by teachers are very important factors to determine the quality of teaching-learning process. Prokop (2007) states that the quality of education that teachers provide to students is highly dependent upon what teachers do in the classroom. Thus, it only shows that teachers play an important role in maintaining a good quality education. Teachers should have sufficient knowledge of how students learn mathematics and how best to teach. Changing the way teachers teach is a continuing professional concern. Efforts should be taken now to inculcate mathematics lesson away from traditional methods to a more effective approach.

Lardizabal, et al, (2002) cited the two types of teacher education namely: (1) pre-service and (2) in-service. Under the pre-service education, it is mentioned that in helping teachers develop the qualities considered essential to quality teaching, the curriculum of any teacher training institution is composed of three basic areas such as: (1) subject-matter education (2) general education, and (3) professional education.

Teaching and learning activities are the application part or the process of the curriculum where the questions of "what should be taught?" and "how do they learn?" are answered. This stage is, to a great extent, the planning of how learning will be actualized. Variables such as learning environment, and methods and techniques of teaching are employed in this stage. The quality of teaching-learning process is defined as the extent to which the way materials to be learnt are presented, explained and devised are appropriate to student's learning (Demirel, 2010).

According to Zevenbergen (n.d), Mathematics has deep meaning – the teaching of Mathematics is based around the notion of developing deep learning and understanding of the discipline as opposed to the common practice of "doing" Mathematics. He also added that Mathematics is taught in an exclusive and supportive learning environment. Knowledge of students is validly and legitimately incorporated in the teaching and learning experiences of the classroom. Thus, teachers, who are always act as facilitator of learning, then possess a deep knowledge in handling the said course. Teachers should not only be focusing on the looking at the process of learning, but will consider the success of the learning experience which would be served as basis on the quality of teaching s/he acquired.

Teaching Mathematics can be a discouraging task. No matter the grade level, teaching Mathematics can be a difficult task. Many children have low self-esteem concerning their math capabilities; others believe that math is boring or futile. All of these views can lead students and teachers alike to become frustrated with the subject. Fortunately, there are a number of Mathematics teaching methods likely to increase student enthusiasm and comprehension such as: Guided Discovery, cooperative learning, questioning techniques and using manipulatives (Schoenfield, 2005).

2.1. Teaching Practices and Methods

The 2002 Basic Education curriculum in Mathematics in the Secondary Level advocates the use a variety of teaching strategies among which are practical work, discussion, problem solving, investigations besides exposition and practice and consolidation as well as cooperative learning (Department of Education, 2002). The teaching strategies perceived to be most effective by Science and Mathematics teachers of schools identified as benchmarks in teaching and learning practices were: hands-on experience that brings students to their fullest learning capacity because they depend on themselves, cooperative learning because they can share better knowledge when they work in groups rather than when they work alone, and self-discovery because it enhances students' learning capability (Penano-Ho, 2004).

In the new mathematics, the focus is on problem solving, mathematical reasoning, justifying ideas, making sense of complex situations and independently learning new ideas. Students must be provided with opportunities to solve complex problems, formulate and test mathematical ideas and draw conclusion. Students must be able to read, write and discuss mathematics, use demonstrations, drawings and real-world objects, and participate in formal mathematical and logical arguments (Battista, 1999 in Education Alliance, 2006).

Consequently, as noted by Romberg (2000), a set of basic assumptions about teaching and schooling practices is implicit in this reform. First, all students must have an opportunity to lean new mathematics. Second, all students have the capacity to learn more mathematics than what is traditionally assumed. Third, new application and changes in technology have changed the instructional importance of some mathematics concepts. Fourth, new instructional environments can be created with technological tools. Fifth, meaningful mathematics learning is a product of purposeful engagement and interaction which builds on prior experience.

Teaching practices are central to understanding what makes for effective teaching. Peterson's (1988) list of effective teaching practices included: (1) a focus on meaning and understanding Mathematics and on the learning task; (2) encouragement of student autonomy, independence, self-direction and persistence in learning; and (3) teaching of higher-level cognitive processes and strategies.

Sabean and Bavaria (2005) have synthesized a list of the most significant principles related to mathematics teaching and learning. This list includes the expectations that teachers know what students need to learn based on what they know, teachers ask questions focused on developing conceptual understanding, experiences and prior knowledge provide the basis for learning mathematics with understanding, students provide written justification for problem solving strategies, problem based activities focus on concepts and skills, and that the mathematics curriculum emphasizes conceptual understanding. Concurrently, the following best practices for implementing effective standards-based math lessons should be followed (Teaching Today, 2005 as cited in Education

Alliance, 2006): (1) Students' engagement is at a high level; (2) Tasks are built on students' prior knowledge; (3) Scaffolding takes place, making connections to concepts, procedures, and understanding; (4) High-level performance is modeled; (5) Students are expected to explain thinking and meaning; (6) Students self-monitor their progress; and (7) Appropriate amount of time is devoted to tasks.

