ALIGNMENT OF ETHIOPIAN PRIMARY SCHOOL PRE-SERVICE TEACHER EDUCATION PROGRAM WITH THAT PRIMARY SCHOOL MATHEMATICS CONTENTS/SYLLABI

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Abstract. This study is a quantitative research that examine the extent of alignment of Ethiopian teacher education program curricula with primary school mathematics contents. So, to collect the data, the study was used content analysis as instrument. The sources of data were primary school mathematics syllabi and curricula materials of college of teacher education. To do this, the study employed quantitative method to collect data from pre-service mathematics teachers. Coders were very experienced teacher educators from three different colleges of teacher education: Kotebe Metropolitan University, Hawassa college of teacher education and Arba Minch college of teacher education. Teacher educators were selected purposely based on their service year in college of teacher education and their positiveness for coding. To do the content analysis, the main documents (primary school mathematics syllabi) were coded or broken down in to manageable categories on a variety of theme and then examined using appropriate content analysis theoretical model. The result of the study portrayed that the curricula materials of generalist have low level of alignment with the primary school mathematics contents whereas those of specialist and linear curricula were align with the mathematical contents of primary school curricula in moderate level. As it was indicated in the findings of the study, the college curricula materials are not fully aligned with the contents of primary school mathematics. There are school mathematical contents which are not included in curricula of teacher education. Thus, it is recommended that appropriate program should be designed which create an opportunity for pre-service mathematics teachers to access school contents either during practicum sessions or should include in the curricula materials of teacher education.

Keywords: alignment of curricula; primary school; pre-service teacher education; mathematics content

Introduction

Background

Teacher education is one of the major disciplines organized to teach young candidates to become teachers in primary schools, secondary schools, universities,

or other academic institutions. Nonetheless, there are consensus among scholars that teacher education is very important, it is conceptualized as an ambiguous and far from homogeneous field within the general discipline of education (Bourdieu, 1987; Furlong, 2013). It has been also a site for contestation between diverse academic and professional interests, and national and local governmental influences (Maguire, 1993; Popkewitz, 1987). Due to these debates, different concepts ,orientations and approaches to teacher education are proposed although sometimes they overlap and sometimes may be perceived differently by different academicians. Most of the time, these differences and the debates are reflected in its definition, scope, nature and structure (Zeichner & Listen, 2006).

Teacher education is concerned with the aspects such as, who (Teacher Educator), whom (Student teacher), what (Content) and how (Teaching Strategy). As Perraton (2007) asserts, the combined effect of these aspects will help the institution to achieve at least four objectives: improving the general educational background of the trainee teachers; increasing their knowledge and understanding of the subjects they are to teach; pedagogy and understanding of students and learning; and the development of practical skills and competences. According to Cooper and Alvarado (2006), there are four components of teacher education programmes that contribute to its effectiveness. These are: existence of high standards for entry, strong content (subject matter) preparation, substantial pedagogical training and supervised clinical experiences. In addition to the four components, they supposed that teachers need to know how to organize and present the content in a way that makes it accessible for increasingly diverse groups of learners. Shulman (1987) calls this knowledge, "pedagogical content knowledge (PCK)." The link between content and pedagogical knowledge shapes teachers' decisions about materials, instructional approaches, and assessment.

In general, teacher education considered as a specific pathway within an institution which designed to equip pre-services with the knowledge, skills and behaviors that require to perform teaching effectively in the classroom, school and wider community. So, it plays a crucial role in the preparation of teachers, not only enhancing their understanding and skill but also increasing the likelihood of their staying in the profession. To achieve this, colleges of teacher education must design programs which have its own academic orientation, that are suitable to pre-services to develop range of skills and competencies (skill learning), and be able to enact understandings in complex classrooms having diverse students as well as a means for teacher retention and makes a difference in student achievement.

In Ethiopia context, the education and training policy designed in 1994 establishes that teacher trainees should have the proper knowledge, skill, ability, diligence, professional interest as needed along with appropriate physical and mental fitness to meet the demand and challenges of the profession. This designed teacher education is comprehended based on the assumption that it encompasses combina-

tion of different teacher education orientations and approaches. It composed of six components: mathematical content knowledge, pedagogical content knowledge, general pedagogical course, practicum, common courses, and seminars and action research. It also prepares primary school teachers using concurrent program type which comprises course work and practicum as its major components. For this to achieve, teacher training institutions of all levels should gear their programs towards the appropriate educational level for which they train teachers. At the end, teachers should be certified before assigned to teach at any level of education. That means, all pre-primary and primary school teachers have been training by a three years concurrent diploma program.

Pre-service Mathematics Teacher Education

Though, there is no consensus on how to adequately train pre-service school mathematics teachers (Chapman, 2005), pre-service teacher education programs play a key role in determining the quality of the mathematics teaching in primary schools (Ma, 1999). Many researchers believed that pre-service mathematics education programs are important in improving the content knowledge of pre-service teachers and in influencing their beliefs regarding mathematics and the teaching of mathematics (Ball, 1990; Battista, 1986). Due to this, preparation of teachers who are teaching mathematics effectively has been one of most urgent and debatable issues in education among scholars (Morris, Hiebert, & Spitzer, 2009). Some of them are: What exactly comprises this knowledge and how it is best delivered and best learned, and in what ways do primary teachers need to know mathematics in order to be effective teachers? What experiences will best prepare preservice teachers to become effective practicing primary teachers? (Liljedahl et al., 2009).

