PRE-SERVICE TEACHERS' MATHEMATICS ACHIEVEMENT ANDCONTENT COMPETENCE IN THE K TO 6 BASIC EDUCATION PROGRAM

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Abstract

This study ascertained the pre-service teachers' (PTs) Mathematics content competence (MCC) of the common content knowledge (CCK) and specialized content knowledge (SCK) emphases of the K to 6 Basic Education Program (BEP) and the relationship between MCC and mathematics achievement among the seventy-eight randomly chosen Bachelor of Elementary Education (BEEd) major in General Education (GenEd) PTs. MCC data were obtained using a researcher-made instrument which was subjected to validation and reliability testing (Cronbach's alpha =0.978). Mathematics achievement data were obtained using the PTs' records from the Registrar's Office. The statistical analyses employed in the study were mean, SD, and Spearman's rho. The findings revealed that the PTs had good MCC in CCK while poor MCC in SCK emphases of the K to 6 BEP and showed very good mathematics achievements. A significant relationship was found between the PTs' mathematics achievement and MCC in the CCK emphases of the K to 6 BEP. Therefore, the PTs showed competence in the basic concepts and procedures of elementary mathematics. However, they had inadequate competence needed in the actual effective teaching of the discipline. Moreover, the more mathematics content and procedures they had learned from their teacher education program, the better were their MCC in the CCK emphases of the K to 6 Program. The findings from this study have implications for faculty development as well as for future research.

Keywords: *mathematics content competence, common content knowledge, specialized content knowledge, mathematics achievement, k to 12 basic education program*

Introduction

The system of education in the Philippines has evolved vis-à-vis the country's rich historical experience from a succession of colonizers to the years of independence. Distinct policies and curricula at every period — exclusive education and different curricula for the males and females during Spanish times, public school system and bilingual instruction in the American period, and the restructured Basic Education Curriculum in the Fifth Republic, among others — have contributed to the formation of our educational system. Today, another massive reform had been enforced inresponse to international calls for global competency and acceleration of Filipino graduates' qualifications to meet global employment standards.

The Philippine Qualifications Framework (PQF), a collaborative program participated in by the Department of Education, Commission on Higher Education, Technical Education and Skills Development Authority, ProfessionalRegulation Commission, and the Department of Labor and Employment, prescribed the reforms that are to transpire in both basic and higher education in the Philippines.

The challenges of globalization, the labor mobility within Southeast Asian nations, and the changing character and needs of 21st-century learners were among the mentioned grounds of this landmark decision. Foremost among these reforms is the implementation of the K to 12 Curriculum under Republic Act 10533, otherwise known as the Enhanced Basic Education Act of 2013, beginning with the compulsory kindergarten schooling in pursuance to RA 10157 or the Kindergarten Act of 2012, to the expanded basic education of additional two years as Senior High School.

The Commission on Higher Education (CHED), on its part, responded to this educational reform by mandating all Higher Education Institutions (HEIs) to offer quality programs that meet nationaland international standards for disciplines and/or professions. Moreover, CHED formulated newpolicy, standards, and guidelines (PSG) of program offerings to cater to the K to 12 BEP graduates who desire to pursue a college degree. Graduates of HEIs' diverse programs are then anticipated to have abilities akin to existing global requirements (CHED Memo. No. 46, s. 2012).

For vertical articulation, changes in the curriculum and teachers' qualification requirementswere also implemented (DepEd Order No. 42, s. 2017). The K to 10 mathematics program adopted a spiral curriculum prepared by the Science Education Institute, Department of Science and Technology (SEI-DOST), and the

Philippine Council of Mathematics Teacher Education (MATHTED), Incorporated (K to 12 Curriculum Guide for Mathematics, 2012). SEI-DOST and MATHTED (2011) also formulated the Framework for Philippine Mathematics Teacher Education (FPMTE) to serve as a guide for Teacher Education Institutions (TEIs) in the educational and professional development of prospective mathematics teachers for the K to 12 BEP. FPMTE delineated the standards of effective mathematics teachers in terms of their content and pedagogical knowledge, and personal and professional attributes to effectively manage various aspects of the teaching and learning process. FPMTE is considered a useful resource manual to educate future K to 12 teachers to becomparable to their foreign counterparts and abreast withworld standards.

