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Curriculum Implementation and Performance of Mathematics Education Students in One State University in the Philippines

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Abstract *- Studies in the past two decades revealed the poor performance of students in Mathematics. In this study, the status of implementation of Bachelor of Secondary Education (BSEd) Mathematics Curriculum in One State University in the Philippines was analyzed using the descriptive evaluative research design. Five Mathematics professors were interviewed together with 42 BSEd Mathematics Major students. Document analysis was done on the submitted syllabi of the professors and the modes of assessment that they use for each lesson objective. Policies and Standards set by the Commission on Higher Education were also used to determine the status of compliance of the University in the offering of Bachelor of Secondary Education-Mathematics field of specialization. Based on the result, the university fully complied with the policies on Program Administration, Library, Facilities and Equipment, Laboratory School, and Admission and Retention but partially compliant on faculty qualifications.*

Keywords – Mathematics Education, Curriculum, Implementation

INTRODUCTION

The basic education curriculum in the Philippines offers 1 year in the Kindergarten, six years in the Elementary Level, four years in the Junior High School, and two years in the Senior High School [1]. This current curriculum is a product of transition from K-10 basic education curriculum which provides avenue for teacher's professional advancement through spiral approach. In this approach, all subject areas in a specific discipline shall be taught by the teacher who teaches the subject which is one of the highlights of Mathematics teaching. This spiral progression conveys that when a specific topic progresses, many details are added in the learners' learning. Because one of the impacts of the addition of two years in basic education is two year-declining enrollees of the higher education institutions (HEIs), some HEIs offered Senior High School that filled the gap in their declining enrollment status. Likewise, the Commission on Higher Education launched lifelong learning track to trace the learners (specifically OSY) to go back to schooling. There is also preparation conducted by the institutions of higher learning since upon full implementation of K-12 curriculum, general subjects in the tertiary level were dissolved and changed to something that is beyond the orientation of specific disciplines which require higher level learning [2].

However, before the transition of the K-to-12 from high school to tertiary, there is a need to review the existing curriculum for the teacher education particularly those who are greatly affected by Spiral progression approach, as an example, Mathematics. Mathematics curriculum in the K-to-12 is really spiral in approach which is in contrast to the curriculum during the time where the teachers were still studying. If the students, according to the K-to-12 law, are expected to be equipped, it is imperative to the teachers to do it n^{th} times to cope up with the needs and competencies of the students. Hence, future Mathematics teacher should be trained to the highest extent for they are expected to have advanced competencies than their future students. With this, there is a need to revisit the curriculum implementation of Bachelor of

Secondary Education Major in Mathematics if it is really matched to what the curriculum sets as standard.

For the past 15 years, results of studies and performance tests revealed the poor Mathematics performance of students. Several studies proved the poor performance of the students in Mathematics from basic education up to higher education level. According to the study about performance on Mathematics Departmental examination [3], the performance of the students in Algebra and Trigonometry in which result showed that students who took the two subjects were not able to meet the required criteria. Similar result is found among proficiency of grade 9 students in which performance is at the beginning level [4]. In the higher learning level, the achievements of students in Mathematics courses such as Fundamental Mathematics and Contemporary Mathematics is at the poor level [5]. Similar results are found about this underachievement of students in Mathematics [6]. More so, the Third International Mathematics and Science Study (TIMSS) 2003 data revealed that Filipino students' poor mathematical performance has placed the country in the 36th rank out of 38 nations worldwide [7]-[8]. With this problem faced by the Mathematics education in the Philippines, there is a need to dig out possible causes and provide solutions, if not, preventive measures for such. In this study, the curriculum implementation in One State University is assessed in relation to the set Standard of the CHED with respect to Administration, Faculty, Library, Laboratory and Facilities, Laboratory School, and Admission and Retention.

According to Commission on Higher Education Memorandum Order 52 series 2007 if the college offering the education degree is a college of education, the dean must be holder of doctorate degree in education or in allied field and passed the licensure examination regulated by the Professional Regulations Commission (PRC). In terms of faculty, a master's degree in education or allied discipline is required for teaching in the tertiary level. One hundred percent of the full-time and a minimum of fifty percent of the part-time must have finished master's degree in the discipline or its equivalent. With respect to library, the library should have a head librarian and an appropriate number of staff. The head librarian should have an appropriate professional training; be a licensed librarian; and have a Master's degree in Library and Information Science.