Global scenarios showed that different perspectives and approaches are used in the preparation of primary school mathematics teachers. These differences of primary mathematics teacher preparation program would reflect different curriculum requirements and their emphasis on professional contents. Adam and Tulasiewicz (1995) appealed that the distinction between primary and secondary school teachers is that primary school teachers need more training in pedagogy. This includes pedagogical theories, research methods and educational psychology. The aim is to enable primary school teachers to acquire an extensive understanding of children, of the society in which they live, of the problems and techniques of curriculum development (Blenkin & Kelly, 1983). For example, in Greece the teachers of primary education are teaching mathematics together with language, history, physical sciences etc. They are not teachers specialized in each one of the above subjects. Many of these teachers undertake one or two courses of mathematics in parallel with their pedagogical studies (Voskoglou, 2009). In Tanzania, the country report in 2011 indicated that teacher trainees most commonly have followed seven years of compulsory primary education and four years of junior secondary education to

become Grade A teachers who can teach a primary school only. During training, teacher trainees are categorized into three, which are Science and Mathematics, Language studies, and Social studies. The emphasis, however, was on teaching methods of the subjects concerned as well as on professional studies.

Furthermore, Tatto, Lerman and Novotna (2009) described in the International Commission on Mathematical Instruction (ICMI) study, most primary teachers are educated as generalists and most of the preparation they receive places low emphasis on mathematics content as per the proportion of time dedicated on mathematics courses as part of their overall program. Pedagogy is given a high level of emphasis in the preparation of primary school mathematics teacher and varied degrees of emphasis on opportunities to learn related to mathematics pedagogy content. The conference participants reported that even if most of the time teacher education programs has given some degree of emphasis to what we have called pedagogical content knowledge in mathematics, there would need to be explored further on emphasis given to pedagogical content knowledge in the education of primary mathematics teachers.

On top of that, the Conference Board of the Mathematical Sciences (CBMS) (2001) recommends that pre-service teachers be required to complete at least nine semester-hours on the mathematical ideas of elementary school mathematics, with the courses focusing on a thorough development of basic mathematical ideas. The National Council of Teachers of Mathematics (NCTM) issued a position statement in 2005 that primary teachers should have completed the equivalent of at least three college level mathematics courses that emphasize the mathematical structures essential to the elementary grades (including numbers and operations, algebra, geometry, data analysis, and probability). The National Council on Teacher Quality echoed these recommendations in stating that they ‘‘strongly recommend teacher candidates take a minimum of three mathematics courses designed specifically for pre-service teachers which deal explicitly with elementary and middle school topics’’ (Greenberg & Walsh, 2008). These and other studies showed that pre-service mathematics teachers should learn elementary school mathematical contents that they will teach in the future.

Curriculum of teacher education

Various definitions were given to the term curriculum with respect to various aspects of subject content, pedagogy, delivery models, moral and ideological values and assessment (Kelly, 2009; Priestley, 2019). However, whatever meaning was given to the term curriculum, it is an important tool for the teaching learning process. Since initial teacher education is the first crucial stage in a teacher’s professional career where it requires pre-service teachers to be both learners and teachers simultaneously , its curricula materials should be designed to ensure that they develop the competencies required by teaching profession and need to be

addressed how teachers learn and refine knowledge, skills and proficiency to teach their own subject (mathematics).In this regard, Snoek and Zogla (2009) mentioned that the initial teacher education curricula materials can generally have three integrated areas which play a pivotal role to create proficient teacher ; subject area aspects/methodologies, pedagogical aspects (linking knowledge of pupils' ways of learning, school curricula and strategies to deal with diversity in the classroom), and teaching practice and supervision.

Regarding the content knowledge part of the curriculum, even though various authors forwarded various frame works, the European commission, under the key features of initial teacher education curricula emphasized that linking these contents with school curricula are one aspect. Similarly, Craig (2016) added that the structure of initial teacher education encompasses the analysis of the nature and goals of school curriculum. Due to this fact, countries like New Zealand designed curriculum of initial teacher education (ITE) programmes by consider the interface between ITE curriculum and the school's curriculum which helped to avoid the challenge of how to prepare their pre-service teachers to become beginning teachers who are able to base their teaching upon the national curriculum (McGee, Cowie, & Cooper,2010).They further described that there is benefit in an ITE curriculum that has a close relationship with the school curriculum in terms of what is learned and the teaching and learning approaches. Thus, in order to preparing student teachers to become beginning teachers, college of teacher education college should have designed learning experiences that link ITE curriculum with school curriculum.

Current Primary School Teacher Education curriculum in Ethiopia

In Ethiopia, the primary education is organized in two cycles: the first cycle (grade1 – 4) or basic education cycle and the second cycle (grade 5 – 8) or general primary cycle. The curriculum of primary school pre-service teacher education program has its own requirements and based on these requirements, candidate can join either generalist, specialist or linear modality to be teachers of 1st cycle or 2nd cycle. The generalist modality prepares teachers for lower primary grades 1 – 4. It is a composite of four subject areas, plus common, professional and practicum courses. The linear modality prepares teachers for upper primary grades 6-8 in a major and minor subject, plus common, professional and practicum courses, and specialist prepares teacher for grade 5 – 6 (Ministry of Education, 2013).

