

Mathematics Teacher Education Training for Quality School Teachers: An Assessment of Mathematics Teaching Needs of Preservice Teachers

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This paper presents the results of assessment of a preservice mathematics teachers' teaching needs study, conducted with university mathematics teacher education training final year preservice teachers who were preparing to become secondary school mathematics teachers and undergoing teaching practice exercises, teaching mathematics at various secondary schools. The semi-structure interview assessed preservice teachers' perspectives on their teaching needs, based on the experience and difficulties encountered during teaching practice. The qualitative results revealed that teaching practice experience was an interesting and memorable event that provided preservice teachers with a lot of learning opportunities and gave them confidence to teach mathematics after graduation. The finding also revealed that there is disconnection between the training curriculum contents and school mathematics curriculum for which preservice teachers were being trained to teach. We present a conclusion and suggestion on how the training should be run, and content areas – which if included would improve the quality of preservice teachers – were discussed.

Key words: *Preservice Teachers, Teacher Education, Teaching Needs, Evaluation, School Teachers, Training.*

Introduction

In view of the needs and aspirations of the society for quality education at all levels of education, the Nigerian government has viewed education as an instrument for national development and societal change (NPE, 2004). On the basis of viewing education as an instrument for national development and societal change, national policy on teacher education (NPE) states the objectives of providing teacher education training in the country as follows (NPE, 2004, p. 64):

1. To provide highly motivated, conscientious, and efficient classroom teachers for all levels in the educational system.
2. To encourage further a spirit of enquiry and creativity in teachers.
3. To help teachers to fit into the social life of the community and society at large, and to enhance their commitment to national objectives.
4. To provide teachers with intellectual and professional background adequate for their assignment, and to make them adaptable to any changing situation, not only in the life of their country but in the world.
5. To enhance teachers' commitment to the teaching profession.

Moreover, the government has vowed to provide quality education at all level of education that is comprehensive, functional and relevant to the needs and aspiration of the society for mathematics education (FME, 2009). The policy has stated certain objectives to achieve at all levels of education in the country as follows: "*The provision of quality education at lower levels (primary and secondary schools) will only be achieved by preparing preservice teachers and to either upgrade or update the knowledge and skills of teachers who were already in the service*" (FME, 2009, p. 6).

The declaration is for providing quality education at all level of education, especially on the need for preparing functional and effective school mathematics teachers who will shoulder the responsibility of providing quality education that is relevant to the needs and aspiration of the society. The declaration has led to a new policy for teacher education training. The new policy stated that the Nigerian government would like to: "*Produce highly skilled, knowledgeable and creative teachers based on explicit performance standards through Pre-Service and In-Service Programs who are able to raise a generation of students who can compete globally*" (FME, 2009, P. 6).

The declaration of new policy has charged teacher training institutions with responsibilities for grooming quality preservice teachers who would be employed to teach at secondary school. And the training should be based on the standard of teacher education, which will make their product adaptable to any changing situation (NUC, 2012). Despite the declaration

of providing quality teacher education training in the national policy on education and responsibility imposed on teacher training institutions for the preparation of quality and effective preservice mathematics teachers who shoulder the responsibilities of teaching mathematics at secondary schools, the teacher training institution has neglected their duty to groom quality and effective school mathematics teachers by producing teachers who are inadequate in terms of subject matter knowledge and pedagogical skills (Odia & Omofonmwan, 2007; Basera, 2019).

Okori and Jerry (2017); Udonsa, (2015) argued that teacher training institutions in the country were unable to train and produce adequate and qualified mathematics teachers who would assist government in providing quality education at secondary school level. (Kuiper, Thomas, & Olorisade, n.d.) posited that the teacher training institution has tended to produce mathematics teachers who are inadequate in their field of study and have low level numerical value and literacy skills. Anaduaka & Okafor (2013); Omorogbe & Ewansiha (2013) have noted that many people have begun to doubt the process by which preservice teachers acquired the certificate they possess, due to lack of subject matter knowledge they display in their field of study. (Musa M, 2011) posited that some school mathematics teachers cannot be relied upon to teach mathematics at lower level due to their low level of understanding of subject matter.

Mathematics Teaching Needs of Preservice Teachers

For preservice teachers to practise and execute teaching tasks effectively, the training should provide and groom them with the required knowledge and skills that are adequate, aligned with intended objectives of the training that are designed to equip and stimulate them to practice their chosen profession. A considerable amount of literature has been published on satisfaction of students' basic needs for them to function effectively and provide better results. These studies are M.A, Ibrahim Wun, T. Y., & Nordin, (2018) who posited that individuals are motivated to function effectively when their needs are satisfied. He further noted that the quality and effectiveness of any training is determined by how the training provided and satisfied the needs of the trainees (M.A, Ibrahim Wun, T. Y., & Nordin, 2018).