SEI-DOST and MATHTED (2011) also stressed that teachers must possess Mathematics Content Competence (MCC) to promote excellence in teaching mathematics, particularly on students' sense-making of concepts and procedures. Teachers with MCC can provide both step-by-step strategies(product-oriented) in problem-solving and logical explanation of underlying concepts and thenecessity of a precise step (process-oriented) (Lachner & Nuckles, 2016). On the other hand, Seteromo et al. (2018) warned of risks in students' learning if teachers lack MCC. Students may misunderstandconcepts due to teachers' poor recognition of correct or incorrectanswers to questions, incorrect usage of mathematical language and notations, and inability to adjust the difficulty of the content to students. Among the prospective/pre-service teachers (PTs), Tasdan and Koyunka (2017) contended that the PTs' limited expertise in mathematics content would cause them to use complex and confusing contexts of real-life examples of a mathematical concept when teaching. This teaching practice may result insuperficial learning among students (SEI-DOST & MATHTED, 2011). Teachers' MCC, therefore,affords them the confidence to explain learners' answers, use correct mathematical language and notations in theirexplanations, and use appropriate representations and examples of a mathematical idea.

The PTs in mathematics, therefore, must have adequate preparation in teaching the discipline's content. Two suggestions were raised to attain this objective: (1) alignment of the PTs' mathematics courses'contents to the school mathematics they are soon to teach and (2) the similarity of teacher educators' representation of mathematicscontents and the actual work of mathematics teachers in theclassroom (Koponen et al., 2016). These requirements are critical as the PTs tend to adopt teaching practices and techniques for

conceptual understanding inmathematics based on how they were taught in their teacher education (Jansen et al., 2017). Hence, appropriately educating the PTs through comprehensive coverage of school mathematics will equip them to address the demands of actual teaching.

One of the programs designed to assist the PTs in mastering the subject matter and effective pedagogical skills in teaching any discipline in Grades 1 to 6 is the Bachelor of Elementary Education (BEEd). BEEd graduateswill teach all subjects at the elementary level, making theiracquisition of mathematics content competence highly essential. The PTs of Carlos Hilado Memorial State College (CHMSC) for the school year (SY) 2018- 2019 were products of the old BEEd program curriculum. Hence, it would appear that their teaching preparations in mathematics were more focused on the acquisition of a wide range of specialized knowledge of the discipline that is different from the content knowledge emphases of the K to 6 mathematics program.

The preceding scenario demonstrates an incongruence between mathematics teaching preparation, specifically oncontent competence and pedagogical skills, of the BEEd GenEd PTs and the mathematics content they are expected to teach. Therefore, the relationship between the PTs' competence in specific mathematics content knowledge emphases in the K to 6 BEP and their mathematics teaching preparation, as measured by their mathematics achievement, is worth investigating. The investigation will then inform teacher education institutions (TEIs) and educators of the particular content knowledge emphases under the K to 6 mathematics program that need to be revisited. It is within this context that this investigation was conducted. Mathematics, 2012). SEI-DOST and MATHTED (2011) also formulated the Framework for Philippine Mathematics Teacher Education (FPMTE) to serve as a guide for Teacher Education Institutions (TEIs) in the educational and professional development of prospective mathematics teachers for the K to 12 BEP. FPMTE delineated the standards of effective mathematics teachers in terms of their content and pedagogical knowledge and personal and professional attributes to effectively manage various aspects of the teaching and learning process. FPMTE is considered a useful resource manual in the quest to educate future K to 12 teachers to be comparable to their foreign counterparts and abreast with world standards.