As stated in the education and training policy launched in 1994, one of the prime objectives of pre-service teacher education program are intended to develop pre-service teacher's knowledge required to meet the standards set by the Ministry of Education for primary school teachers, and competently create learning contexts that will promote the learning and social development of children. Thus, to achieve these, curriculum is designed in 2013 to address the following components in more

rigorous manner than the other components. Its major components are: subject matter knowledge, pedagogical content knowledge (PCK), general pedagogical/ educational courses and practicum. The following table depicts the four major components of primary teacher education curriculum and its coverage in percentage.

Table 1. Four major components of primary teacher education program and their intensity

No	Primary school Teacher Education curriculum of Mathematics			
	Components	*% in 1st cycle (Generalist)*	*% in 2nd cycle (Specialist)*	*% in 2nd cycle (Linear)*
1	Subject matter knowledge	39	34	29
2	Pedagogical content knowledge	14	9	-
3	General pedagogy/educational courses	24	25	24*
4	Practicum	11	12	12.4

Source: curriculum framework for primary pre-service education (Ministry of Education, 2013)

*Professional courses

Table-1 shows that these four major components of the program cover 88% and the rest are common courses, seminars and Research.

Statement of the problem

After education and training policy launched in 1994, the country experienced drastic change in education sector and made several efforts to make education quality and more relevant through transforming society via education and maintain quality education. It established the foundation for all subsequent strategies, guidelines and programs to address the question of relevance (quality) in teacher education, like Education Sector Development Programs (ESDP I-V) since 1997, teacher Education System Overhaul Program (TESO) in 2003, Teacher Development Programs (TDPs) in 2003, Continuous Professional Development (CPD) in 2009. In addition, in order to meet the articulated objectives, the policy clearly expresses that teachers of all levels will be required to have the necessary teaching qualification and competency through pre-service and in-service training programs.

Furthermore, the Ethiopian government has initiated a countrywide teacher education and training program which aims to increase the relevance and quality of mathematics education. To realize this, for primary teacher education, a three years diploma concurrent program was designed in order to equip mathematics pre-services with the knowledge and skills of the subject matter (academic content), methods of teaching subject (pedagogy content), theory-practice connection (practicum) and general pedagogy for teaching primary grades. The provision of academic, pedagogy content knowledge and general pedagogical courses to mathematics pre-services in the college aims to help them to have adequate subject matter

knowledge to teach curriculum contents of primary grades subjects, to have thorough knowledge and skill on how students develop concepts, develop intellectually & socially and to have in depth knowledge of learning how to teach. However, these all deals with generic teacher education.

Nevertheless, the overall preparation process of teachers has been criticized in terms of provision of quality teaching and better-quality education for pre-services which enable them to develop the required knowledge and skills (Workneh & Tassew, 2013; UNICEF, 2010). Even though, much researches were not conducted on how much this teacher education program is addressed primary school mathematics contents, there are studies on school teacher's weak mathematical knowledge (Yohannes, 2007). As a result of these criticisms, the curriculum of pre-service primary teacher education program was reformed and restructured in 2013. However, study at national level and other studies indicated that the questions of quality education after 2013, are still continued as indicated in study conducted by Ethiopian Ministry of Education (MoE, 2016).

In addition, the Ethiopia primary pre-service teacher education program set a guiding set of principles in order addresses issues like correspondence between the pre-service teacher education curriculum and the revised primary school curriculum as indicated contained in the Curriculum Framework for Ethiopian Education (MOE, 2010). However, no studies were conducted to what extent this revised college curricula have correspondence with school curricula and fulfill the mathematical knowledge need of future teachers in every way that leads to professionalism.

Therefore, teacher education program needs to be assessed in terms of its mathematical content alignment with primary school mathematics contents which is one indicator of quality of education. It is with this understanding that this study focuses on examining the alignment of pre-service primary mathematics teacher education program with that of mathematical contents of primary school.

Research question

This study poses the following question to investigate the alignment of mathematical contents of Ethiopian teacher education mathematics curricula materials with that of primary school mathematics contents.

– Are mathematical contents of school mathematics embedded in curricula materials of teacher education program?

Significance of the study

Alignment of mathematical contents of teacher education program curricula material with that of the mathematical content of school syllabi is considered as one indicator of quality education. Thus, it provides information on the issues of program quality currently experienced in the preparation of primary school mathematics teachers at colleges of teacher education. Again, since the country currently

shifts the focus from higher education expansion to quality improvement and recently ministry of education has prepared a new educational roadmap to reform the education sector in accordance with the national vision and development goals, the findings will be expected to have more inputs in this regard especially in creating knowledgeable and skillful mathematics teachers in primary school.