Abraham Maslow's theory of needs has highlighted the quality and effectiveness of students when their basic needs are satisfied. He posited that individuals are motivated to function effectively and produce better results when their basic needs are provided and satisfied at the appropriate time (Maslow, 1954). The above theory of needs establishes the evidence that every preservice mathematics teacher has the capacity and potential of producing better results when their basic needs are provided and satisfied at the appropriate time. To groom qualitative and effective preservice mathematics teachers, the task rests on the shoulders of

trainers of the program, as a large and growing body of literature has investigated the requirements mathematics teaching needs.

Shulman, (1986) is the pioneer advocate of the required mathematics needs that each teacher should possess to qualify as effective classroom teacher. He identified content knowledge, curriculum knowledge and pedagogical contents knowledge as the required mathematics training that each preservice teacher should possess to qualify as an effective classroom instructor (Shulman, 1986). There is a consensus among educationists and mathematics educationists in which they identified content knowledge (Danisman, 2017), comprehensive knowledge of mathematics (Wu Thiam Yew, Sharifah Norul Akmar Syed Zamri, & Lian, 2011), knowledge of learners, curriculum knowledge, knowledge of instructional strategies and resources, knowledge of measurement and assessment, content knowledge, knowledge of context, and knowledge of pedagogy (Hashweh, 2005) as the required mathematics training that each teacher should possess in order to produce better results.

Moreover, there is large volume of published studies that describe pedagogical content knowledge as the basic requirement of teaching (i.e. subject matter knowledge, knowledge of students, knowledge of teaching strategies, knowledge of shaping and elaborating the content, knowledge of curriculum material, media for the instruction, instructional processes; knowledge of purposes, knowledge of curriculum, knowledge of assessment and knowledge of pedagogy) that each training should provide and equip preservice teachers with in order to function effectively and produce better results (Fennema & Franke, 1992; Hill et al., 2008; Magnusson et al. 1999; Mark, 1990).

Consequently, based on the above literature reviews, the researchers deem it necessary to examine and assesses mathematics teaching needs of preservice teachers, to find out whether the training has provided and satisfied the mathematics teaching needs of preservice teachers.

Research Objective: The study aims to explore the mathematics teaching needs of preservice teachers.

Research Question: The research will provide an answer to the below question:

1. What are the mathematics teaching needs of preservice teachers?

Methodology: A qualitative method were used in the course of data collection, in which 10 preservice mathematics teachers were interviewed on their mathematics teaching needs based on the experiences and difficulty encountered during teaching practice.

Outcomes of the Assessment

The discussion of mathematics teaching needs of preservice teachers' focusses on the six (6) themes generated from the analysis of information obtained from interview protocol. The six (6) themes generated from semi-structure interview protocol are; teaching experience, difficulties encountered, relationship between the program curriculum and school mathematics curricula, how the program should be run, content areas if included the program objectives could be achieved, and achievement of program objectives.

Teaching Practice Experience

Table 1: Teaching Practice Experience of Preservice Mathematics Teachers

Teaching Practice Experience	Preservice Mathematics Teachers
Interested	PMT1, PMT2, PMT8, PMT9, PMT10
Confidence	PMT1, PMT8
Memorable	PMT6, PMT8
So funny	PMT3
Adequate	PMT5
Appreciated	PMT5
Learn a lot	PMT7
Courageous	PMT9
Not Comfortable	PMT4
Phobia	PMT4

Table 1 shows the Teaching Practice Experience of Preservice Mathematics Teachers. Teaching practice provides preservice mathematics teachers with teaching opportunities in which they put into practice what they have learned in school. All the 10 PMT that responded to interview questions of this study have described their teaching practice experience as a memorable event. To PMT 1, 2, 8, 9 and 10 the experiences was so interesting that it gave them confidence to teach mathematics in school after graduation.

According to PMT 1, "My teaching practice was very interesting because I was happy when I taught successfully, and my students understood the topic because I taught better than what their mathematics teachers taught them, and I also got confidence from outside when I met with my friend who told me, Muhammadu Sani we heard your students saying you are a good mathematics teacher that they never met before".

PMT 2 sees the experience as quite interesting, while PMT 1 and 8 described the experience as a joyful event that boosted their confidence in teaching school mathematics. To PMT 6 and 8 the experience was a memorable event that provided them with an opportunity to

interact with different people. PMT 3 described the experience as very funny. He says, “it is very funny, as I learned a lot of things”.