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Theoretical Framework

Ball et al. (2008) posited in their Mathematical Knowledge for Teaching (MKT) Framework that high-quality mathematics teaching requires subject matter knowledge (SMK) and pedagogical content knowledge (PCK). In this framework, SMK is the teacher's knowledge that does not need knowledge about students or knowledge of teaching methodology. It includes three categories of knowledge: common content knowledge (CCK), specialized content knowledge (SCK), and horizon content knowledge (HCK). On the other hand, Ball et al. (2008) categorized PCK as a combination of teachers knowledge of the content and students (KCS), knowledge of content and teaching (KCT), and knowledge of content and curriculum (KCC). However, for this study, the researcher chose to focus on teachers' SMK, specifically CCK and SCK. Lee (2017) stressed that these domains of teachers' knowledge are the most essential in actual teaching.

CCK is described as the common mathematical knowledge and skills everyone should know (Browning et al. 2014; Ball et al., 2008). In the case of teaching, CCK may encompass teachers' knowledge and abilities on defining and describing properties of a concept, calculating, problem-solving, making the connection of one concept to other concepts, relating concept's application to real-world situations, using mathematical terms and notations correctly, and performing the assigned task to students (Tasdan & Koyunkaya, 2017; Koponen et al., 2016; Ball et al., 2008).

SCK refers to the teachers' mathematical knowledge and skills that are useful in effective teaching. This knowledge is used when teachers use appropriate examples or representations of a mathematical concept and when teachers need to simplify or complicate the teaching of a concept (Ball et al., 2008; Tasdan & Koyunkaya, 2017). Teachers also use SCK once they justify or prove mathematical ideas or conjectures, pose appropriate problems of the concept, use correct mathematical language in explaining the concept, and relate to the different usage or meaning of a concept (Tasdan & Koyunkaya, 2017).

The FPMTE formulated by SEI-DOST and MATHTED was also used in the study. SEI-DOST and MATHTED (2011) stressed that teachers must be competent in the content knowledge emphases of each strand in the K to 6 mathematics, namely: number and number sense, measurement, geometry, patterns, functions, and algebra, and data, analysis, and probability. Teachers can show their mathematics content competence (MCC) if they can define or describe the properties and structures of mathematical concepts correctly, derive formulas, solve problems, pose problems involving mathematical ideas, make conjectures based on observable phenomena, verify conjectures, represent concepts using appropriate objects or real-life situations, and work with all types of operations and analysis.

Therefore, it is precise to adopt the FPTME set of standards in assessing the PTs' MCC of the content knowledge emphases of the K to 6 Mathematics (SEI-DOST & MATHTED, 2011) and use the MKT framework of Ball and his colleagues in specifying the domain of SMK as to CCK or SCK. Finally, it was worth determining if BEED–GenEd PTs' mathematics achievement in the teacher education program is related to their MCC. More specifically, this study sought to (1) determine the level of the PTs' MCC as a whole and in terms of the CCK and SCK emphases of the K to 6 BEP according to content strands; (2) determine the level of the PTs' mathematics achievement; and (3) determine if there is a significant relationship between the PTs' mathematics achievement and their MCC as a whole and in terms of CCK and SCK emphases of K to 6 BEP.

A schematic diagram showing the variables treated in this study is presented below.

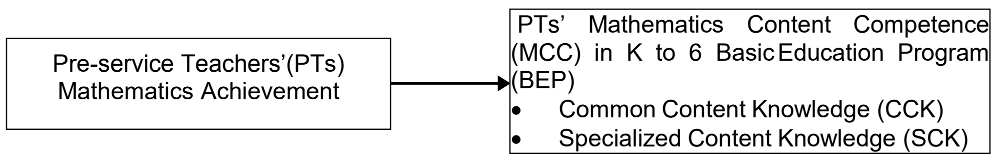

Figure 1. PTs' Mathematics achievement in relation to their Mathematics Content Competence (MCC) of the knowledge emphases of K to 6 BEP.

Methods

Research Design

This study employed a descriptive correlational design since it was concerned with assessing the relationship between BEEd-GenEd The PTs' mathematics achievement and their MCC. The study is descriptive since it aimed to describe the PTs' mathematics achievement and MCC of the knowledge emphases of the K to 6 BEP (McMillan & Schumacher, 2006).

Study Participants

The study participants were seventy-eight (78) of the ninety-six (96) PTs under the program — BEEd –Gen. Ed., SY 2018-2019. They were chosen since their mathematics teaching preparation seemed to be incongruent to the required teaching content competence of K to 6 BEP. They were randomly selected, and their number was determined using Slovin's formula.