Methodology

Research Design and Methods

This study is a quantitative research that examine the extent of alignment Ethiopian teacher education program curricula with primary school mathematics contents. So, to collect the data, the study was used content analysis as instrument. The sources of data were primary school mathematics syllabi and primary school pre-service mathematics education curricula materials. Thus, the study follows quantitative research methodologies for both the analysis methods and data collection procedures.

Data Collection Instruments

In a research method, content analysis is defined as a research technique for the objective, systematic, and quantitative description of manifest content of communications (Berelson,1952). So, it is a method of analyzing documents. All methods of content analysis share common components. They can be quantitative (counting) and qualitative (meaning) analyses. Analysts can use one or both methods.

There are five units to be considered in content analysis. However, one must choose the unit that best fits the type of analysis he/she wishes to do. The critical units in content analysis are: word, theme, character, item (newspaper, political, International affairs), pace and time measures (inches, paragraph, page or interrelation of units).

Having this assumption, this study was used quantitative content analysis in order to examine to what extent the teacher education curriculum addresses school mathematics contents which enable the candidates to teach the subject adequately at primary schools.

In this study, the instrument designed by Karen in 1997 entitled with Mathematics Material Analysis Instrument (MMAI) was adapted. The instrument MMAI adapted here consisted thirteen categories for generalist and fourteen for specialist/linear for checking the extent to which the pre-service mathematics curricula align with primary school mathematics. Each has number of subcategories (concepts) in it.

Population and Sampling Techniques

Coders were teacher educators from three different very experienced colleges of teacher education; Kotebe Metropolitan University from Addis Ababa city, Hawassa college of teacher education and Arba Minch college of teacher education both

from Southern Nation Nationalist Region(SNNR) which were found in Hawassa city and Arba Minch city respectively.Teacher educators were selected purposely based on their service year in college of teacher education and their positiveness for coding . Thus, five teacher educators, one from Hawassa, two from Kotebe and two from Arba Minch from department of mathematics were participated. All were second degree (MSc) holders either in mathematics specialization or mathematics education and taught various courses including Teaching Mathematics (TeMa) across all level of pre-service teachers (first year to three years) and all modalities and have also advisees.

Validity and Reliability

Concerning its reliability, interrater reliability was checked by measuring the extent to which similar ordinal values were assigned by five coders at separate locations who were experienced teachers in college of teacher educations. This involved testing to see if there were significant differences in the coding assigned by these coders (Coder-1 up to Coder-5) using MMAI on the curricula. Supplementary attachments were included with MMAI to assist the coders in assigning values.

Moreover, the means of ordinal values assigned by each coder were computed and ranked for each curriculum (Generalist and Specialist/linear) and coded. Since the dependent variable was continuous or ordinal variable, the non-parametric Kruskal-Wallis H-test was then performed for each curriculum at first cycle and second cycle grade level and significant differences among them were check. As a result, the findings indicated that no significant difference among raters were found since the Kruskal value and alpha for generalist was $H=7.112$, $df=4$ and $p=0.130 >0.05$ and for specialist $H=1.835$, $df=4$ and $p=0.766>0.05$.Similarly, the result indicated that no significant difference among raters for linear since the Kruskal value and alpha was $H=1.001$, $df=4$ and $p=0.910>0.05$. Therefore, these confirm that they have equal mean/median

Method of data analysis

To do content analysis, the main documents (primary school mathematics syllabi) were coded or broken down in to manageable categories on a variety of theme and then examined using appropriate content analysis theoretical model.

The instrument Mathematics Materials Analysis Instrument (MMAI) includes an ordinal value scale: 1=no representation, 2 = moderate representations, 3= high representations. These ordinal values used for the first part reflect the extent of alignment of contents in the pre-service mathematics teacher curriculum and primary school mathematics outlined in the subcategories on MMAI.

The Mathematics Materials Analysis Instrument (MMAI) was used to obtain ordinal data from the curricula. Coding was performed by five coders. These data were converted to statistical measures of dispersion for analysis.

Data was collected from data collection worksheets and the coders were examined carefully whether each concept were addressed or not in the curricula and assign their ordinal values for them on the worksheet containing tables prepared for MMAI and in which each rows of the table have list of concepts under each category. Finally, using the ordinal data they have, they calculated the rank of each category.

In pursuit of this, the following steps were employed to conduct the content analysis on alignment of the two curricula.

First, detail review was made on all the primary school mathematics text books and syllabi to identify the topics and areas covered and the number of concepts to code for. The review also valuable to obtain the nature of contents and to provide insight in to the scope and direction of the content and objectives.

Since the study used content analysis, as Weber (1990) describes, it involves selecting a unit of analysis, constructing category systems, selecting a sample of content, and providing reliable and valid coding. Categories should be mutually exclusive to prevent interpretative errors.

To determine unit of analysis, currently used all primary school mathematics textbooks and syllabi (they are 8 textbooks and 8 syllabi) were collected and compiled. Then each text books and syllabi were reviewed page by page in order to identify major concepts under each chapter, and subtitle. This was designed to determine the degree of emphasis/representation placed on each mathematical concept in curricula of pre-service mathematics teacher education.