PMT 5 described the experience as very adequate and appreciated, which encouraged him to solve a lot of mathematical problems, particularly general mathematics. He described the experience as follows: *“I find my teaching practice experience very adequate, because my principal always appreciated the efforts I made, they like the way I am teaching my students, this gave more courage to double my effort”*. Moreover, PMT 7, has viewed his teaching practice experiences as a memorable event that provides him with an opportunity to learn a lot about students’ individual differences, present lessons based on individual differences, stand in front of students to deliver a lesson, and an opportunity to interact and share information with students and teachers.

According to PMT 7: *“I learned about individual differences of students and I can tackle the problem; I can successfully write a good lesson plan, and I have knowledge of students’ behaviour”*. PMT 9 described the experience as a lifetime experience which provides him with the opportunity to meet a lot of people. He says: *“it is a lifetime experience. It helps me to stand in front of students to deliver a lesson without any fear. The teachers and students are very friendly”*. PMT 4 sees the experience as a horrible event that make him uncomfortable throughout the period. He further noted that the students did not actively participate in the lesson because of the fear of mathematics.

Difficulties Encountered

Table 2: Difficulties Encountered by Preservice Mathematics Teachers

Difficulty Encountered	Preservice Mathematics Teachers
Lack of Interest	PMT1
Phobia	PMT1, PMT8, PMT10
Lack of Instructional Materials	PMT1, PMT2
Over Population	PMT3, PMT5, PMT8
Difficult Topics	PMT3, PMT5
Teaching aids	PMT4, PMT5, PMT6, PMT7, PMT9
Subject Matter Knowledge	PMT4
Communication Problem	PMT4
Students Co-operation	PMT6
Classroom Management	PMT7
Poor Students Background	PMT8, PMT9
Indiscipline	PMT9

Table 2 shows the difficulties that preservice mathematics teachers encountered during their teaching practice. All the 10 preservice mathematics teachers that were interviewed on their mathematics teaching needs had a different encounter with difficulties during teaching practice. According to PMT 1, he sees lack of interest and mathematics phobia among his students as the major difficulty encountered. PMT 1, states that: *“my difficulties during teaching practice is that the students do not have an interest in mathematics lessons, because of the persistent phobia of the subject, that is why they don’t have a mathematical set”*. To PMT 1, 8 and 10, they described mathematics phobia among their students as the difficulty they encountered.

PMT 1, and 2, viewed lack of instructional materials as the difficulty encountered, which has *“seriously affected”* their classroom instruction. PMT 1 says *“the problem of instructional materials has seriously affected my teaching and students’ learning”*. PMT 3, 5 and 8 see the number of students in class as the difficulty encountered, which prevents them controlling their students and providing effective teaching and learning process. According to PMT 3 and 5, they viewed difficult mathematics topics that are not relevant to their program curriculum as the difficulty they encountered. To PMT 4, 5, 6, 7 and 9, they described lack of instructional materials as the difficulty they encountered.

PMT 4 noted that if he had the courage to speak in public before teaching practice, his teaching performance could be better. Therefore, he views his inability to speak in public and lack of subject matter knowledge that is not relevant to his program curriculum as the difficulties encountered. PMT 4 says: *“I never speak in public, that is why I am not comfortable with students”*. PMT 6 views lack of students’ cooperation as the difficulty he encountered. According to PMT 8, and 9, the difficulty they encountered is students’ poor background in mathematics, which has seriously affected their classroom instruction. PMT 9 described indiscipline among his students as the difficulty he encountered.

Relationship between the Program Curriculum and School Mathematics Curricula

Table 3: Relationship between the Program Curriculum and School Mathematics Curricula

Relationship between the Curricula	Preservice Mathematics Teachers
Objectives	PMT1
Purpose of the Study	PMT1
Syllabus	PMT1
Different	PMT2, PMT5
Partially Related	PMT3
Irrelevant	PMT4, PMT6, PMT7
No Relationship	PMT8
Entirely Different	PMT9
Not the same	PMT10

Table 3 shows the relationship between the mathematics teacher education training curriculum and the secondary school mathematics curriculum in which the preservice teachers are being trained to teach after graduation. Based on the information gathered from the 10 preservice mathematics teachers that are been interviewed, seven (7) out of the 10 preservice teachers believed that their training curriculum is totally different from school mathematics curricula, only three (3) of the interviewees believed that the curriculum of teacher education training and school mathematics curricula are related in terms of objectives, purpose of the study and syllabus.

