International Forum
Vol. 20, No. 2
December 2017
pp. 143-159

FEATURE

NEEDS ASSESSMENT OF SENIOR HIGH SCHOOL MATHEMATICS TEACHERS IN TEACHING STATISTICS AND PROBABILITY

Zussette Candelario-Aplaon

Abstract. *Statistics and probability is one of the branches of mathematics with many applications and problem-solving situations that require critical thinking and problem-solving skills. With this, it is included in the elementary and junior high school curriculum in spiral progression approach and core subjects in senior high school. Because of this, the researcher was motivated to conduct the study to determine the needs of senior high school mathematics teachers in teaching statistics and probability which would serve as basis for conducting needed training. This is a descriptive research wherein 35 senior high school mathematics teachers from 27 private and public secondary schools in the Second District of Oriental Mindoro were asked to answer the self-made questionnaire and comprehensive test to gather the needed data. Mean, frequency percentage, standard deviations, percentage of correct response and mean percentage scores were used in this study. Based on the results, the respondents have fair level of content knowledge but do not always practice different pedagogical methods in conducting research but they cannot apply it in their respective schools. Further, trainings are needed by the teachers for them to effectively teach Statistics and Probability.*

Keywords: needs assessment, senior high school mathematics teachers, content knowledge, pedagogical knowledge, research knowledge, Second District of Oriental Mindoro, Philippines

Introduction

Mathematics has always been perceived as the most difficult subject to learn and teach. Students' performance in mathematics is always low as compared to other subjects in the curricula. From the national level down to school level, various strategies were employed to address this issue. Mathematics teachers are constantly devising and implementing new plans on how to improve their students' mathematics performance.

There are various branches of mathematics that need to be learned by students. One of them is statistics and probability. The subject provides a wide range of applications like weather forecasting, life expectancy, sports, games and recreational activities, risk assessment in business and game theory, environmental regulation, product reliability, defense strategies, medical decisions, scenario analysis and population estimates.

During the previous curriculum of the Philippines, the subject statistics and probability was offered in higher education along the later part of the curriculum and among math-related courses only. In the current curriculum, it is offered in the senior high school as a core subject. It is therefore important that the mathematics teachers in the senior high schools be knowledgeable in the said subject. The subject also aims to help the students in applying various statistical tools in their respective research projects which is also a subject in the senior high school and a requirement for graduation. In this sense, senior high school teachers must also possess significant knowledge in conducting research. This study aimed to determine the knowledge level of the senior high school mathematics teachers in content and pedagogy when it comes to teaching statistics and probability as well as their knowledge in conducting research. This study provided baseline data in the preparation of training design for the extension program of the college. For the purposes of the international readership, senior high school was added to the Philippine education a couple of years prior to this study.

Literature Review

Learning mathematics is important to almost all fields of endeavor in today's diverse society. Despite its usefulness and wide application, mathematics is perceived by most students as boring, difficult, not very practical and abstract (Ignacio, Nieto & Barona, 2006). Mathematics can appear as a foreign language to many for it has its own alphabet, comprised of numbers and figures, and is constructed with a complicated syntax (Ashby, 2009). This leads to the prevalent problem of the poor performance of students in mathematics. However, there are various factors that could affect the students' success in mathematics. Some of them are the teachers themselves and others are teacher-related factors.

Learning mathematics must be pleasurable and motivating. The mathematics teachers should employ welcoming, stimulating, and empirical approaches to help students enjoy and learn the content of the subject (Valle, 2011). Also, they should take into account the learners' differences, multiple intelligences, and attitudes towards mathematics (Tella, 2007), apply various teaching practices that are well suited for their students' learning ability, integrate lessons with other disciplines, use appropriate instructional materials and technology as well as connect to concrete experiences (Aplaon, 2015) to make mathematics active, investigative, and adventurous (Tella, 2007). Further, the teachers should acknowledge that the students can develop positive mathematical values and become productive citizens regardless of their diversity (Anthony & Walshaw, 2009).