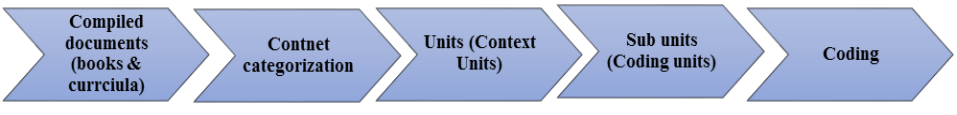

Figure 1. Unit of Analysis of content analysis

In addition, three categories were used to indicate the degree of emphasis/ representation of each subtitle. This leads the construction of the rating scale that shows the amount of information given to each concept in the curricula. The following table indicates the ordinal values and their meaning.

Table 2. Ordinal values and their meaning

1 = Not represented (No)	Concepts are not represented in the pre-service mathematics curriculum
2 = Moderate level of representation (Mod)	Concepts were represented in moderate level in the pre-service mathematics curriculum
3 = High level of representation (Hi)	Concepts were got high level representation in the pre-service mathematics curriculum

The sum of coded values for each category is transferred to the appropriate section on the worksheet. The worksheet provides details for calculating and interpreting the results.

Result and Discussion

Result

Currently, in Ethiopia, pre-service primary school mathematics teachers were trained under three modalities with three different curricula. These are generalist modality curriculum (to teach grade 1 – 4 students), specialist modality curriculum (to teach grade 5 – 6 students) and linear modality curriculum (to teach grade 5 – 8 students). Three of them were launched after the new education and training policy was launched in 1994. But generalist and specialist curriculum were the recent one. They were design to produce quality teachers through quality education system in colleges of teacher education.

After generalist and specialist curriculum were launched, a number of directions were launched and they were revised three times just to improve the system but the last revision was made in 2013 at Debre Tabor.

The frame work of the final revised curricula was composed of five components. These are: (A) Subject matter/Content (B) General Education/Pedagogical Knowledge and Skill (C) Pedagogical Content Knowledge (D) Practicum/field experiences (E) Common Courses and (F) Seminars and Research. These courses are offered in six semesters. In addition, the frame work indicates that some of these components offered in more intensive manner than the other components. For example, the following table-3 shows the proportion and intensity of the various components' generalist curriculum across the six semesters:

Table 3. Intensity of various components generalist curriculum across semesters

Components	*First Year*		*Second year*		*Third year*	
	Semesters					
	1st	*2nd*	*1st*	*2nd*	*1st*	*2nd*
Common course	20	45	15	10	5	30
Subject matter	80		15	5		
Practicum		5	20	30	30	50
PCK			35	50	60	20
General Education		50	15	5	5	

The Table-3 presented that 80% of the courses in first year first semester are focused on subject matter courses and its intensity decreases in the succeeding semesters. The rest 20% in this semester covered by common course offered like

basic English and hand writing skills. It also showed that pre-service mathematics teachers started practicum in first year second semester and increased its intensity in the subsequent semesters. Courses which have PCK content like teaching mathematics in primary school (TeMa) have started in second year first semester and reached a maximum intensity in 3rd year first semester (60%) of the program.

Content alignment

To do this, categorizations of concepts were made using chapters/context units in primary school mathematics textbooks, and syllabi. The following two tables summarized the chapters/units included in the primary school mathematics text books (1st cycle and 2nd cycle) and pre-service mathematics education curricula.

Table 4. Summary of chapters included in 1st and 2nd cycle primary school mathematics text books

	Chapters		Chapters
First Cycle Mathematics	Natural and whole numbers	**Second Cycle Mathematics**	Whole numbers, Integers, and Rational numbers, fractions, and decimals, and the four operations
	The four operations on whole numbers		Squares, square roots, cubes and cube roots
	Measurements using informal		Ratio, proportion and percentage
	Fractions and decimals		Basic concepts on sets
	Points, lines, simple shapes and olids		Working with variables
	Time		Linear equations linear inequalities and proportionality
	Money		Data handling
	Data handling and pattern		Geometric figures and measurement, similar figures, and circles
			Introduction to probability

First cycle primary mathematics books have four areas of learnings: numeracy, measurements, shapes, and data handling. As presented in the table-4 above, such four areas of learnings contain topics like Natural and whole numbers, the four operations on whole numbers, Measurements using informal, Fractions and decimals, Points, lines, simple shapes and solids, Time, Money and Data handling and pattern are included. Similarly, second cycle mathematics books contain contents which are basically an extension and broad version of first cycle mathematics contents. These are: Whole numbers, Integers, and Rational numbers, fractions, and decimals, and the four operations, Squares, square roots, cubes and cube roots, Ratio, proportion and percentage, Basic concepts on sets, Working with variables, Linear

equations linear inequalities and proportionality, Data handling, Geometric figures and measurement, similar figures, and circles, and Introduction to probability. Generalist pre-service mathematics took about seven mathematics related courses within three years. Whereas, those of specialist pre-service mathematics teachers are taking about nine mathematics related courses with in three of college life.

According to Curriculum Framework for Primary Pre-service Teacher Education, the structure of the upper primary curriculum (linear) is contained in the Curriculum Framework for Ethiopian Education (KG – Grade 12) (MoE,2013) and its most basic principle is to anchor the pre-service teacher education program firmly in the principles of the primary curriculum and make the structure of pre-service teacher preparation relevant for high-quality teaching in primary schools. Thus, teachers for the second cycle primary schools are going to be trained in linear form. That is major of mathematics and minor of physics.ш Similarly, the linear level is made up of six areas of study adding up to a total of 113 credit hours (approximately 20 credit hours per semester, two semesters per year over three years). The first three areas focus on subject matter and the last three on common, professional and practice-oriented courses.