Students are the subjects of teaching activities, but the key factor of teaching effects is teacher because students' quality is influence by teaching effect (Andrew & Schwab, 1995, Bents & Bents, 1990). If teacher quality's influenced on teaching effectiveness can be further understood, it would be more assured that teacher's teaching performance and students' learning outcome will be improved.

The most persistent component of teaching activity is students. However, the key to teaching effectiveness is teacher. It is necessary to probe into teacher quality to help teachers ascertain their shortcoming so that they cannot only improve themselves but also increase their teaching effectiveness. Secondly, teachers with good effectiveness usually value teaching performance, maintain teaching quality, pursue best teaching effectiveness and improve students' learning effectiveness.

2.2. Teaching Competence and Learning Domains

Teacher quality and teacher competence are concepts that are often referred to and frequently applied in different educational contexts: Whitty (1996) identifies professional competence, which includes knowledge and understanding of children and their learning, subject knowledge, curriculum, the education system and the teachers' role. Professional competence also necessitates skills such as subject application, classroom methodology, classroom management, assessment and recording and undertaking a wider role. Teacher with high competence is one of the most significant factors manipulate the student learning as well as serving the schools to meet its objectives and missions. (Achwarin, n.d.).

A facilitative learning environment described by Pine and Horne (1990) as cited by Corpuz and Salandanan (2007) is learning environment which encourage people to be active; promotes and facilitates the individual's discovery of personal meaning of idea; emphasizes the uniquely personal and subjective nature of learning; in which difference is good and desirable; and where people feel they are respected and accepted for who they are and what they say and do.

Quality teaching is one of the enduring concerns in education. This interest is obvious; when schools are thought. Teachers also come in mind. Given the instructional and economic dominance of teachers in schooling, it is natural to want to judge effectiveness of educational investments in part by looking at teaching. The problems begin when one tries to operationalize the measurement of the quality of teaching and confuses it with the "quality of teachers. Using student achievement as a way to estimate teaching effectiveness is one approach. It seems like reasonable tactic; after all, teachers ought to help students learn (Baker, n.d.).

2.3. Related Studies

This section describes related studies pertaining to the quality of teaching secondary Mathematics. The studies of Prokop, Tuncer and Chuda (2007), the ACER (2001), Manullang (n.d.), and Lin, Xie, Jeng, and Huang (2010) provide insights and learning on relevant issues under quality teaching such as teaching effectiveness, teaching practices, and students' perceptions towards teachers.

According to Prokop *et al.* (2007), some research studies tell that the quality of education depends on the teachers' provision to students upon what teachers do in the classroom. They concluded then, that in preparing the students of today to become successful individuals of tomorrow, science and mathematics teachers need to ensure that their teaching is effective. It only implies that in teaching-learning process, teachers are elements that hold an important role in pursuing teaching-learning process effectively.

In 2001, the Australian Government commissioned the Australian Council for Educational Research (ACER) to conduct an investigation of effective Mathematics teaching and learning in Australian secondary school. The purpose of the research was to examine the range of factors including knowledge, beliefs, understanding and practices of teacher of Mathematics and their qualifications, professional development and relevant personal experiences, and how these impact on student learning outcomes in the high school years. One of the main findings of the study was that teacher knowledge and educational background is positively, but weakly related to the teacher effectiveness. The more that this education has to do with Mathematical content and pedagogy, the more likely it is that teachers will be effective.

A case study of Manullang (n.d.) entitled "Quality of Teaching and Learning Interaction for Mathematics Teachers" attempted finding out a correlation among known variables in relation to the development and improvement of the quality of teaching and learning interaction for Mathematics teachers. Findings showed that there is a significant correlation of the variables of the teachers' educational level, teaching experience, and professional attitude with the quality of teaching and learning interaction. The findings of the study suggest that Mathematics teachers should improve their knowledge about the course, other related institutions should be involved in supervising the interaction, cooperation with institutions producing teacher graduates should be developed, and the training programs should be evaluated in terms of efficiency, effectiveness, and investment.

The study conducted by Lin, Xie, Jeng, and Huang (2010) dealt on the relationship between teacher quality and teaching effectiveness as perceived by students from industrial vocational high schools. They found out that both teacher quality and teaching effectiveness differ significantly with school type, with students from private schools having a better perception. Teacher quality differs significantly with school category, with students from industrial and commercial schools having a better perception. They recommended that

teachers in vocational high schools should undergo professional growth and conduct periodical commending of outstanding teachers. Furthermore, they suggested that teacher should improve teaching strategies and enhance their interaction with students.