There are various factors that could affect mathematics performance. In their study, Singh, Granville, and Dika (2002) concluded that high performance in mathematics is caused by interrelated variables related to students, families, teachers, and schools. On the part of the students, negative attitude towards mathematics is prevalent. Negative culture around mathematics may be caused by bad experiences in mathematics, math anxiety, and lack of support from adults (Chinn, 2012). It can be improved, however, if an adult or a teacher creates a more positive and confident culture around mathematics and numeracy (Johnson-Wilder, 2013). Further, the teacher should provide situations of success for all students to improve their self-efficacy and attitudes towards learning (Rosaly, 1992) that would highlight his or her positive emotional disposition towards mathematics (Zan & Di Martino, 2008).

It is a well-accepted view in the present-day society that teacher quality and student achievement are tightly correlated. Teachers should therefore be mentored and provided with specific feedback on their areas of strength and weakness both in subject content and related aspects like how students learn. This can help build teacher capacity and improve students learning (Educational Initiatives, 2010).

Teaching mathematics requires more than teaching students arithmetic and mathematical concepts. Mathematics involves solving and accepting mathematical problems (Castillo, 2012). Its principles and concepts are precise; that is why mathematics teachers should not only have talents in using teaching strategies but should also know which among these strategies best develop the understanding of students' mathematical thoughts. According to Saritas and Akdemir (2009), teachers' competency is one of the most influential factors for mathematics achievement. Teachers should be competent because they are expected to model appropriate mathematical concepts and terms and communicate their meaning in a way that students understand the particular mathematical language (Anthony et al., 2009).

Math teaching should be a balance of conceptual and procedural approach. It is ineffective to emphasize a high degree of procedural proficiency without developing a conceptual knowledge. Mathematics teachers should put an emphasis the relationship between, applications, and connections of mathematical concepts to real life situations (Marzano, 2008). The development of teacher knowledge is greatly enhanced by the efforts within the wider school community to improve teacher's own understandings of mathematics and mathematics teaching and learning (Cobb & McClain, 2001; Sherin, 2002). In order to enhance their knowledge, teachers need the material, systems, human and emotional support provided through professional development initiatives. Support and resourcing can also come from the joint efforts of other mathematics teachers within and outside of the school (Kazemi, 2008).

Pedagogical knowledge is also required among mathematics teachers because instructional strategies and methods should be carefully planned and executed by the teachers to provide students with learning situations where they can develop and apply higher-order operations that are necessary to improve the mathematical achievement of the students (Saritas & Akdemir, 2009). Further, teaching math should be standards-based, integrated, engaging, and open to practices of differentiated instruction, problem solving, guided practice, manipulatives, games, calculators, mathematical software and assessment and research-driven instruction (Frie, 2012), with effective motivation and integration to everyday life, and students' experiences (Köğe, Yıldız, Aydın, & Altındag, 2009), and suited for students' different learning styles (Glickman, 2011). Further, the students should be motivated by the teachers to actively participate in learning activities because they could understand mathematics concepts and have higher retention when they are practicing and experiencing the teaching and learning process (Festus, 2013).

This study focused on the subject statistics and probability offered in the senior high school curriculum as a core subject. According Garfield and Ben-Zvi (2007), statistics education is still regarded as a new and emerging discipline, when compared to other areas of study and inquiry. Leading statistics educators formulated difficulties in learning statistics, raising issues of concern in statistical education and urged a reform of statistics instruction and curriculum based on strong synergies among content, pedagogy, and technology. Statistics and probability provides a wide range of applications especially in research in all field of endeavors. Further, it is used in weather forecast, sports strategies, insurance options, games and recreational activities, risk assessment in business, game theory, environmental regulation, product reliability, defense strategies, medical decision and life expectancy, sale forecasting, scenario analysis, and gambling.

The researcher also would like to determine the knowledge level of the senior high school teachers on conducting research because the new curriculum requires the students to conduct research related to their chosen track and specialization.

Conducting research provides evidence of teachers' pedagogical practices that can contribute to desirable student outcomes (Hill, Rowan, & Ball, 2005). The teacher should understand how students learn and construct ideas, integrate evaluation with the teaching process to increase learning and improve teaching (Anthony & Walshaw, 2007).

Because of the aforementioned points, the researcher was motivated to conduct this teacher's needs assessment to determine the status of the senior high school teacher in terms of content, pedagogy, and research knowledge. In many cases, teachers are in need of specific feedback which will provide them insights on where, what and how to improve their own abilities in order to function effectively. These are needed because teachers have a number of misconceptions that they pass on the students (Educational Initiatives, 2010). Through needs assessment, planning, and implementation of intervention can be done effectively.