According to PMT 1, the teacher education training curriculum is related with the school mathematics curricula in terms of objectives of the study. He says: *“I can relate my program curriculum with school mathematics curriculum by considering the objectives, purpose of the studies and syllabus”*. PMT 2 and 5, see the mathematics teacher education curriculum as something that is totally different from the school mathematics curriculum, which is more of engineering mathematics, while the school mathematics curriculum is more of general mathematics. PMT 2 says: *“the curriculum is totally different because the training curriculum is more engineering mathematics, while the school mathematics curriculum is general mathematics that deals with algebra”*.

To PMT 5, *“my program curriculum content is mostly further mathematics, and some aspect of engineering mathematics, whereas school mathematics curricula is mostly general mathematics”*. To PMT 3, the mathematics teacher education training curriculum is partially related with the school mathematics curriculum. PMT 4, 6, and 7 noted that the mathematics teacher education training curriculum is totally irrelevant with the school mathematics curriculum which the preservice mathematics teachers are being trained to teach after graduation. PMT 7 says: *“The mathematics teacher education training curriculum contents is*

irrelevant to the school mathematics curriculum, because the contents are not the same and have no relationship with the school mathematics curriculum”.

According to PMT 8, *“our program curriculum contents has no relationship with the curriculum contents that was given to us to teach during our teaching practice; that is why we find it very difficult in teaching some topics”.* Moreover, PMT 9 described the mathematics teacher education training curriculum contents as entirely different with school mathematics curriculum contents. He says: *“the curriculum is entirely different with school mathematics curriculum, only a few topics can be related with some topics of secondary school mathematics”.* To PMT 10, the mathematics teacher education training curriculum contents are not the same as the school mathematics curriculum. He says: *“actually the curriculums are not the same, because my program curriculum is irrelevant to the school mathematics curriculum”.*

How the Program Should be Run

Table 4: How the Program should be run

How the Program Should be run	Preservice Mathematics Teachers
Student Encouragement	PMT1
Regular Exercise	PMT1
Curriculum Relevant to School Curriculum	PMT2, PMT10
Include School Curriculum	PMT3, PMT8
Add School Curriculum	PMT4
Rich Educational Courses	PMT5
Students Motivation	PMT6
Curriculum Similar to School Mathematics	PMT9

Table 4 present preservice mathematics teachers’ views and recommendations on how mathematics teacher education training should be run in order to achieve the intended objectives of the training, based on the information gathered from preservice mathematics teachers that have been interviewed on their mathematics teaching needs. The interviewees had a different perception on how the training should be run in order to achieve the intended objectives of the training. According to PMT 1, lecturers of the program should encourage preservice teachers to read beyond their training content areas by being given regular assignments and exercises on the school mathematics curriculum; this could enhance and consolidate preservice teachers’ effectiveness. PMT 2, 3, 4, 8, 9 and 10 believed that, if mathematics teacher education training could include secondary school mathematics curriculum contents, the objectives of the training can be achieved as stated in the national policy of education.

According to PMT 2, “the program should be run in such a way that the curriculum is related with what is taught in secondary school”. PMT 3 says: “my opinion is that mathematics curriculum contents of secondary school should be injected into teacher education training”. He further, explained that, if the training program includes “general mathematics” in their curriculum the “objectives of the training can be achieved”. To PMT 4 and 8, the training program should prepare preservice teachers with curriculum contents that contains all the secondary school mathematics curriculum, and the trainers of the program should give more emphasis on teaching aids, by providing preservice teachers with skills of how and when to improvise the teaching aids. To PMT 4; “my opinion is that the training supposes to add courses that include all contents of secondary school mathematics. Most of us can’t teach the secondary school mathematics curriculum, because we were not taught it in our program”.

PMT 5 says: “lecturers should provide students with skills of teaching aids, in order to know how and when to use it, and improvise it”. PMT 6 emphasised the importance of motivation as a means of engaging students for active learning. He suggested that the training should encourage preservice mathematics teachers to motivate as a means of engaging students for effective classroom instruction.

Content Areas that if Included, the Program Objectives could be achieved

Table 5: Content Areas that if Included, the Program Objectives could be achieved

Content Areas to be Included	Preservice Mathematics Teachers
Arithmetic	PMT1, PMT10
Algebra	PMT2
General Mathematics	PMT3, PMT8
School Mathematics Curriculum	PMT4, PMT5
Modern Instructional Material (i.e. Computer)	PMT6
Contents Relevant to School Mathematics	PMT7
Geometry	PMT9
Trigonometry	PMT9, PMT10

Table 5 shows some of the contents areas that if included in the training, the intended objectives of the training could be achieved. Based on the information gathered from interview protocol, all the preservice teachers that have been interviewed had a similar perception on the contents areas if included, the objectives of the training could be achieved. All the ten preservice teachers believed that, if the training included the general mathematics curriculum, the objectives of the training could be achieved. According to PMT 2, 3, and 8, the training should include the general mathematics curriculum and algebra that are related to

secondary school mathematics curriculum contents, to enable preservice teachers to effectively teach mathematics in school.