Larsson (2009) conducted a study which dealt with discerning competence within a teaching profession. There were eight teachers shadowed with a video camera in their ordinary settings for one day. They then participated in stimulated recall sessions based on three sequences drawn from the video observations. The results showed that teachers' and researchers' discernment of competence fall into four qualitatively different categories namely pedagogical knowledge, pedagogical intentions, pedagogical consideration, and pedagogical assets. The main difference between the teachers' and the researchers' discernment concern the notion of the space given to the children. While teachers appear to be passive, they reflect on what step to take next while putting their pedagogical intentions into practice. The study also shows that the participating teachers have no difficulty describing or talking about what they think is their teaching competence.

Achwarin's (n.d.) study of teacher competence of teacher in Thailand revealed features that most of the teachers hold bachelor's degree; very few teachers hold master's degree or higher degree. The level of teacher competence of teachers at schools was at high level. Teachership was the highest teacher competence. In order from highest to lowest of nine competencies, the ranking was teachership, psychology for teachers, educational measurement and evaluation, classroom management, learning management, educational innovation and information technology, language and technology for teachers, curriculum development and educational research. Furthermore, there was a positive significant relationship between teacher qualification and teaching experience, teacher competence areas in language and technology for teachers, curriculum development, and educational research.

3. Research Questions

This study aims to determine the quality of Mathematics teachers in a public school and a private school in Nasipit, Agusan del Norte, Philippines. Specifically, the following questions are answered in this study:

- a. What is the NNVS and SMCC teachers' extent of practice in their teaching methods used?
- b. What is the NNVS and SMCC teachers' level of competencies based on the National Competency-Based Teacher Standards (NCBTS)?
- c. What is the level of the NNVS and SMCC students' performance in Mathematics?
- d. Is there a significant difference between the NNVS and SMCC teachers in terms of teaching methods and teaching competency?
- e. Is there a significant difference between the Mathematics performance of students from both schools?

4. Research Methods

4.1. Research Design

This study primarily employed quantitative techniques to conduct a descriptive-comparative research. It described each of the aforementioned variables that serve as indicators of the quality of Mathematics teachers. It then compared the data gathered from NNVS and SMCC Mathematics teachers.

4.2. Research Setting and Participants

This study was conducted in Nasipit, Agusan del Norte, Philippines. Two schools were included in this study namely: Nasipit National Vocational School (NNVS) and Saint Michael's College of Caraga (SMCC). The first school is located approximately 26 kilometers from Butuan City, the capital of Agusan del Norte, and specifically located in Bayview Hill, Nasipit, Agusan del Norte. The latter is located almost one kilometer distance from Nasipit National Vocational School. SMCC is a Catholic school, so it is adjacent to Saint Michael Parish Church. It is also near (approx. 20 meters away) the Municipal Hall of Nasipit. Out of 11 secondary schools in Nasipit, Agusan del Norte, both schools produce good quality students who are prepared for tertiary education. The respondents who participated in this study were the population of Mathematics teachers in NNVS and SMCC. There were five (5) Mathematics teachers in both schools, which means there were only ten (10) respondents.

4.3. Research Instruments

The study made use of a researchers-made questionnaire on the teaching methods, which was based on the book of Corpuz and Salandanan (2007) entitled *Principles of Teaching 1*. In terms of validity, the researchers assumed that the items are valid since those are made based on how the authors described the teaching methods. Ten teaching methods were included in the questionnaire, having five descriptors each. Thus, it made a 50-item questionnaire and a 4-point Likert scale was used to rate each statement according to frequency. These are *Always Practiced*, *Often Practiced*, *Seldom Practiced*, and *Never Practiced*. Table 1 shows the distribution of items to each teaching method/approach.

Table 1. Statement Distribution according to Teaching Method.

Teaching Methods/Approach	Item Distributions
1. Inquiry	1, 4, 7, 10, 13
2. Problem Solving	16, 19, 22, 24, 27
3. Project	2, 5, 8, 11, 14
4. Inductive	3, 6, 9, 12, 15
5. Constructivist	17, 20, 23, 26, 29
6. Reflective	18, 21, 25, 28, 30
7. Cooperative Learning	31, 34, 37, 40, 43
8. Peer Tutoring	32, 35, 38, 41, 44
9. Deductive	33, 36, 39, 45, 48
10. Demonstration	42, 46, 47, 49, 50

Included in the instruments is the Competency-Based Performance Appraisal System for Teachers (CBPAST)

which is used to measure the level of the respondents' competence. The questionnaire is based on the seven (7) learning domains in the National Competency-Based Teacher Standards namely: Social Regard for Learning, Learning Environment, Personal, Social Growth and Professional Development, Curriculum Content and Pedagogy, Diversity of Learners, Planning, Assessing and Reporting, and Community Linkages. There are different numbers of indicators in each learning domain. For instance, Social Regard for Learning has four indicators, then six indicators for Learning Environment and Community Linkages. There are seven indicators for Diversity of Learners while Curriculum Content and Pedagogy has twelve indicating statements. Planning, Assessing and Reporting has nine indicators and ten indicators for the Personal, Social Growth and Professional Development. The following tables show the corresponding qualitative description of mean values. These were used to interpret the gathered data after the analyses.