Methodology

This study aimed to determine the needs of senior high school mathematics (SHS) teachers in the Second District of Oriental Mindoro in teaching statistics and probability.

Specifically, it aimed to determine:

1. the profile of the senior high school mathematics teachers.
2. the level of content knowledge (CK) of the senior high school mathematics teachers.
3. the level of pedagogical knowledge (PK) of the senior high school mathematics teachers.
4. their knowledge level in conducting research.

Research Design

The descriptive method of research was used in this study. Descriptive method is characterized by an attempt to determine, describe, or identify (Ethridge, 2004) the perception of the senior high school mathematics teachers in the Second District of Oriental Mindoro respondents on their level of CK, PK, and knowledge on conducting research.

Participants, Sampling, and Setting

The respondents of the study were the 35 senior-high school mathematics teachers from the 27 private and public schools in the Second District of Oriental Mindoro. Total enumeration method was used in determining the participants of this study because the researcher wanted to have a clear picture of the needs of all the senior high school teachers in the area. The respondents were approached personally and the objectives of the study were explained to them. Informed consent from the school principals and respondents were secured for ethical considerations. The respondents were assured of the confidentiality of the

information. They were also informed of their right to withdraw their participation in the said study.

Data Collection

The main data gathering tool used for this study was a questionnaire with three major parts. The first part was the survey asked about the profile of the respondents in terms of age, sex, educational attainment, position, number of hours of seminars attended related to senior high school teaching and years of teaching mathematics. The second part was a comprehensive multiple-choice type of test in which competencies came from the prescribed curriculum guide of the Department of Education of the Philippines. This was used to determine the level of content knowledge of the respondents in Statistics and Probability. The third part of the questionnaire focused on the pedagogical and research knowledge of the respondents. The said instrument was content validated with the help of five experts. Further, its reliability was determined by using a test-retest method with the aid of Pearson's product moment correlation coefficient (CK=0.879, PK=0.966 and RK=0.941). After the instrument was proven valid and reliable, the researcher went to the different schools to distribute the instrument. It was explained to the respondents and they were given one hour to answer the comprehensive test and thirty minutes to answer the questionnaire for content knowledge and knowledge in conducting research.

Data Analysis

The data was analyzed using descriptive statistics such as mean and percentage, standard deviations, percentage of correct response and mean percentage scores. To describe the CK, the index of mastery used by the Department of Education in item analysis was applied such as *mastered* (86% - 100%), *moving towards mastery* (66% - 85%), *average mastery* (35% - 65%), *low mastery* (15% - 34%), *very low mastery* (5% - 14%) and *no mastery at all* (0 – 4%). A 5-point scale was used to describe the mean perceptions of the respondents for PK as *always practiced whenever possible* (5), *knowledgeable but not always practiced* (4), *familiar but not knowledgeable* (3), *have very limited knowledge* (2) and *no idea* (1). For the knowledge in conducting research the following interpretation was used: *very much knowledgeable and applied* (5), *knowledgeable and can apply if guided* (4), *knowledgeable but cannot apply* (3), *got the idea but don't know how to start* (2) and *no idea* (1).

Results

Among the 35 respondents, the majority of them are on early to middle-age of being professionals from age 21 to 40 (Figure 1). Further, female teachers comprised 54% of the total respondents (Figure 2). As the senior high school includes subjects that were formerly offered in the college curriculum, the Department of Education required the senior high school teachers to have a master's degree in the field of specialization or at least have some earned units in master's programs with specified number of units in major subjects. Among the respondents, only 14 of them are master's degree holders while 21 are bachelor's degree holders; however, they are all pursuing master's degree programs with specialization in Mathematics (Figure 3). Because of high academic requirements, the department issued position from teacher 2 to teacher 3 for the new applicant depending on their qualifications and promoted some of the teachers from junior high school who applied to senior high school from head teacher 1 to head teacher 3 or from master teacher 1 to master teacher 3. In the case of the senior high school teachers involved in this study, most of them were enjoying the position of teacher 3 and master teacher 1 during the data collection (see Figure 4).

The Department of Education also knew the importance and of and valued trainings and seminars since the since senior high school teachers were now expected to teach these subjects for the first time, and teaching in the senior high school is different from the usual teaching and learning process in the junior high school. Among the 35 respondents, only 5 had undergone 161 hours and above of seminars related to senior high school. As figure 5 shows, there are a large number of respondents who had not attended or attended a brief seminar about teaching senior high school, while the majority of them were the newly hired teachers with 0 to 5 years of teaching experience (Figure 6).