Research Instrument

This study utilized the PTs Mathematics Content Competence (MCC) Questionnaire (PTMCCQ), a researcher-constructed instrument in gathering data of PT's MCC on the content knowledge emphases of the K to 6 BEP. The PTMCCQ was based on the FPMTE and composed two blocks of questions: Block I – PTs' Personal Information and Block II – PTs' Mathematics Content Competence (MCC).

Block II was made up of (1) number and number sense, with 14 items covering description of properties or structures of real, irrational, imaginary, and non-real numbers, percentage, ratio and proportion, numbers in exponential notation, and divisibility and other competencies as posing problems and making and verifying conjectures; (2) measurement, with 18 items covering description of properties or attributes of length, mass, weight, time, temperature, speed, angle measurement, electric meter, and water meter, derivation of formula for perimeter and area of various plane regions and volume and surface area of various solids, and other competencies as using appropriate units, comparing mathematical and real world objects, posing and solving problems, and making conjectures on measurement; (3) geometry, with 16 items covering description of properties and relationships of points, lines, planes, angles, parallel, intersecting, and perpendicular lines, triangles, quadrilaterals, and various solid figures, and other competencies as representing geometric terms, constructing geometric figures, demonstrating geometric connections, posing and solving problems, and making and verifying conjectures; and (4) patterns, functions, and Algebra, with 8 items covering sequence, finding missing values, formulating conjectures on observed patterns, solving simple equations and inequalities, translating real-life verbal expressions into algebraic expressions and equations, representing quantities, posing algebraic problems, and solving routine and non-routine mathematical problems; and (5) data, analysis and probability, with 13 items covering organization and interpretation of collected textual, tabular, and graphical data and other competencies as representing outcomes of experiments, describing terms in counting techniques, describing the meaning of probability, posing and solving problems using data presented involving experimental and theoretical probability, and making and verifying predictions.

Respondents rated their competence in teaching each mathematics content using a 4- point scale with 4 for Very Competent (VC), 3 for Competent (C), 2 for Incompetent (I), and 1 for Very Incompetent (VI). The face and content validity of the instrument were ascertained through a peer review of mathematics educators. The instrument was pilot tested to thirty (30) BEED-GenEd PTs of one City College. The instrument was reliable with a reliability index of 0.978 using Cronbach's alpha.

The PTMCCQ was used to assess the PTs' MCC of the content knowledge emphases of all content strands of the K to 6 Mathematics Program. PT's MCC level was interpreted using the following scale:

Mean Scale	Description	Verbal Interpretation
3.51– 4.00	Very Good	The PTs have the complete knowledge needed in theteaching of mathematical concepts and/or skills.
2.51– 3.50	Good	The PTs have adequate knowledge needed in the teachingof mathematical concepts and/or skills.
1.50 -- 2.49	Poor	The PTS have inadequate knowledge needed in the teaching of mathematical concepts and/or skills.
1.00 –1.49	Very Poor	The PTs have no knowledge needed in the teaching of mathematical concepts and/or skills.

To determine the strength of the linear relationship between the two variables, the following scale for *rS* is adopted from Lind et al. (2006):

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Value of *rS*	Interpretative Description
± 1.00	Perfect correlation
Between ± .50 to ± 1.00	Strong correlation
± .50	Moderate correlation
Between .00 to ±.50	Weak correlation
.00	No correlation

Data Analysis Procedure

The statistical analyses employed in the study were mean, standard deviation, and Spearman rho. The mean was used to ascertain the level of the BEEd-GenEd PTs' mathematics achievement. It was also used to ascertain the level of their MCC in the overall content knowledge, CCKand SCK emphases of K to 6 BEP, and when classified according to the different content strands. The SD was used to determine the index of variability. The SD helped the interpretation of homogeneity or heterogeneity of means. Lastly, Spearman rho was used to determine if a significant relationship existed between the PTs' mathematics achievement and their MCC as a whole and in terms of CCK and SCK emphases of K to 6 BEP.