Table 2. Qualitative Scale for Teaching Methods.

Scale Range	Qualitative Interpretation
1.00-1.74	Never Practiced
1.75-2.49	Seldom Practiced
2.50-3.24	Often Practiced
3.25-4.00	Always Practiced

Table 3. Qualitative Scale for Teaching Competencies.

Scale Range	Qualitative Interpretation
1.00-1.74	Below Basic
1.75-2.49	Basic
2.50-3.24	Proficient
3.25-4.00	Highly Proficient

Table 4. Qualitative Scale for Students' Performance.

Scale Range	Qualitative Interpretation
91 – 95	Very Good
86 – 90	Good
81 – 85	Fair
76 – 80	Poor

4.4. Data Analysis

Mean was used to compute for the average responses of the respondents to the questionnaires. Mann-Whitney U Test was used to determine whether the variables representing the quality of teaching Mathematics in both schools has a significant difference. Levene's Test and *t*-test for Equality of Means were used to determine whether a significant difference in Mathematics performance exists between NNVS and SMCC students.

5. Results and Discussion

5.1. Teaching Methods/Approach

In this part, the NNVS and SMCC respondents' extent of practice of some teaching methods is tabulated. These teaching methods are inquiry approach, problem solving

method, inductive method, constructivist approach, reflective method, cooperative learning approach, peer tutoring method, deductive method, and demonstration method. In

this section, the comparison of the findings is also reflected in order to achieve the objective of this study.

Table 5. Mean Results of the Respondents' Extent of Practice of the Inquiry Approach.

Methods/ Approach	NNVS		SMCC	
	M	Description	M	Description
1. Inquiry	3.48	Always	3.56	Always
2. Problem Solving	3.52	Always	3.44	Always
3. Project	3.80	Always	3.72	Always
4. Inductive	3.68	Always	3.68	Always
5. Constructivist	3.60	Always	3.48	Always
6. Reflective	3.36	Always	3.32	Always
7. Cooperative Learning	3.76	Always	3.68	Always
8. Peer Tutoring	3.56	Always	3.51	Always
9. Deductive	3.60	Always	3.64	Always
10. Demonstration	3.76	Always	3.68	Always

5.2. Teaching Competence

This section presents the data on teachers' teaching competence based on the seven domains of the National Competency-Based Teacher Standards prescribed by the Department of Education.

Table 6. Mean Results of the Respondents' Competence in the Seven Domains of the National Competency-Based Teacher Standards.

Domains	NNVS		SMCC	
	M	Description	M	Description
Social Regard for Learning	3.70	Highly Proficient	3.26	Highly Proficient
Learning Environment	3.63	Highly Proficient	3.23	Proficient
Personal, Social Growth and Professional Development	3.58	Highly Proficient	3.41	Highly Proficient
Curriculum Content and Pedagogy	3.35	Highly Proficient	3.47	Highly Proficient
Diversity of Learners	3.31	Highly Proficient	3.23	Proficient
Planning, Assessing and Reporting	3.29	Highly Proficient	3.30	Highly Proficient
Community Linkages	3.23	Proficient	Highly Proficient	
Grand Mean	3.44	Highly Proficient	Highly Proficient	

Shown in Table 6 is the summary of the respondents' competence in the domains establish as NCBTS. It can be seen that the respondents are highly proficient in the domains social regard for learning, learning environment, personal, social growth and professional development, curriculum content and pedagogy, diversity of learners, and planning, assessing and reporting. While in community linkages they are proficient. Therefore, the NNVS teachers can be described as competent teachers. Considering they are Mathematics teachers, they have to have instilled within their practices the domains used as bases to define them as teachers. Fortunately, NNVS teachers show that they have fulfilled it.

The table above also shows the summary of the SMCC respondents' competencies on the seven domains of the NCBTS. In general, the respondents are highly proficient (Grand Mean = 3.324). Specifically, they are highly proficient with all the domains except for community linkages in which they are still at proficient level. This implies that the respondents are competent as teachers of Mathematics and that brings a quality teaching-learning process.