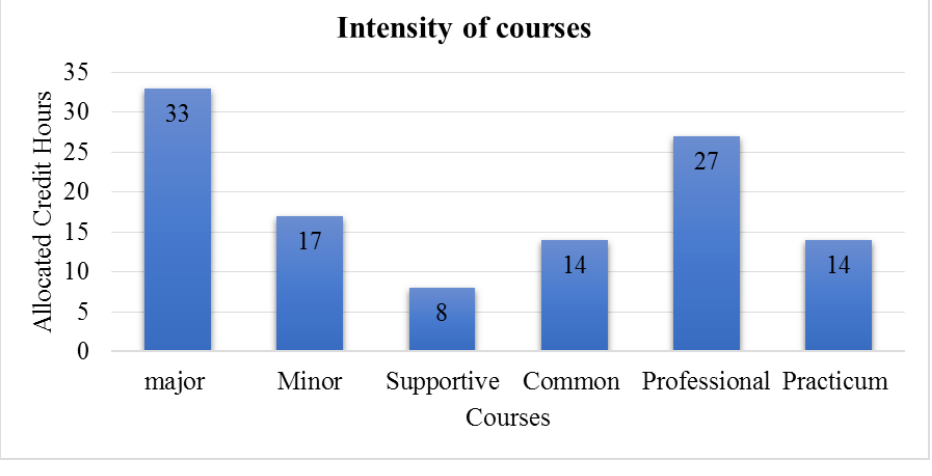

Figure 2. Intensity of various courses of linear program

As indicated in figure-2, the linear curriculum is composed of various course and their time allocation was Major (33 credit hours), Minor (17 credit hours), Supportive (8 credit hours), Common Courses (14 credit hours), Professional Courses (27 credit hours) and Practicum (14 credit hours). Accordingly, Major course and professional take the highest share of time allocation in the curriculum, then minor course, and common course and practicum followed.

Mathematical Material analysis instrument (MMAI)

The evaluative instrument MMAI consists of thirteen categories for Generalist curriculum and fourteen categories for Specialist/linear curriculum were identified for conducting content analysis. Each category in both modalities contains 4 to 25 sub categories (concepts).

Table 5. Recoding units per categories

Code No	*Categories of Generalist*	*Categories of Specialist and linear*
A	The whole numbers up to 1,000,000	Whole numbers and the four operations
B	The four operations on whole numbers up to 1,000,000	Divisibility of whole numbers
C	Fractions and decimals	Fractions and decimals
D	Lines and simple shapes	Integers
E	Points, lines and shapes	Rational numbers
F	Shapes and solids	Squares, square roots, cubes roots
G	Measurement using non-formal units	Basic concepts of Sets
H	Measurement	Ratio, proportion and percentage
I	Time	Working with variables
J	Ethiopian currency	Linear equations, inequalities and proportionality
K	Money	Geometry and Measurement
L	Data handling and pattern	Circle
M	Data handling	Data handling
N	-	Introduction to Probability

The categories of concepts included in first and second cycle primary mathematics curriculum have various loads and their coverage in terms of percentage are presented in the following table (table-6 below). The percentage were calculated using the allotted time indicated in syllabi.

Table 6. Categories and their loads in the 1st and 2nd cycle mathematics textbooks

Categories	*1st cycle (%)*	*2nd cycle (%)*
Number system	70.2	35.2
Sets	-	3.0
Ratio proportion & percentage	-	3.8
linear equation and inequalities	-	18.7
Geometry	18.9	31.6

Time	4.1	-
Money	2.4	-
Elementary Statistics	4.4	7.7
Total	**100**	**100**

The table-6 indicated that 70.2% of the total allotted time in 1st cycle mathematic curriculum is covered by "number system" which is much higher than the coverage of other topics whereas the coverage of "money" is very small which is about only 2.4% of the time. Similarly, mathematical contents which have high intensity in 2nd cycle is again number system and geometry, both accounts 35.2% and 31.6% of the total allotted time while topics which have small coverage is sets which accounts only 3.0%.

Furthermore, each categorizes mentioned in first and second cycle primary school mathematics curriculum contained number of concepts or sub topics in it. Each category in first cycle mathematics curricula contained a minimum of four and maximum of twelve concepts. That is, Number system has 12 concepts in it, Geometry contained five concepts, time, money and elementary statistics have contained each four concepts in it. Similarly, each category of second cycle primary mathematics curricula contained number of concepts.

Descriptive statistics were used to explore the materials in more detail. Central measures of tendency were computed from data obtained from MMAI for the generalist, specialist and linear curricula (Tables 7 – 9) respectively.