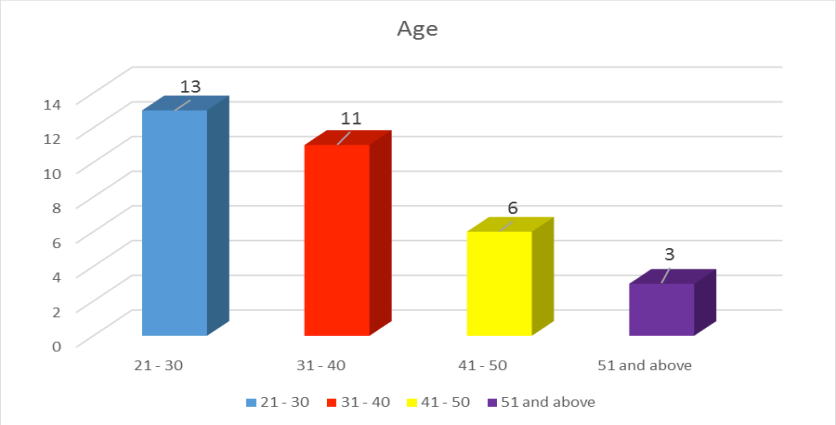

Figure 1. Age of the respondents

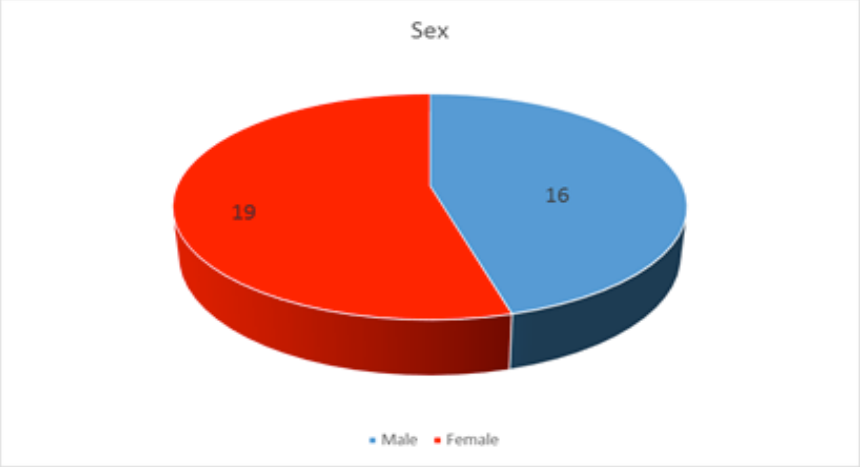

Figure 2. Sex of the respondents

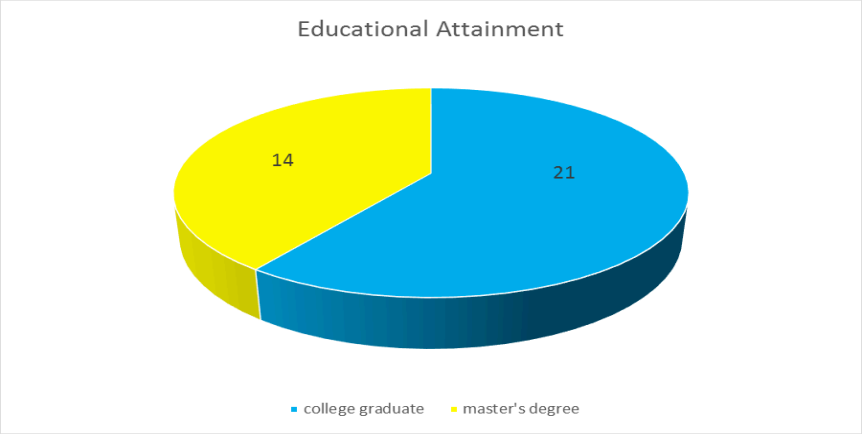

Figure 3. Educational attainment of the respondents

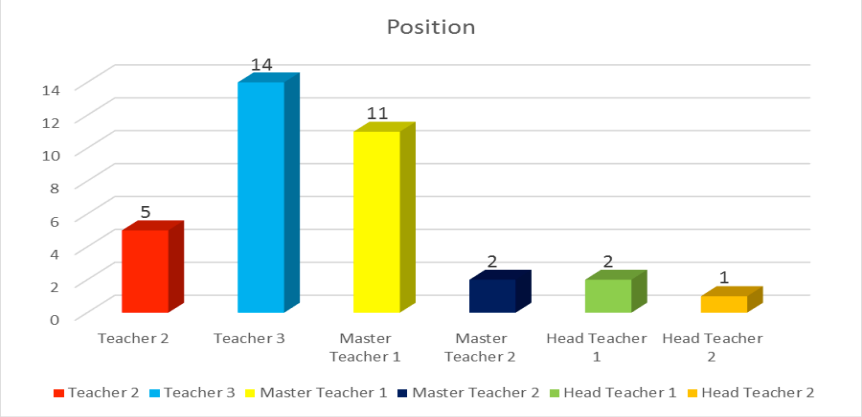

Figure 4. Position/ranking of the respondents

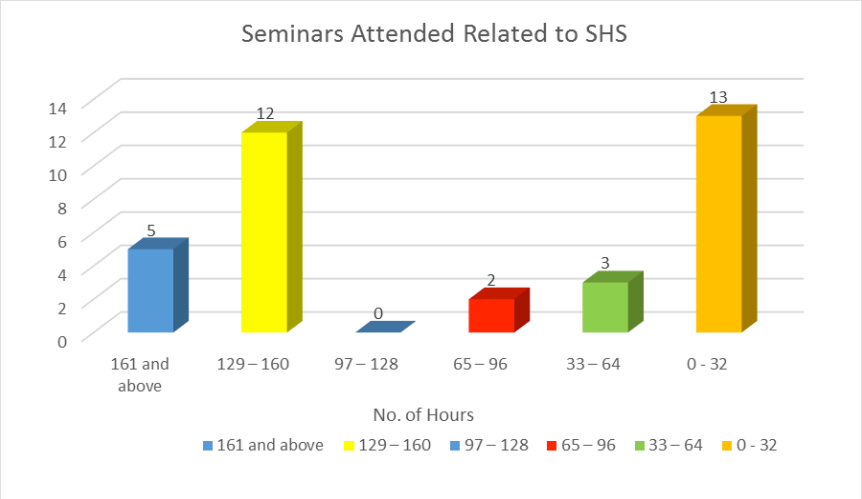

Figure 5. Seminars attended related to SHS

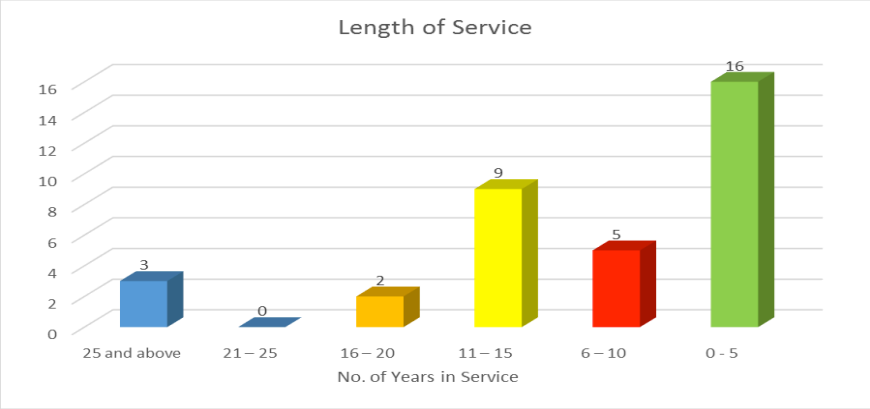

Figure 6. Years of teaching mathematics

Level of Content Knowledge

The respondents have fair level of content knowledge on the average (M = 18.29, SD = 4.93), based on the result of the 50-item test given to them. Twelve of the 35 respondents (34.29 %) have an average level of content knowledge while 22 (62.86 %) have a fair content knowledge level. There was

Table 1

Level of Content Knowledge

Score	Frequency	Percentage	Description
41 – 50	0	0	Very Good
31 – 40	0	0	Good
21 – 30	12	34.29	Average
11 – 20	22	62.86	Fair
0 - 10	1	2.86	Poor
Mean: 18.29 SD: 4.93			Fair

one respondent who had a poor level of content knowledge in Statistics and Probability (Table 1).