5.3. Students' Mathematics Performance

Reflected in Table 7 is the distribution of SMCC and

NNVS students in accordance to their grade in Mathematics. Using the grading system of DepEd, their grades are described with a rating. The data shows that there are 2 (4.9) students who got a rating of Very Good which means that their grade fell on the range 91-95. There are 12 (29.3%) students who got grades within 86-90 described as Good. Furthermore, 19 (46.3%) students have Fair grades in Mathematics which belongs to the range 81-85. Finally, 8 (19.5%) of them performed Poor in the subject and received grades 76-80. Therefore, there are near to half (46.3%) students who got grades within 81-85 which are rated as Fair. The mean of the students' grades resulted as 84.205 which is also rated as Fair. This means that their performance in Mathematics is considerable although it is not that better. This implies that students should improve their performance and change their study habits. Moreover, SMCC teachers should look into the reasons that affect the students' performance. They should confirm as well if their teaching methods affect the students' learning because the finding signifies that their high proficiency and competence do not reconcile with the students' level of performance in Mathematics.

Table 7. Distribution of SMCC and NNVS 1st Year Students according to Grade Rating.

Range	SMCC			NNVS			M	
	F	%	M	F	%	M		
91 – 95	2	4.9		5	10.0			
86 – 90	12	29.3		12	24.0			
81 – 85	19	46.3		9	18.0			
76 – 80	8	19.5	84.025	12	24.0		79.32	POOR
75				3	6.0			
74 and below	0	0		9	18.0			
Total	41	100.0		50	100.0			

In the same table, the distribution of NNVS students according to their grade rating is viewed. It can be seen that there are 5 (10%) students who got a Very Good rating and 12 (24%) with Good rating. Furthermore, 9 (18%) of them disclosed to have performed Fair while 12 (24%) got a Poor rating in their grade. There are also 3 (6%) who gained a Passing rate. However, there are 9 (18%) students who failed the subject. As a result, the mean grade of the students is 79.32, described as Poor performance. Although there are students who performed better in the subject, there are only few of them in the class. Accordingly, this finding creates a notion that there are underlying problems in the performance of most of the students, particularly who performed poor and even failed the subject. The performance of students also does not reflect the level of competence of NNVS teachers. This also signifies that there is a discrepancy happening in the teaching-learning process of NNVS. As an implication, students must strive harder to perform better in Mathematics. Moreover, teachers should also check closer this scenario and bust the culprit behind it.

5.4. Difference between the Respondents' Teaching Methods and Competencies and the Students' Mathematics Performance

This section shows the results of the independent samples tests of the Mathematics teachers' teaching methods and competencies and the students' Mathematics performance. Mann-Whitney U test, a nonparametric statistical tool, was used to determine if there is significant difference between the respondents' teaching methods and competencies since the samples were less than 30 and that the data is not normally distributed. T-test for independent sample means was used to determine if there is significant difference between the students' Mathematics performance, represented by their grades.

Table 10. Independent Samples Test of the Students' Mathematics Performance in NNVS and SMCC.

Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	p-value	t	df	p-value
Grades	Equal variances assumed	16.720	0.000	2.457	89	0.016
	Equal variances not assumed			2.606	75.614	0.011

Table 10 shows the results of the *t*-test independent samples test regarding the Mathematics performance of NNVS and SMCC students, represented by their grades in the subject. The Levene's Test was used for determining the

Table 8. Test Statistics of the Difference between Competencies of NNVS and SMCC Respondents.

Test Statistics	Teaching Competencies	Action Taken
Mann-Whitney U	10.000	
Wilcoxon W	25.000	H ₀ is Accepted
Z	-0.525	
p-value	0.599	

Table 8 made the previous implication clearer. Using the Mann-Whitney U test, the resulting value is 10.00 with *p*-value of 0.599. Since *p* is greater than the significance level 0.05, then the null hypothesis "There is no significant difference between the level of teaching competency of NNVS teachers and SMCC teachers" is accepted. This means that their proficiency is comparable and has no significant difference.

Table 9. Test Statistics of the Difference between Teaching Methods of NNVS and SMCC Respondents.

Test Statistics	Teaching Methods	Action Taken
Mann-Whitney U	12.000	
Wilcoxon W	27.000	H ₀ is Accepted
Z	-0.105	
p-value	0.917	

Reflected in Table 9 is the test statistics showing whether or not there is a significant difference between the extent of practice of the teaching methods among NNVS and SMCC Mathematics teachers. As shown in the table, the *p*-value is 0.917. When compared to the level of significance 0.05, it is much greater which means that the difference between the respondents' extent of practice of the teaching methods is not significantly considerable. Thus, the null hypothesis "There is no significant difference between the extent of practice of the teaching methods among NNVS and SMCC Mathematics teachers" is accepted. It further signifies that the NNVS and SMCC Mathematics teachers use teaching methods identified in this study at similar extent.

comparability or homogeneity of the two groups, NNVS and SMCC. The null hypothesis H₀: "The variances of the two groups are the same" for Levene's Test is rejected (F=16.720, *p*<0.05). The results show that the variances of the two

groups are not the same.