In terms of classrooms, for lecture classes, the ideal size is 35 students or less per class, and the maximum should be 50. For laboratory and research classes, special lectures with more than 50 students may be allowed as long as there are provided attendant facilities. Also All TEIs should maintain a facility within which the students can undertake their field study. This facility may be a laboratory school which is administered by the TEI and its faculty. In cases when TEI has no laboratory school, the TEI must have a long-term memorandum of agreement with a cooperating school or with a cluster of cooperating schools within which students can undertake their field study. The basic requirement for eligibility for admission of a student to any tertiary level degree program shall be a graduation from the DepEd recognized secondary school. TEIs must have a system of selective admission into the programs for teacher education. These criteria include passing a standardized admission test in which students who do not meet the minimum competency may be admitted under probationary status. However, certain minimum retention requirements must be met before the student can proceed to the major or professional education courses [9].

OBJECTIVES OF THE STUDY

The primary objective of the study is to determine the status of implementation of the BSEd Mathematics Major curriculum in One State University in the Philippines such as program administration, faculty, library, facilities and equipment, laboratory school or cooperating school, and admission and retention policy as reflected in the Commission on Higher Education Memorandum Order Number 52, series 2007. In addition, it aims to determine the

performance of BSEd mathematics major students in their major subjects. The conceptual framework below shows the influence of six curriculum parameters to the performance of the students in when properly implemented. The program administration, faculty, library, facilities and equipment, laboratory school or cooperating schools, and admission and retention are the baseline policies to be implemented in the BSEd curriculum. The roof of the framework shows the performance of the students in their different major subjects. Curriculum implementation is being affected by several factors such as the students, teachers, resource materials, facilities, assessment culture, and environment [10].

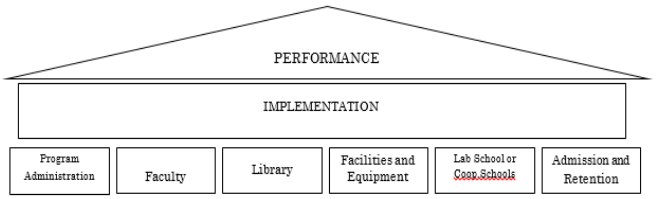

Figure 1. Conceptual Framework of the Study.

MATERIALS AND METHOD

This research utilized descriptive evaluative design of research. This design was found as the most appropriate since it gives emphasis on actual present scenario in the chosen setting. Through the use of this design, the coherence between the practice (implementation) and outcome (evaluated performance) is determined. The respondents of the study were all Mathematics professors in the College of Teacher Education who were teaching Major subjects during the conduct of the study. There were 5 full time Mathematics professors/instructors interviewed in addition to 42 Mathematics major students who were requested to provide copy of their grades in their major subjects enrolled during the previous semester relative to the conduct of the study. The present study used the CHEd Memorandum Order No. 30 series of 2004 Revised Policies and Standards for Undergraduate Teacher Education Curriculum as well as the section 2 of the CHEd Memorandum Order (CMO) 52 series of 2007 or the Addendum to CMO 30 series of 2004 entitled revised policies and standards for undergraduate teacher education curriculum in determining the adherence of the College on the Curriculum Standard. Upon approval of the research proposal, the questionnaire subjected to content validation and approval by the experts in the field of education and Mathematics. Teacher-respondents were given request letter asking for the copy of the submitted course syllabi (learning programs) in the office of the Dean for evaluation. Upon approval, a letter request was forwarded to the office of the Dean of the College of Teacher Education. Finally, letter request was given to Mathematics major students for the copy of their grades during the previous semester of the Academic Year. Letter request was also sent to the quality assurance officer requesting for the evaluation of the submitted syllabi against the developed and validated criteria.

RESULTS AND DISCUSSION

Adherence to Curriculum

The Bachelor of Secondary Education (BSEd) Major in Mathematics in the State University where the study was conducted consists of 63 units of general education subjects, 51 units of Professional Education courses, and 60 units of major subjects. In addition, the college added a 3-unit non-credit subject for Licensure Examination Review to ensure high passing percentage in the Licensure Examination for Teachers. As stipulated in the CMO 30 series of 2004, BSEd should have taken 63 units of general education courses, 51 units of Professional Education courses, and 60 units of major subjects. The general education and legislated courses shall follow the CMO 59 s. 1996 recommendation that there shall be 63 units in the general education courses. In terms of professional education courses, subjects are expected to be taught in an integrated manner. This means that theoretical disciplines must be

linked to the actual setting and development of methods, strategies and imposed experiential learning. After the data were subjected to documentary analysis; it is found that there is congruency between the actual implementation of the Mathematics curriculum and the minimum requirement prescribed by the Commission on Higher Education. Hence, the present curriculum implementation adheres to what the CMO 30 series of 2004 stated that teacher education curriculum provides minimum requirements for the course specifications for selected general education courses, all professional education and specialization courses.