Analyzing the data further, the index of mastery was determined per competencies to identify which among the prescribed competencies were not mastered and should be given emphasis on the conduct of content seminar. Based on the result presented in Table 2, none of the competencies was mastered by the respondents, although random variables and probability distribution were mastered only on average.

Table 2

Index of Mastery

Competencies	Percentage of Correct Response	Interpretation
Random Variables and Probability Distribution	40.29%	Average Mastery
Normal Distribution	26%	Low Mastery
Sampling and Sampling Distribution	32.5%	Low Mastery
Estimation of Parameters	17%	Low Mastery
Test of Hypothesis	22.8%	Low Mastery
Correlation and Regression Analyses	13%	Very Low Mastery
MPS: 36.6%		

Also, the result shows that the respondents had low mastery when it came to correlation and regression analyses because most of the respondents had not yet finished their master's degree in which this knowledge was usually offered as the last subject. The data clearly show that the respondents needed to master the content in order to deliver the lesson well to the senior high school students.

Level of Pedagogical Knowledge

Table 3 presents the level of pedagogical knowledge of the respondents. As shown, constructivism was understood by most of the teachers (M = 3.87). Since some mathematics topics require pre-requisite skills, the teachers prepare and teach the topic based on the students' prior knowledge. Further, the teachers make use of diagnostic tests to identify students' prior knowledge and formulate appropriate strategies during and for the teaching and learning process. In addition, the K-to-12 curriculum uses a spiral progression approach and some of the pre-requisite skills must have been learned in students' previous grades. It is therefore necessary to review some of the topics prior to the presentation of the lesson.

Communicating mathematical concepts is the last among the presented items (M = 3.08). The senior high school math teachers were not able to use other resources such as graphic calculators, mathematical software, and manipulatives. However, they still demonstrated some ability to deliver mathematical concepts by using concrete examples and providing opportunities for the students to develop their own solution to the problems through constant practice, collaboration, and other worthwhile tasks.

Table 3

Level of Pedagogical Knowledge

Items	Mean	Interpretation
Building on Students' Thinking	3.87	Knowledgeable but not always practiced
Designing Worthwhile Tasks	3.64	Knowledgeable but not always practiced
Integrating Real Life Experiences	3.53	Knowledgeable but not always practiced
Designing Assessment for Learning	3.41	Familiar but not knowledgeable
Communicating Mathematical Concepts	3.08	Familiar but not knowledgeable
Overall Mean	3.51	Knowledgeable but not always practiced

Legend: 1—*no idea*, 2—*have very limited knowledge*, 3—*familiar but not knowledgeable*, 4—*knowledgeable but not practiced*, 5—*always practiced whenever applicable*

Level of Knowledge in Conducting Research

The respondents were knowledgeable and reported that they could present the results of a study (M = 3.52). As Mathematics teachers, it is advantageous for them in this area because they are knowledgeable in constructing graphs and interpreting them. However, some of them still showed difficulty in using excel and other software packages in constructing graphs. Another problem was the formulation of conclusions and recommendations based on the result of the study.

On the contrary, designing or mapping the research process and applying appropriate statistical tools were considered by the respondents as weak in conducting research (M = 3.04). Some of them were not familiar with the different research designs and how to construct the research paradigm. On the part of statistical treatment of the data, the respondents reported the difficulty in formulating and testing the hypothesis and identifying the appropriate tools to test the hypothesis.

Table 4

Level of Knowledge in Conducting Research

Items	Mean	Interpretation
Identifying Topic/Problem	3.23	Knowledgeable but cannot apply
Designing/Mapping the Research Process	3.04	Knowledgeable but cannot apply
Gathering Data	3.10	Knowledgeable but cannot apply
Applying Appropriate Statistical Tools	3.04	Knowledgeable but cannot apply
Presenting the Results	3.52	Knowledgeable and can apply if guided
Overall Mean	3.19	Knowledgeable but cannot apply

Legend: 1—*no idea*, 2—*got idea but don't know how to start*, 3—*knowledgeable but cannot apply*, 4—*knowledgeable and can apply if guided*, 5—*very much knowledgeable and applied*

Conclusion

The majority of the senior high school mathematics teachers of the Second District of Oriental Mindoro are aged 21 to 30 years old, female, teacher 3 or master teacher 1, bachelor's degree holders but pursuing their master's degree, have attended seminars related to senior high school and are new in the teaching profession. Because of the guidelines set by the Department of Education regarding the hiring of senior high school teachers, only those applicants with at least a master's degree or pursuing a master's degree program were hired.