In comparing the means of the two groups, it could be seen from the table that the t -value is 2.606 with a p -value of 0.011 which is less than 0.05 level of significance, thus, the null hypothesis H_{03} : “*There is no significant difference between the means of the grades of students of the two groups, NNVS and SMCC*” is rejected. The findings show that, on the average, the grades of students in NNVS and SMCC are not the same. This finding seems to support the initial notion formulated previously that the performance of SMCC students in Mathematics is significantly better than that of NNVS students.

6. Conclusion and Recommendations

The findings of the study shed light on the quality of teaching secondary mathematics. The age of the respondents showed that they attained seniority, which entails wider experiences and diverse encounters in the profession. However, despite their seniority and educational attainment, still they are in different employment statuses and are compensated differently since NNVS teachers are more incentivized than SMCC teachers. This is basically caused by the type of educational institution they are affiliated to.

As asserted by Prokop (2007), quality of education crucially depends upon teachers’ methods of teaching. The respondents reported frequent practice of all the teaching methods identified in this study. Thus, they clearly are practicing an integrated teaching method. In this regard, the utilization of variety of teaching strategies is highly advocated (DepEd, 2002) as it fosters quality of education. It is concluded then that teachers from both schools are potential contributors to quality teaching of Mathematics. This is a generalization as well since, as tested, there is no difference between their teaching methods. This finding is reinforced further by their level of proficiency, which was found to be highly commendable. With their high proficiency in almost all of the domains in the competency-based performance appraisal, it can be concluded that there is quality in their teaching of secondary Mathematics.

When the students’ Mathematics performances were compared, it was found that they were significantly different. Specifically, SMCC students performed better than NNVS students. Thus, it creates an inconsistency especially in NNVS because according to Andrew and Schwab (1995) and Bents and Bents (1990), students’ quality is supposed to be influenced by teachers’ quality. In other words, the quality of teaching secondary Mathematics of both schools is comparable based on the teaching methods practiced by teachers and their teaching competency but differed when the performance of students are compared. Hence, there are other factors, which may have caused this unpredictable phenomenon.

In the light of the sufficient findings of this study, the following recommendations are forwarded. As adapted from Manullang’s (n.d.) suggestion, teachers should improve their knowledge about the course as well as their proficiency in teaching, although they are already highly proficient since

teaching also mean continuous growth and development. Together with the school administration, they should also conduct an investigation regarding the reasons behind the inconsistency found between their teaching methods and competencies and students’ performance. School administrators should address the issue regarding the improvement of students’ performance in Mathematics. Programs and interventions are imperative to supplement and solve this. Teachers should be given more avenues to grow professionally, personally, and socially through sending them to enhancement trainings and seminars. A deeper analysis of this study should be pursued through widening the sample size and broadening its scope. Through this, a more reliable and valid generalization can be carried out to explain the remaining phenomena beyond the scope of this study. Students can be the respondents in assessing their Mathematics teachers’ teaching methods and teaching competencies. By that, the perspective of the students would be given attention.

References

- [1] Abraao, L. (2006). Improving Methods of Teaching Mathematics in Middle School. An Interactive Qualifying Project. Worcester Polytechnic Institute. http://www.wpi.edu/Pubs/E-project/Available/E-project-042406-060014/unrestricted/Abraao_Lourenco_IQP_report_NTH2368.pdf. Retrieved: March 29, 2013.
- [2] Alberta. (2004) Alberta Learning. Learning and Teaching Resources Branch. Focus on inquiry: a teacher’s guide to implementing inquiry-based learning. <http://www.learning.gov.ab.ca>. Retrieved on March 29, 2013
- [3] Ali, R., Hukamdad, Akhter, A., & Khan, A. (2010). The Effect of Using Problem Solving Method in Teaching Mathematics on the Achievement of the Mathematics Students. *Asian Social Sciences*. Vol. 6, No. 2. Retrieved: March 29, 2013.
- [4] Al-Qaisi, T. (2010). The Role of Mathematics Teachers towards Enhancing Students’ Participation in Classroom Activities. *Journal of Social Sciences*, 22 (1), 39-46.
- [5] Australian Council for Educational Research (ACER). (2001).
- [6] Battista, M. (1999). The Mathematical Miseducation of America’s Youth. *Phil Delta Kappan*, 80 (6).
- [7] Bellon, Jerry; Bellon, Elner, & Blank, Mary Ann, *Teaching from a Research Knowledge Base* (1992), New York: McMillan.
- [8] Bents, M. & Bents, R. (1990). Perceptions of Good Teaching among Novice, Advanced Beginner and Expert Teachers. Paper presented at the annual meeting of the American Educational Research Association, Boston, MA, USA.
- [9] Cai, J. (n. d.). What research tells us about teaching mathematics through problem solving. Department of Math Sciences. University of Delaware. <http://ccsenet.org/journal/index.php/ass/article/download/5040/4181>. Retrieved: March 29, 2013
- [10] Cavaye, J. (n. d.). Strengthening Links Between Schools and Community. Retrieved: march 21, 2013 from www.communitydevelopment.com.au