Limitations of the Study

The study involved a small size of sample drawn from one higher education institution. Hence,it is not the intention of this study togeneralize the mathematics content competence of the PTs for elementary education. A further limitation of the study is the measure of MCC based on the sample's perception. This may be broadened by observing the actual teaching of the PTs. Validation of teaching practices of PTs may be linked totheir teacher education program.

Results and Discussion

Level of MCC of the Content Knowledge Emphases of the K to 6 BEP

Table 1 presents that the MCC of the PTs in the overall content knowledge emphases was good (*M* = 2.53, *SD*= .46). Both mean scores in the overall content and in each strand were highly homogeneous (*SD*=.46 - .56*).* The PTs appeared to have good MCC in the overall content knowledge emphases of number and number sense (*M* = 2.68, *SD* = .48), measurement (*M* = 2.55, *SD* = .52), and geometry (*M* = 2.57, *SD* = .52) while they had poor MCC in patterns, function, and algebra (*M* = 2.41, *SD* =.56) and data, analysis, and probability (*M* = 2.35, *SD* = .56).

This study ascertained the BEEd-GenEd PTs' competence in the Mathematics content (MCC) knowledge emphases of the K to 6 BEP and the relationship between their MCC and mathematics achievement. The result of the study appeared that the PTs had adequate mathematical knowledge of the overall content knowledge emphases of the K to 6 BEP. Also, they commonly knew and understood the basic mathematical concepts and procedures related to number and number sense,measurement, and geometry. However, their content knowledge was inadequate, specifically in patterns, functions and algebraand data, analysis, and probability.

The PTs' MCC on the overall CCK emphases seemed to be good and highly homogeneous (*M* = 2.64, *SD* = .46). Furthermore, they appeared to have good MCC in the overall CCK emphases of number and number sense (*M* = 2.78, *SD* = .50), measurement (*M* = 2.68, *SD* = .53), and geometry (*M* = 2.71, *SD* = .55) while they had poor MCC in patterns, functions, and algebra (*M* = 2.48, *SD* = .59) and data, analysis, and probability (*M* = 2.42, *SD* = .58) which scores were also highly homogeneous (*SD* = .50 - .59).

However, the PTs indicated poor competence in the MCC in the overall SCK emphases (*M* = 2.29, *SD* = .50) aswell as in all content strands: numbe and number sense (*M*= 2.28, *SD* = .57), measurement (*M* = 2.36, *SD* = .57), and geometry (*M* = 2.26, *SD* = .58), patterns, functions, and algebra (*M* = 2.30, *SD* = .56) and data, analysis, and probability (*M* = 2.19, *SD* = .60) with mean scores being highly homogeneous (*SD* = .56 -.60).

Of the two categories of content competence, it appeared that the PTs had inadequate knowledge of specialized content. Other empirical studies on teachers' knowledge of Mathematics content had also reported teachers having inadequate knowledge on specialized content knowledge in mathematics (Seteromo et al.,2018; Tasdan & Koyunkaya, 2017;Jansen et al., 2017). This finding indicates that the PTs had inadequate competence in some of the required MCC, which is very essential for their actual effective teaching (Ball et al., 2008; SEI-DOST & MATHTED, 2011). Consequently, the PTs possibly found difficulty in using appropriate examples and representations of mathematical concepts; in justifying or proving mathematical ideas or conjectures; in posing appropriate problems of the concept; in using correct mathematical language in explaining the concept; and in relating to the different usage or meaning of a concept (Ball et al., 2008; Tasdan & Koyunkaya, 2017).