Table 7. Representation of each category of first cycle mathematics using rating scale in the generalist curriculum of CTEs

Categories	***Representation/emphasis in Generalist Mathematics Curriculum***					***Group Mean***	***SD***
	Coder's mean						
	1	***2***	***3***	***4***	***5***		
A	1.80	1.80	1.60	1.80	2.00	1.80	0.14
B	1.75	2.00	2.50	1.75	1.75	1.95	0.33
C	1.75	2.00	1.88	1.63	1.50	1.75	0.20
D	1.60	2.00	2.00	2.20	2.00	1.96	0.22
E	2.00	2.00	1.67	1.67	1.67	1.80	0.18
F	2.25	2.00	3.00	2.75	2.00	2.40	0.45
G	2.00	2.00	2.33	2.33	1.67	2.07	0.28
H	1.00	1.50	1.67	1.67	1.33	1.43	0.28

I	1.22	1.44	1.00	1.89	1.11	1.33	0.35
J	1.00	2.00	1.00	2.00	1.50	1.50	0.50
K	1.00	1.00	1.00	1.50	1.00	1.10	0.22
L	1.20	1.80	2.60	1.60	1.40	1.72	0.54
M	1.40	1.40	3.00	2.20	1.00	1.80	0.80
Average Rating of total categories	1.54	1.76	1.94	1.92	1.53	1.74	
Median	1.60	2.00	1.88	1.80	1.50	1.8	
SD	0.43	0.33	0.71	0.36	0.36	0.34	

The data in Table 7 above clearly show the average rating of total categories and median measures centering below 2 with small standard deviations. This indicates that the coders agreed that the generalist curricula represented low levels of content related to contents of the first cycle mathematics curricula. More specifically, among the listed categories; shapes and solids and Measurements using non-formal units are got relatively high representation in pre-service mathematics curriculum whereas Measurement, Time and Money are rated least among the thirteen categories listed in the table-7 above. In general, the findings in the table indicated that the association between curricula of the CTE and first cycle primary is least (below 2) that need to be investigated further.

Table 8. Representation of each category of second cycle mathematics using rating scale and their measure dispersion in specialist mathematics curriculum

Categories	***Representation/emphasis in specialist Mathematics Curriculum***					***Group Mean***	***SD***
	Coder's Mean						
	1	***2***	***3***	***4***	***5***		
A	1.86	2.86	2.29	2.14	1.71	2.17	0.44
B	3.00	3.00	1.67	2.67	1.67	2.40	0.68
C	1.89	2.67	1.67	2.33	1.89	2.09	0.40
D	3.00	3.00	3.00	2.33	3.00	2.87	0.30
E	3.00	3.00	3.00	2.50	3.00	2.90	0.22
F	1.00	1.00	1.00	1.00	1.00	1.00	0.00
G	2.67	3.00	3.00	3.00	3.00	2.93	0.15
H	1.25	1.50	1.00	1.50	1.25	1.30	0.21

I	1.67	2.89	1.33	1.78	1.22	1.78	0.66
J	1.40	2.20	1.50	1.70	1.00	1.56	0.44
K	2.77	1.97	2.43	2.60	2.00	2.35	0.36
L	2.50	2.00	1.50	2.25	2.50	2.15	0.42
M	2.80	1.80	3.00	3.00	1.60	2.44	0.68
N	3.00	2.00	3.00	3.00	3.00	2.80	0.45
Average Rating of total categories	2.27	2.35	2.10	2.27	1.99	2.20	
Median	2.58	2.43	1.98	2.33	1.80	2.26	
SD	0.73	0.66	0.80	0.60	0.77	0.61	

Similarly, the data in Table-8 show the average rating of total categories and median measures centering around 2 with small standard deviations which was below 1. This indicates that the coders agreed that the overall pre-service mathematics curriculum represented moderate levels of content related to the contents of second cycle mathematics curricula. In addition, the group mean in the table-8 above indicated categories which have relatively low and high representation by the five coders. Consequently, the findings show that among categories listed in the table-8, squares, square roots, cubes roots and Ratio, Proportion and Percentage are found to have the lowest emphasis in the pre-service mathematics curriculum and that of points, lines and shapes and Basic concepts of sets have got relatively high representation in the pre-service mathematics curriculum. In general, table-8 indicated that majority of concepts in primary schools are moderate (above 2) emphasis in college of teacher education. Of course, four concepts have got low emphasis in the specialist curriculum.

Table 9. Representation of each category of second cycle mathematics using rating scale and their measure dispersion in linear modality

Categories	***Representation/emphasis in Linear Mathematics Curriculum***					***Group Mean***	***SD***
	Coder's mean						
	1	***2***	***3***	***4***	***5***		
A	1.71	2.57	2.43	2.29	1.86	2.17	0.37
B	2.67	3.00	2.00	3.00	1.67	2.47	0.60
C	1.89	2.78	1.78	2.44	2.00	2.18	0.42
D	3.00	2.67	3.00	2.67	2.67	2.80	0.18
E	3.00	2.50	3.00	2.00	3.00	2.70	0.45
F	1.00	1.00	1.00	1.00	1.00	1.00	0.00