- [11] Cheng, H. (2011). A Case Study of Cooperative Learning in Mathematics: Middle School Course Design. Xianyang Normal University, China. *Journal of Mathematics Education*. Vol. 4, No. 1, pp. 75–78.
- [12] Clancy, W. C. (1997). *Situated cognition: On human knowledge and computer representations*. Cambridge: Cambridge University Press.
- [13] Corpuz, B. and Salandanan, G. (2007). *Principles of Teaching I*. Quezon City, Metro Manila. Lorimar Publishing Inc.
- [14] Current Perspectives in Assessment. (2005). Retrieved on 17 March 2013 from www.eduweb.vic.gov.au/edulibrary/public/teachlearn/student/assessment_current_per.pdf
- [15] Damodharan, V. S. & Rengarajan, V. (n. d.). *Innovative Methods of Teaching*.
- [16] Department of Education. (2002). *Operations Handbook in Mathematics 2002 Basic Education Curriculum in the Secondary Level*. Pasig City: Bureau of Secondary Education.
- [17] Demirel, M. Tuncel, I. Tuncel, Z. A. (2010). A Study on Quality Teaching-Learning Process in Elementary Education in Turkey: A Case Study. *American-Eurasian Journal of Scientific Research 5 (1)*.
- [18] Eggen, P. D. & Kauchak, D. P. (2000). *Educational Psychology: Windows on Classroom (5th Edition)*. Upper Saddle River, NJ: Prentice Hall.
- [19] Fernandez-Santander, A. (2008). Cooperative learning combined with short periods of lecturing: a good alternative in teaching biochemistry. *Biochemistry and Molecular Biology Education*, 36(1), 34-38.
- [20] Fulk, B., & King, K. (2001). Classwide Peer Tutoring at Work. *Teaching Exceptional Children*. Vol. 34, No. 2, pp. 49 – 53.
- [21] GLEF (George Lucas Educational Foundation). (2001). Project-based learning research. *Edutopia online*. Retrieved July 12, 2004, from http://www.glef.org/php/article.php?id=Art_887
- [22] http://www.pcer.ac.in/B.Ed._20notes/Paper_20V/math/unit_20_3.pdf. Retrieved: March 29, 2013
- [23] <http://www.peersupport.nl/Media/view/20585/UsingPeerTutoringforMath06-06-2.pdf>. Retrieved: March 29, 2013.
- [24] Ingvarson, L. Beavis, A. Bishop, A. Peck, R. Elsworth, G. (2004). Investigation of Effective Mathematics Teaching and Learning in Australian Secondary Schools. www.acer.edu.au/document/Ingvarson_EffectiveMathematicsTeachingLearningAUSecsch.pdf. 01March2012.
- [25] INTIME. (2001). Pedagogy. Retrieved on 16 March 2013 from <http://www.intime.uni.edu/model/teacher/pedagogysummary.html>
- [26] Kilpatrick, J. (1992). A history of research in mathematics education. In D. Grouws (ed.). *Handbook of research on mathematics research and teaching*. (pp. 3-39). New York: MacMillan.
- [27] Kolb, D. & Boyatzis, R. (1999). *Experiential Learning Theory: Previous Research and New Direction*. Department of Organizational Behavior. Case Western Reserve University.
- [28] Kühne, B. (1995). The Barkestorp project: Investigating school library use. *School Libraries Worldwide*, 1(1), 13–27.
- [29] Lardizabal, A. (2002). *Principles and Methods of Teaching*. Phoenix Publishing House Inc.
- [30] Larsson, J. (2009). Discerning Competence within a Teaching Profession. *European Masters in Early Childhood Education and Care (EMEC)*.
- [31] Lin, R. Xie, J. Jeng, Y. & Huang, S. (2010). The Relationship between Teaching Quality and Teaching Effectiveness Perceived by Students from Industrial Vocational High Schools. *Asian Journal of Arts and Sciences*, 1 (2), 167-187.
- [32] Lucas, M.R. and Corpuz, B. (2007). *Facilitating Learning: A Metacognitive Process*. Quezon City, Metro Manila. Lorimar Publishing Inc.
- [33] Manullang, M. (n.d.). *Quality of Teaching and Learning Interaction for Mathematics Teacher: A Case Study*.
- [34] N. A. (2008). *Inspired Issue Brief: Inquiry Based Teaching*. Center for Inspired Teaching. www.inspiredteaching.org. Retrieved: March 29, 2013
- [35] National Staff Development Council. (2005). *A Study of Professional Development for Public School Educators in West Virginia*. Oxford, OH: Author.
- [36] Overbaugh, R. (2005). *An Overview of Jerome Bruner His Theory of Constructivism*.
- [37] Parsons, S., Croft, T., & Harrison, M. (2009). Does Students' confidence in their ability in Mathematics matter? *Teaching Mathematics and Its Applications*, 28(2), 53-68.
- [38] Penano-Ho, L. (2004). The Science and Mathematics Teachers: Key Players in the Classroom. In Ibe, M., Ogena, E., & Brawner, F. (Eds.). *Effective Practices in Science and Mathematics Education: A Benchmarking Project (Major Report)*. Quezon City: Vibal Publishing House, Inc.
- [39] Peterson, P., Carpenter, T., & Fennema, S. (1989). Teacher's Knowledge of Students' Knowledge in Mathematics Problem Solving: Correlational and Case Analyses. *Journal of Educational Psychology*, 81, 558–569.
- [40] Pine, G., & Home, P., (1990). "Principles and Conditions of Learning in Adult Education", Carmela D. Ortigas, ed. *Handbook for Facilitators – Group Process and the Inductive Method – Theory and Practice in the Philippines*, pp. 138–140.
- [41] Prince, M. & Felder R. (2006). Inductive Teaching and Learning Methods: Definitions, Comparisons and Research Bases. *J. Engr. Education*, 95(2), 123–138.
- [42] Prokop, P., Tuncer, G., & Chuda, J. (2007). Slovakian Students' Attitude Toward Biology. *Eurasia Journal of Mathematics, Science and Technology Education*, 3(4), 287–295.
- [43] Romberg, T. (2000). Changing the Teaching and Learning of Mathematics. *AMT*, 56 (4), 6-9.
- [44] Sabeen, M. P., & Bavaria, R. (2005). *Sylvan Learning Center Math Research*. Sylvan Learning, Inc.
- [45] Salandanan, G. (2009). *Methods of Teaching*. Quezon City, Metro Manila. Lorimar Publishing Inc.