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Table 1

Level of MCC as a Whole and in Terms of CCK and SCK Emphases of K to 6 BEP and Classified according to Content Strands

Mathematics Content Competence (MCC)										
Content Strands	*N*	Common Content Knowledge (CCK)			Specialized Content Knowledge (SCK)			Overall Content Knowledge		
		SD	Mean	Desc.	SD	Mean	Desc.	SD	Mean	Desc.
Whole	78	.46	2.64	Good	.50	2.29	Poor	.46	2.53	Good
Number and Number Sense	78	.50	2.78	Good	.57	2.28	Poor	.48	2.68	Good
Measurement	78	.53	2.68	Good	.57	2.36	Poor	.52	2.55	Good
Geometry	78	.55	2.71	Good	.58	2.26	Poor	.52	2.57	Good
Patterns, Functions, and Algebra	78	.59	2.48	Poor	.56	2.30	Poor	.56	2.41	Poor
Data, Analysis, and Probability	78	.58	2.42	Poor	.60	2.19	Poor	.56	2.35	Poor

Legend:

Mean Scale	Description (Desc.)
3.51 – 4.00	Very Good
2.51 – 3.50	Good
1.50 -- 2.49	Poor
1.00 – 1.49	Very Poor

Level of Mathematics Achievement

Data on the mathematics achievement of the PTs were obtained from the Registrar's Office after the PTs had given their consent to allow the researcher to use their mathematics grades in this study. The PTs' mathematics achievement level was interpreted using the following scale:

The results revealed that the PTs' achievement in mathematics (*M* =86.48, *SD* = 1.97) appeared to be very good. Moreover, the average grades of the PTs in the mathematics courses included in their teacher education program seemed to be heterogeneous, as indicated by a large SD of 1.97.

Mean Scale	Description	Verbal Interpretation
95.00–100.00	Excellent	The PTs learned 95% to 100% of the mathematics content knowledge on the various fields of mathematics included in their teacher education program.
90.00– 94.00	Superior	The PTs learned 90% to 94% of the mathematics content knowledge on the various fields of mathematics included in their teacher education program.
85.00– 89.00	Very Good	The PTs learned 85% to 89% of the mathematics content knowledge on the various fields of mathematics included in their teacher education program.
80.00– 84.00	Good	The PTs learned 80% to 84% of the mathematics content knowledge on the various fields of mathematics included in their teacher education program.
75.00– 79.00	Fair or Passing	The PTs learned 75% to 79% of the mathematics content knowledge on the various fields of mathematics included in their teacher education program.

The result of the study also indicated that BEEd GenEd PTs had very good mathematics achievement. This implies that they learned an adequate amount of mathematics content knowledge on the various fields of mathematics that were needed in teaching the discipline.

Table 2

Level of Achievement in Mathematics

Mathematics Courses	N	SD	Mean	Description
Mathematics Achievement	78	1.97	86.48	Very Good
Integrated Math	78	3.14	84.81	Good
Contemporary Mathematics	78	3.03	86.40	Very Good
Advanced Algebra and Trigonometry	78	2.70	87.67	Very Good
Plane and Solid Geometry	78	2.24	85.44	Very Good
Analytic Geometry and Introduction to Calculus	78	2.43	85.90	Very Good
Problem Solving	78	2.66	88.67	Very Good

Legend:

Mean Scale	Description (Desc.)
95.00 - 1.00	Excellent
90.00 – 94.99	Superior
85.00 – 89.99	Very Good
80.00 – 84.99	Good
75.00 – 79.99	Fair or Passing

PTs' Mathematics Achievement and MCC

Data for mathematics achievement were not approximately normally distributed as indicated by the Shapiro-Wilk test of normality (p = .001, p < .05). Hence, Spearman's correlation was used to determine the relationship between the PTs' mathematics achievement and their MCC of the knowledge emphases of the K to 6 BEP using a small sample of seventy-eight (78). Table 3 presents the resultsof Spearman rho (r_S), showing possible relationships between the variables.

Results in Table 3 indicate that PTs' Mathematic achievement had no significant relationship with MCC in the overall content knowledge emphases (r_S = .211, p = 0.063) and MCC of SCK (r_S = .184, p = 0.108) but has a significant but weak positive correlation with MCC of CCK (r_S = .242*, p = 0.033, p < .05).

Moreover, it appeared that there was a significant relationship between the PTs' mathematics achievement and their competence in CCK emphases of the K to 6 mathematics. The finding suggests that the PTs' learning in various contents of Mathematics courses which were included in their teacher education program, can be associated with the CCK emphases of the K to 6 Mathematics.