The Department of Education provided the newly hired senior high school teachers some seminars and trainings for them to be familiarized with the new curriculum.

The respondents' content knowledge was found to be below the needed level of mastery among the teachers. For some teachers, statistics and probability is not an easy subject to teach and they need to improve their content knowledge and mastery to be able to deliver the lesson with ease and for their students to grasp the content, principles, and application of the subject. Further, the knowledge and skills in conducting research among the senior high school teachers were also below the expected knowledge level. Since research is included in the senior high school curriculum, the teachers should be the knowledgeable in order to guide the learners when they conduct various research on their selected track or specialization.

From the findings of this study, it is recommended that teacher training should be regularly conducted by the Mindoro State College of Agriculture and Technology through the Instruction and Extension Departments. The said training should focus primarily on the content and also tackle pedagogy and research of senior high school teachers of statistics and probability. Such trainings can greatly help the senior high school teachers to improve their content and pedagogical knowledge especially in making mathematics teaching and learning innovative, exciting, and better suited for the nature and needs of the learners. Further, skills in conducting research can help them in applying for promotion and higher ranking or position and in understanding the nature of their students, devising and finding ways to improve their instruction as well as their students' performance. Higher education institutions are capable of helping these teachers because their faculty had been teaching senior high school subjects in the former college curriculum. Further, higher education institutions also have facilities and other resources like software and modules that can be used for such trainings.

Based on the result of this study, teachers need the support of other institutions, particularly in terms of materials, systems, and human and emotional support. The result of the study supports the idea of Anthony and Walshaw (2007) which proved that although the teachers may be creative and resourceful, even more, they can learn greatly by working together with a group of supportive mathematics colleagues. Professional development initiatives are often a necessary catalyst for major change.

Acknowledgements

The author wishes to extend her gratitude to the following: MinSCAT President, Dr. Jesse T. Zamora, VPRED, Dr. Christian Anthony Agutaya, Bongabong Campus Administrator, Dr. Gregoria C. Pesigan, Director for Research, Prof. Algeline S. Herrrera, School Principals and SHS Mathematics Teachers of 27 secondary schools of the Second District of Oriental Mindoro that had been in one way or another help in the realization of this study.

References

Anthony, G. & Walshaw, M. (2009). Characteristics of effective teaching of Mathematics: A view from the West Massey University, New Zealand. *Journal of Mathematics Education © Education for All*, *2*(2), 147-164. Retrieved from http://educationforatoz.com/images/_9734_12 _Glenda_ Anthony.pdf

Anthony, G. & Walshaw, M. (2007). Effective pedagogy in mathematics/ pāngarau: Best evidence synthesis iteration [BES]. Wellington, New Zealand: Ministry of Education. Retrieved from https://www.educationcounts.govt.nz /publications/series/2515/5951

Aplaon, Z. (2015). The teaching practices in Mathematics IV, students' competence and mastery level in Bongabong Districts. Paper presented in the 2nd International Research Presentation and Seminar, Puerto Galera, Oriental Mindoro, Philippines, MinSCAT, TUCST and EDS Business School *International Research Journal, 2*(2), 18- 24.

Ashby, B. (2009). Exploring children's attitudes towards mathematics. In M. Joubert (Ed.) Proceedings of *British Society for Research into Learning Mathematics*, *29*(1), 7 - 12. Retrieved from https://www.researchgate.net /publication/237345708_Exploring_Children's_Attitudes_towards _Mathematics

Castillo, A. (2012). Level of problem solving performance in mathematics, (Master's Thesis, Mindoro State College of Agriculture and Technology, Philippines).

Chinn, S. (2012). Beliefs, anxiety and avoiding fear in mathematics. *Child Development Research*. doi:10.1155/2012/396071

Cobb, P. & McClain, K. (2001). An approach for supporting teachers learning in social context. In F. Lin & T. Cooney (Eds.), *Making sense of mathematics*

teacher education (pp. 2007-231). Dordrecht, Netherlands: Spinger. doi: 10.1007/978-94-010-0828-0_10.