PMT 2 says: “*algebra should be included in the program, so that it relates with school mathematics*”. PMT 4, 5 and 7 posited that the training should include courses which will reflect all secondary school mathematics curriculum contents and equip preservice teachers with secondary school mathematics subject matter knowledge. To PMT 6, the objective of the training could be achieved if the secondary school mathematics curriculum is incorporated into teacher education training, and providing preservice teachers with basics skills and knowledge of using modern instructional technology.

PMT 6 says: “*the only thing to be included into teacher education training is the course, which will provide preservice teachers with knowledge and skills of using instruction*”. According to PMT 7, “*the training should add geometry topics to enable preservice mathematics teachers to master the secondary school mathematics curriculum*. PMT 9, and 10, posited that the program should include secondary school mathematics trigonometry topics in the training, to enable preservice teacher to effectively teach school mathematics.

Achievement of Program Objectives

Table 6: Achievement of Program Objectives

Achievement of Program Objectives	Preservice Mathematics Teachers
Not Achieved	PMT1, PMT7, PMT8, 9, 10
Fairly Achieved	PMT2
Partially Achieved	PMT3
Achieved	PMT4, PMT5, PMT6

Table 6 present preservice mathematics teachers’ views on whether the intended objectives of mathematics teacher education training have been achieved or not, based on their teaching practice experienced. The information gathered from preservice mathematics teachers that responded to interview questions showed the preservice mathematics teachers had a similar view on the achievement of objectives of the training. Five (5) of the PMT (1, 7, 8, 9, and 10) posited that the objectives of the training are not achieved, three (3) of the PMT (4, 5, and 6) viewed the objectives of the training are achieved, while two of the PMT (2, and 3) perceived the objectives of the training are partially achieved.

According to PMT 1, 7, 8, 9, and 10 that view the intended objectives of the training are not achieved, have noted that the curriculum content of the training is different from what has been taught in school, the training is more of preparation PMT for “*academic pursuit*”, and most of the PMT cannot teach all the topics that are given to teach in school, because all the

curriculum contents they have learned is totally different from what has been presented to them. PMT 8 says, *“the objectives of mathematics teacher education training are not achieved, since the training is geared toward M.Sc. curriculum rather than the secondary school mathematics curriculum”*.

PMT 9, believed that: *“the objective of mathematics teacher education training could only be achieved, when the curriculum content of the training is related with what is taught in the secondary school mathematics curriculum”*. PMT 2, and 3 argued that the objectives of the training are not achieved, because training curriculum is different from secondary school mathematics curriculum, and PMT cannot teach all secondary school mathematics curricula with confidence. Consequently, they asserted that the objectives of the training are partially achieved. PMT 2 says: *“ideally what is taught in the program is different with secondary school curriculum, the teaching practice students must study secondary school curriculum before he/she present his/her lesson. Hence the objective is fairly achieved”*. According to PMT 3, *“it is partially achieved since there are content areas which are needed to be included into program curriculum, so that teachers cannot be faced with the problem of learning secondary school curriculum at the instant of presentation of the lesson in school”*.

According to PMT 4, 5, and 6 who perceived the intended objectives of the training have been achieved, they posited that the objectives are achieved since the training has provided them with required teaching skills, and they have successfully taught secondary school mathematics curriculum during their teaching practice. Therefore, they are qualified as professional teachers, because they have mastered their subject area, and discharged their teaching practice exercise effectively, which is the objective of the training – to groom professional teachers who are competent to teach the secondary school mathematics curriculum after graduation.

Conclusion

The present study was designed to explore the mathematics teaching needs of preservice teachers, based on their teaching practice experiences and difficulties encountered. One of the more significant findings to emerge from this study is that the curriculum content of teacher education training was totally different from the school mathematics curriculum, for which the preservice teachers were being trained to teach after graduation. It is however revealed that the teaching practice exercises were organised in a such a way that all the preservice teachers have described the experience as a very interesting and memorable event that provided them with a lot of learning opportunities and boosted their confidence of teaching mathematics. Considerably more curriculum content that is relevant to school mathematics curricula will need to be included in the training, in order to provide and satisfy preservice teachers needs for them to function effectively and produce better results.



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