Table 3

Relationship between the PTs' Mathematics Achievement and their MCC as a Whole and in terms of CCK and SCK Emphases of the K to 6 BEP

Variables	N	Mathematics Content Competence (MCC): Common Content Knowledge (CCK) r_S	Sig. (2-tailed)	Specialized Content Knowledge (SCK) r_S	Sig. (2-tailed)	Overall Content Knowledge r_S	Sig. (2-tailed)
Mathematics Achievement	78	.242*	0.033	0.184	0.108	0.211	0.063

* p < 0.05

Conclusions

First, the PTs believe that they are competent in the mathematics content knowledge emphases of the K to 6 BEP, specifically in the basic concepts and procedures of elementary mathematics. Conversely, they have inadequate competence needed in the actual effective teaching of the discipline that may result in teaching the content emphases of K to 6 mathematics superficially.

Considering the mathematics content strands of the K to 6 BEP, the PTs believe that they have a good grasp of the overall content knowledge emphases on number and number sense, measurement, and geometry. However, they lack a thorough understanding of the overall content knowledge emphases on patterns, function, algebra and data, analysis, and probability.

Therefore, the PTs do not possess some of the required competence in the actual teaching of the content emphases on patterns, function and algebra, and data, analysis, and probability.

The PTs also believe that they are competent in the fundamentals of umber and number sense, measurement, and geometry. At the same time, they have inadequate competence in patterns, function and algebra and data, analysis, and probability. They also believe that they have inadequate knowledge and skills needed in the actual teaching of all mathematics content strands in the K to 6 BEP. Based on the preceding results, the greatest challenge of the PTs in mathematics teaching is their poor grasp of the knowledge needed in the actual effective teaching of the discipline.

Second, the PTs' mathematics achievement is very good.This shows that they are well prepared in teaching elementary mathematics since they have mastered a sufficient number of mathematics contents and procedures in the various fields of mathematics in their teacher education program.

Finally, the more mathematics contents and procedures the PTs have masteredfrom their teacher education program, the better is their Mathematics Content Competence (MCC) in the basic content knowledge emphases of the K to 6 BEP. Therefore, the PTs' learning onthe essentials of mathematics in their education program helps them understand the mathematics common content knowledge emphases of the K to 6 BEP.

The learning of mathematics depends significantly on the teachers' competence (SEI-DOST & MATHTED, 2011). Teachers' mathematics content competence is influenced by TEIs' program curriculum and educators' methods of teaching (Jansen et al., 2017; Koponen et al., 2016).This study suggests that TEIs may revisit the mathematics courses used to prepare the PTs in the teaching of mathematics. Educators may align their teaching orientation to the school mathematics that future teachers will be teaching (Jansen et al., 2017; SEI-DOST & MATHTED, 2011; Koponen et al., 2016). Educators need to cover all the topics in the mathematics courses since teachers cannot effectively teach the sense-making of the concept if the mathematics content was not developed in their teacher education course work. In addition, there is a need for educators to model instructional approaches that develop students' critical thinking and problem-solving since future teachers tend to adopt instructional approaches from their educators (Jansen et al., 2017).

Moreover, there is a need for TEIs to develop future teachers' SCK in Mathematics (SEI-DOST & MATHTED, 2011). SCK is the knowledge used by teachers in effective teaching (Ball et al., 2008; Tasdan & Koyunkaya, 2017). Teachers must effectively use this knowledge in their teaching so that students can meaningfully learn the mathematical concepts and procedures (Jansen et al., 2017; Lachner & Nuckles, 2016; Seteremo et al., 2018). Finally, if teachers have a complete grasp of SCK in their teaching, they can encourage their students to develop essential skills and processes needed in critical thinking and problem-solving (K to 12 Curriculum Guide in Mathematics, 2011).

Since TEIs are responsible for educating future mathematics teachers, TEIs may use the FPTME's set of standards in assessing and facilitating the career development of prospective mathematics teachers (SEI-DOST & MATHTED, 2011). TEIs may support their educators by providing professional development sessions on FPTME. Educators may also align their teaching practices and teaching materials with FPTME's standards.

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