Ethridge, D. E. (2004). *Research methodology in applied economics*. Ames, IA: John Wiley & Sons.

Festus, A. (2013). Activity-based learning strategies in the Mathematics classrooms: National Mathematical Centre, Abuja. *Nigeria Journal of Education and Practice 4*(13), 8-14. Retrieved from http://www.iiste.org/Journals/index.php/JEP/article /view/6768/6881

Frie, K. (2012). Balanced approach to literacy development in the early years. *National Educational Psychological Services*. Retrieved from https://goo.gl/nYnZNX

Garfield, J., & Ben-Zvi, D. (2007). How students learn Statistics revisited: A current review of research on teaching and learning Statistics. *International Statistics Review*, *75*(3), 372-396.

Glickman, C. (2011). *Supervision of instruction: A Developmental approach* (2nd ed.). Needham Heights, MA: Allyn and Bacon.

Educational Initiatives Pvt. Ltd. (2002). Teacher needs assessment. Retrieved from http://www.ei-india.com/wp-content/uploads/2012/07/Teacher -Needs-Assessment-Issue-8.pdf

Hill, H., Rowan, B., & Ball, D. (2005). Effects of teachers' mathematical knowledge for teaching on student achievement. *American Education Research Journal*, *42*(2), 371-406. doi: 10.3102/00028312042002371

Ignacio, N., Nieto, L., & Barona, E. (2006). The effective domain in mathematics learning. *Journal of Mathematics Education*, *1*(1), 16-32. Retrieved from https://www.researchgate.net/publication/316249720_The_Affective _Domain_in_Mathematics_Learning

Johnston-Wilder, S., Kooken, J., Welsh, M., Mccoach, D., & Lee, C. (2013). Measuring mathematical resilience: An application of the construct of resilience to the study of mathematics. Paper presented at the *American Educational Research Association (AERA) 2013Annual Meeting: Education and Poverty: Theory, Research, Policy and Praxis*. Pacific Grove, CA. Retrieved from http://oro.open.ac.uk/38987/

Kazemi, E. (2008). School development as a means of improving mathematics teaching and learning. In K. Krainer & T.Wood (Eds.). *Participants in mathematics teacher education* (pp. 209- 230). Rotterdam, Netherlands: Sense.

Köğe, D., Yıldız, C., Aydın, M., & Altındag, R. (2009). Examining elementary school students' attitudes towards mathematics in terms of some variables. *Procedia*, *1*(1), 291-295.

Marzano, R. (2008). Declarative vs. procedural knowledge. Retrieved from www.marzanoresearch.com.documents.

Rosaly, A. (1992). The relationship between attitude of students towards mathematics and achievement. (Master's thesis, Madurai Kamaraj University, India)

Saritas, T., & Akdemir, O. (2009). Identifying factors affecting the Mathematics achievement of students for better instructional design. Retrieved from www.itdl.org/journal/Dec_09/article03.htm.

Sherin, M. (2002). When teaching becomes learning. *Cognition and Instruction*, *20*(2), 119-150. doi:10.1207/S1532690XCI2002_1

Singh, K., Granville, M., & Dika, S. (2002). Mathematics and science achievement: Effects of motivation, interest, and academic engagement. *Journal of Educational Research*, *95*(6), 323-332. doi: 10.1080/002200670209596607.

Tella, A. (2007). The impact of motivation on students' academic achievement and learning outcomes in Mathematics among secondary school students in Nigeria. *Eurasia Journal of Mathematics, Science and Technology Education, 3*(2), 149-156.

Valle, S. (2011). Problem solving difficulties in Grade V and VI students in four districts in Baguio City. (Master's Thesis, Baguio Central University, Philippines).

Zan, R. & P. Di Martino, P. (2008). Attitude towards mathematics: Overcoming the positive/negative dichotomy. *The Montana Mathematics Enthusiast, 3, 157-168*. Retrieved from http://citeseerx.ist.psu.edu/viewdoc /download?doi=10.1.1.471.3805&rep=rep1&type=pdf

Zussette Candelario-Aplaon, MAEd Mathematics
Instructor I/Monitoriing Coordinator, Arts and Sciences
Mindoro State College of Agriculture and Technology
Bongabong Campus, Oriental Mindoro, Philippines
zeth_trix@yahoo.com