The Commission on Higher Education Memorandum Order Number 52 series of 2007 provides guidelines on the Competency Based Teacher Standards that serves as standard in the evaluation of adherence. There are six major requirements set by the CMO 52 s. 2007 which were used to determine the status of adherence of the College of Teacher Education. As to program administration, it was found that the Dean of the College of Teacher, offering the Bachelor of Secondary Education Major in Mathematics, is a graduate of Doctor of Philosophy in Education Major in Educational Management, a licensed professional teacher who has been teaching more than 10 years. According to the standard set by the Higher Education, if the College offering the Education degree is a College of Education, the Dean must be a doctoral degree holder in education. This result reveals that section 2 of the CMO 52 is adhered by the College of Teacher Education. Giving focus on the remaining sections of the CMO 52, only section 3 is not fully adhered by the BSEd Mathematics curriculum. The findings show that only 50% of the regular faculty who are teaching Major field of Specialization are graduates of Master's degree related to Mathematics. Since the impact of faculty and their belief about the teaching and learning mathematics are critical in determining the curriculum reform [11], faculty members who are teaching Mathematics major subjects were interviewed and based on the result about their behavior in teaching mathematics and the support given by the institutions. Faculty members who are teaching major subjects in Mathematics strongly believed that the essence of Mathematics is not on the problems and skills in solving the problems but on work, positive attitude and engagement. They likewise strongly agreed that there should be integration of technology in delivering topics and concepts to students. Additionally, they believe that there should be no gender bias, stereotyping, and stratifications in teaching Mathematics.

In terms of institutional support, results show that there is a support given to them by the institution when it comes to finishing higher education in allied field. There is also encouragement coming from the administration regarding the attendance of the faculty to seminars, trainings, conferences and the like. Paper presentations of faculty to different symposia, fora, and seminars are also supported by the institution. There are also awards and incentives given by the institution to the faculty particularly in their scholarly accomplishments. Thus, the institution is found responsive to the needs of the faculty members. The institution has also provided subsidies for graduate studies of the faculty especially in the tuition through a contract. According to the faculty respondents, the institution has a mechanism to grand study leave with pay aside from the subsidies given to the faculty who wishes to avail the program. Incentive system is also present in the institution in giving publication awards aside from the budget allotted per faculty in terms of research presentation.

Content of Syllabus

The competencies set by the curriculum and the objectives set by the faculty in their submitted syllabi are presented below. The Bachelor of Secondary Education major in mathematics specialized curriculum started with the exploration and familiarization of primitive mathematics up to modern world mathematics (history of mathematics) followed by the theory and evolutions of numbers (number theory) and

proving theories related to mathematics development (abstract algebra). The study of fundamental concepts of functions leading to the advanced concepts of mathematics is the 4th major subject (Advanced Algebra) of the student-respondents taken during their second year of studying. The development of skills and concepts about trigonometric functions, identities, principles, laws and theorems and the applications of these concepts to problem solving (Trigonometry) is the major 5 of the students under the curriculum. Studying points, lines and planes including angles and other basic principles of Euclidean Geometry (Plane Geometry) is the 6th major subject of the respondents. Next major subject is about collection of data using different sampling techniques, methods of presenting, describing, and interpreting data (Elementary Statistics) then, studying limits, continuities, and derivatives are covered in the Calculus I major subject. Doing research in mathematics discipline through Action Research in Mathematics is the 9th major subject of the students. Calculus II which focuses on the anti-differentiation or integration including its application in solving areas and volumes is the 10th major subject offered in the curriculum. Solid Geometry, Linear Algebra, and Advanced Statistics are the next three major subjects. These subjects focus on three dimensional structures and constructions; discussion on matrices and vectors including spaces, and hypothesis testing applied using statistical measures in both parametric and non-parametric data. Instructional Planning through the use of different techniques in teaching mathematics (Instrumentation in Mathematics) is the 14th major subject of the respondents. It focuses on training the respondents to become effective and efficient mathematics teachers in terms of developing instructional aids and prepare necessary instructional tools with minimum cost. Two Geometries follow after major 14. These Geometries focus on Analytic and Modern or non-Euclidean Geometry. Analytic geometry focuses on solving problems integrating algebra and geometric concepts while Modern Geometry goes beyond Euclidean. It solves problems related to Spherical and Hyperbolic geometries. Next is the Probability. In this subject, the binomial theorem, counting techniques and principles, probability concepts and decision making are given focus. The last three major subjects highlighted the development of facilitating competencies of the students through Seminar in Mathematics, Problem Solving, and the use of Technology in teaching mathematics. Based on the underlying concepts, it is observed that nine (9) course descriptions mentioned the utilization of graphing calculator and computer algebra system. This result signifies that there is technology integration happening from the traditional Mathematics teaching to more technology-based methodologies. It is also noteworthy that the offering of the subjects started from the development of mastery of the subject matter (Mathematics) while the last part is on the development of teaching competency. In general, the objectives set by the faculty are parallel to the course description of each subject in the BSEd curriculum.