G	2.67	2.67	3.00	3.00	3.00	2.87	0.18
H	1.25	1.75	1.00	1.50	1.50	1.40	0.29
I	2.22	2.89	2.56	2.11	2.22	2.40	0.32
J	2.50	2.80	2.40	2.50	2.60	2.56	0.15
K	2.77	2.00	2.47	2.63	2.03	2.38	0.35
L	2.50	2.00	1.75	2.25	2.50	2.20	0.33
M	2.80	2.00	3.00	3.00	1.40	2.44	0.71
N	3.00	2.50	3.00	3.00	3.00	2.90	0.22
Average Rating of total categories	2.36	2.37	2.31	2.39	2.18	2.32	
Median	2.59	2.54	2.45	2.47	2.13	2.42	
SD	0.65	0.55	0.71	0.60	0.65	0.54	

Table-9 illustrates that the average rating of total categories and median measures centering near and above 2 with small standard deviations which was below 1. This indicates the raters agreed that the overall pre-service mathematics curriculum represented moderate levels of content relating to the contents of second cycle mathematics curricula. In addition, the group mean in the table-9 above indicated categories which have relatively low and high representation by the five coders. Consequently, the findings show that among categories listed in the table-9, square, square roots and cubic roots and ratio, proportions and percentage have found low emphasis in pre-service mathematics curriculum, that is 1.0 and 1.4 respectively. Whereas that of Basic concepts of sets has got relatively high representation (2.9) in the pre-service mathematics curriculum. In general, code square roots and cubic, and Ratio, proportions and Percentage have low representation in linear curriculum and are rated below 2. The table-8 indicates that majority of concepts have got moderate (above 2) emphasis in linear curriculum.

Discussion

Various authors explain curriculum alignment in different ways. But in this study, curriculum alignment is addressing the extent to which the mathematical contents of pre-service mathematics teachers learn in college align with the primary school mathematics they will teach in future. The alignment of the contents prepares pre-service mathematics teachers for what is coming and assists them in understanding on the relationship between what they are currently studying and what they will teach or do. Therefore, curriculum alignment can be considered as one of quality indictor in teacher education program. In other words, it improves the quality of education and academic achievement, and have a significant role in

academic performance during the teaching process (Bay, 2014). The significance of well-aligned teacher education programs for adequately preparing teacher candidates for their future careers, which will for sure affect the quality of education at schools in the long run (Tekir, 2016).

However, the data obtained from this study informed that the extent of alignment of mathematical content components of generalist curriculum is low with that of the mathematical contents of primary school syllabi but mathematical contents of specialist and linear curriculum is moderately aligned with primary school mathematics contents components. This mean that there is a lack of some contents of primary school mathematics in college teacher education curricula, which created contents gap between contents of pre-service mathematics learn and the contents they teach in primary school after their graduation. In briefing this, some topics of primary school mathematics are not existed in curriculum of teacher education program which leads to opens space and time for pre-service mathematics teachers to focus on fewer topics in greater depth, developing their sense-making and reasoning capabilities as they work with the primary school mathematics curricula material. After their graduation, in this regard, various studies and reports indicated that graduate pre-service teachers were not equipped with the content knowledge they need for teaching (Teacher Education Ministerial Advisory Group, TEMAG, 2015). This showed that there are either some school contents were not incorporated in to teacher education program or not assisted to ensure pre-service teachers maximize their learnings of the various contents of school mathematics. To alleviate this, Livy, Vale, & Herbert, (2016) thought that preservice teachers are provided with opportunities during teacher education programs to ensure they develop different categories of school mathematical content knowledge they will rely on for teaching primary mathematics. One of the opportunities suggested by various authors were practicum or school-based learning (Adoniou, 2013; Allen, Ambrosetti, & Turner, 2013). The longitudinal study conducted by Turner et al (2012) identified that working with students and reflecting on classroom experiences assists development of school Mathematical content knowledge.

It is commonly known that, in mathematics classrooms, textbooks /syllabi are main part of what is involved in doing school mathematics; they provide frameworks for what is taught, how it might be taught, and the sequence for how it could be taught (Nicol & Crespo,2006). In short, textbooks and syllabi are an important part of classroom life in elementary and secondary schools. However, they further claimed that, little attention has been given to the role these materials might play in teacher preparation and teacher development which helped them to understand and know basic school mathematical contents and its nature. This is to mean that contents of primary school were got little attention in teacher education program, which agreed with the findings of this study.

Conclusion and Recommendation

Conclusion

The result of the study portrayed that the curricula materials of generalist have low level of alignment with the primary school mathematics contents whereas those of specialist and linear curricula were aligned with the mathematical contents of primary school curricula in moderate level. As it was indicated in the findings of the study, the college curricula materials are not fully aligned with the contents of primary school mathematics. There are school mathematical contents which are not included in curricula of teacher education. Therefore, the intentions might be the pre-service are able to teach these concepts since they were learnt all those concepts in secondary schools.

Recommendations

In addition, this study is only a snapshot with limited data and participation on the three sampled college. Therefore, conducting further detailed (explore with further qualitative) studies with similar samples in Ethiopia would provide more explicit findings for pre-service mathematics teachers. Since the researches are growing worldwide and recently emerged on knowledge required for teachers, and what experiences pre-service mathematics teachers need in order to improve their content knowledge as well as their pedagogical content knowledge, such kind of research will help Ethiopian teacher education system to create vibrant teachers who can challenge the dynamic nature of the teaching profession.

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