- [46] Schoenfeld, A. (2005). *Mathematics Teaching and Learning. Effective Math Teaching Method*. http://www.eHow.com/info_7927064_effective-math-teaching-method.html. 10March2012.
- [47] Seehorn, A. (n.d). *The Effectiveness of Varying Delivery Methods in Teaching Math*. http://eHow.com/info_8031437_effectiveness-delivery-methods-teaching-math.html. 01March2012.
- [48] Segers, M., Dochy, F. & Cascallar, E. (2003). *Optimizing New Models of Assessment: In Search of Qualities and Standards*. Kluwer Academic Publisher, Dordrecht.
- [49] Seiler, M., Ken, C., Alexander, A., Loody, B., Nelson, D., Olds, S., White, K., & Young, P. (2009). *Mathematics Study Part 2: Educator Preparation and Teacher Quality*. Legislative Research Commission, Research Report No. 369.
- [50] Slavin, R. (2003). *Educational Psychology. Theory and Practice*, 7/E. <http://www.pearsonhighered.com/samplechapter/0205351433.pdf>. Retrieved: March 29, 2013.
- [51] Stigler, J. & Hiebert, J. (2004). *Improving Mathematics Teaching*. *Educational Leadership*, 61 (5).
- [52] Torno, B. (n. d.). *Teacher Education and Development Program (TEDP) –National Competency-Based Teacher Standards (NCBTS) Philippine Education Reform*. http://www.cfo-pso.org.ph/pdf/8thconferencepresentation/day2/Overseas_presentation_NCBTS_and_TSNA.pdf. Retrieved: March 29, 2013
- [53] Ulep, S. (n.d.). *Good Mathematics Teaching Practices – In the Making: A Philippine Experience*. National Institute for Sciences and Mathematics Education Development, UP.
- [54] Uy, F. (n. d.). *Teaching Mathematics Concepts Using Multicultural Approach*. California State University – Los Angeles. Retrieved: March 21, 2013 from http://www.ccd.rpi.edu/eglash/nasgem/ncsm04/Uy_20Fred_20Teaching_20Concepts.pdf
- [55] Vega, V., Prieto, N. and Carreon, M. (2009). *Social Dimensions of Education*. Quezon City, Metro Manila. Lorimar Publishing Inc.
- [56] Walker, E. N. (2007). *The Structure and culture of developing a mathematics tutoring collaborative in an urban high school*. *The High School Journal*, 91(1), 57-67.
- [57] Whitty, G., (n. d.) “Professional competences and professional characteristics: The Northern Ireland approach to the reform of teacher education. In D. Hustler and D, McIntyre (2001), *developing competent teachers; approaches to professional competence in Teacher Education*, London: David Fulton.
- [58] Zebergen. (n. d.). *Reforming Mathematics Education: A Case Study within the Context of New Times*. Retrieved: November 2, 2011.

Biography



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