Assessment Tools

The most frequent number of assessment tool in teaching Mathematics major subjects is recitation as it comprised 25.25%. This is followed by Quizzes (21.21%), Paper and Pencil Test, Take Home activities, boardwork, journal writing, problem sets/worksheets, and term paper. The same rank is given to concept note, demonstration, film review, hands-on with computer, reporting, and research. Assessment does not merely occur at the end of a unit or course. It rather occurs continuously and is an integral part of daily classroom practice [12]. The statement conforms to the principle of assessment that it can be done before, during, or after the lesson or course. The documented tools by the faculty of Mathematics Education show that there are variety of assessments given by the faculty to the BSEd students. These assessment tools are also categorized as traditional, performance, and portfolio assessments. Overall, recitation ranked

first which provides an implication that in the 21st century mathematics education, recitation still shows its effectiveness. A study in 2014 [13] concluded in using three different sessions of recitations in which the study demonstrated methods of raising student success rates in large enrolment (lecture-format) course.

Performance in the Field of Specialization

The grading system in the University where the study was conducted ranges from 1.00 (Excellent) – 5.00 (Failed). The grade of 1.00 is equivalent to 99-100% performance rating; 1.25 means 96-98%; 1.50 is equivalent to 93-95%; 1.75 represents 90-92% performance; 2.00 is 87-89% performance; 2.25 is equivalent to 84-86%; 2.50 represents 81-83% performance; 2.75 is 78-80%; 3.00 is 75-78% performance. Below 3.00 is 4.00 which means the student is in conditional stage while 5.00 means that the student is failed. Incomplete grade (INC) means that a student needs to comply with necessary requirements in order to obtain his/her actual performance. The performances of the Mathematics major student-respondents were obtained the data they provided and verified through the records of their respective professors with their informed consent. Based on the illustration, except for Major 3 which is an isolated case, all other subjects do not provide large dispersion value. Performances do not vary significantly among each other. Focusing on Major 3 (Abstract Algebra), based on the responses of the students during the unstructured interview, the subject is really difficult for it focused more on proving and applying Mathematics theories in logical and analytical reasoning rather than use of specific examples in which they are more familiar with. The orientation of the student-respondents in their high school mathematics is dissimilar on the discussions done in Abstract Algebra. In general, Mathematics major students performed Satisfactory in their different major fields of specialization. Data revealed that Mathematics major students performed conditional when the subject requires advanced analytical and logical reasoning (Abstract Algebra). While they performed Very Satisfactory when the subject is technology integrated discipline (Modern Geometry). This result connotes that in the advancement of technology where everything is placed on-line, the attitude and study habits of the students are gradually decreasing. This is due to the reason that everything is already provided to them. Hence, in return, they become dependent on what they see in the internet without chunking what is constructive and destructive in their learning. In an increasingly technological society, where knowledge of mathematics is needed to obtain a desired position in workforce, this means that students who procrastinate in the learning of mathematics are likely to limit their career choices to those that do not require mathematical skills [14]. In addition, findings show that when it comes to foundation subjects, students performed satisfactory while very satisfactory when it comes to advanced subjects. This result implies that there is a need to upgrade the foundation of the students in their major subjects since it was found to have significant effect to their performance in their higher Mathematics subjects.

CONCLUSION AND RECOMMENDATION

The Mathematics curriculum in the College of Teacher Education in the research setting was found conformant to the set minimum requirements of the Commission on Higher Education in terms of Program Administration, Library, Facilities and Equipment, Laboratory School, and Admission and Retention but not on the faculty qualifications. The Mathematics curriculum content, particularly major subjects are offered progressively in which some of the subjects are pre-requisite of the succeeding subjects. Most of the teacher respondents are engaged in to utilizing recitation assessment and few among the subjects are given other modes of assessment. The overall performance of the Mathematics major students is Satisfactory. In terms of teacher's behavior, all the respondents agreed that teaching mathematics is not only

teaching of skills but also attitude. Based on the foregoing findings, it was concluded that the BSEd Mathematics Major curriculum follows directly what is mandated by the Commission on Higher Education in terms of Program Administration, Library, Facilities and Equipment, and Admission and Retention while partially compliant on Faculty qualification. It was also concluded that majority of the used mode of assessment in teaching major subjects is recitation which solicits students critical and creative response to the posed problems. Finally, it was concluded that there is a need to upgrade the foundation of the students in basic Mathematics. Relative to the findings and conclusion of the study, it is recommended that the institution should provide a concrete faculty development plan to comply with the minimum requirements set by the higher education. Teachers on the other hand, are encouraged to create their own professional development plan so that they can continuously grow in their field of specialization. In addition, BSEd Mathematics major students are encouraged to widen horizon in venturing basic Mathematics for them to become skilled more when studying advanced mathematics. Finally, similar study should be conducted using other set of variables to further determine the status of adherence to the set standard by the higher education.

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