Butwal Campus Journal, Vol. 8, No. 1: 193-203, August 2025
Research Management Cell, Butwal Multiple Campus, Tribhuvan University, Nepal
DOI: https://doi.org/10.3126/bcj.v8i1.85567

Mathematics Teacher Training for Quality Teachers: An Appraise of Teaching Needs of Preservice Teachers

Mandhoj Giri

girimd36@gmail.com

Abstract

The article presents the findings of a study on the teaching requirements for preservice mathematics teachers that was carried out with final semester preservice university teachers who were aspiring secondary school mathematics teachers and involved in teaching practice exercises as well as teaching mathematics at different secondary schools, preservice teachers' assessments of own teaching requirements were assessed in regard to their experiences and obstacles during teaching practice, the content and pedagogical knowledge, how the program should be run? And achievement of the program objective. The qualitative research with phenomenological approach limited only on four students studying master degree fourth semester with mathematics as a major subject in Butwal Multiple Campus Butwal. The site and the participants of the study was selected purposively for the convenience of the researcher. The research was also limited on only the interview as a tool of information collection. The result suggest that the practice teaching increased the confidence to teach mathematics and their teaching practice experiences were fun and valuable opportunities them to learn. The results also demonstrated a gap between the math teaching that preservice teachers were trained to deliver in schools and the content of the training curriculum. Discussion included a summary, suggestions for how the course could be ordered and prospective areas of the curriculum that could improve the preservice teachers' competencies.

Keywords: Preservice teachers, teacher education, secondary school, teacher training.

Introduction

Pre-service teacher education programs are a core element of education systems, providing a foundation of knowledge and skills that new teachers rely on in the classroom. As such, major interventions aimed at foundational literacy and numeracy (FLN) in primary schools in low- and middle-income countries (LMICs) must place more emphasis on pre-service teacher preparation to ensure the sustainability of the quality of the teaching workforce. (Sunzuma & Luneta, 2023)

According to the European Commission (2007 b), key Competences for Lifelong learning. The teacher education curriculum includes the following four components: Strong subject knowledge, pedagogical expertise, the abilities and knowledge necessary to guide and encourage learners, and knowledge of the social and cultural aspects of schooling. The balance between these elements within the curriculum depends on a

variety of issues and is related to the views the different stakeholders have. There are several views on teaching and teacher education, and each view has its specific impact on the curriculum of teacher education and the learning of student teachers of teacher education. More and more teachers must be able to play multiple roles and contribute to: Development of children and young people as individuals. supervision of classroom learning activities. the transformation of the school as a whole into a "learning community." Relationships with the neighborhood and the world at massive (Swennen & Klink, 2008).

The current Australian context the practicum, or professional experience in teacher education, continues to be a very challenging area in which to work in Australian universities, given the multiplicity of political, professional and economic issues surrounding professional placements. The recent National Inquiry into Teacher Education (2007) stated that, while there was no crisis in teacher education, there were still ongoing concerns about the quality of teacher preparation. The practicum was identified as a key persistent in the paper that provides a conceptual framework for developing high-quality professional experiences for pre-service teachers (Le Cornu & Ewing, 2008).

(Stylianides & Hino, 2017). The Mathematics-Pedagogy Tasks (MPTs) were designed to help pre-service elementary teachers develop professionally, especially those who did not major in a subject related to mathematics. Pre-service elementary teachers can coordinate math learning, student cognition, and the order in which mathematics information is presented in the curriculum by using MPTs with appropriate theories. The learning of mathematics should be the starting point, as it enables them not only to understand the mathematics but also to build personal learning theories and to realize student cognition. The integration of mathematics and student cognition becomes the foundation for pre-service elementary teachers to comprehend curriculum arrangement and textbook design.

(Fosnot, 1993)Schifter & Fosnot, 1993). Teacher education encompasses teaching skills, sound pedagogical theory and professional skills. Teacher Education = Teaching Skills + Pedagogical theory + Professional skills. Teaching skills would include providing training and practice in the different techniques. Pedagogical theory includes the philosophical, sociological and psychological considerations that would enable the teachers to have a sound basis for practicing the teaching skills in the classroom. Professional skills include the techniques, strategies and approaches that would help teachers to grow in the profession and also work towards the growth of the profession.

Educating the younger generations ready to succeed in the knowledge society is a global challenge. Now, many nations understand the fundamental importance of effective education and the need for highly qualified instructors. The United Nations 2030 Agenda for Sustainable Development, which approved one of its Sustainable Development Goals, availability of qualified teachers and the caliber instruction. As a

result, providing all children and youth with a high-quality education and investing in the preparation of qualified teachers are priorities for advancing. The skills needed to function now 2025 are analytical thinking and innovation, active learning and learning strategies, complex problem solving, critical thinking and creativity (World Economic Forum, 2020). According to Hahl and Mikulec (2018), teacher educators must teach teachers how to actively learn throughout their careers. Learners must be able to learn permanently on their own in order to enjoy active learning. This competence requires the metacognitive abilities of planning, monitoring, and evaluation (Mutambuki et al., 2020). Curiosity, drive, persistence, and self-control are characteristics of lifelong learners (Solmaz and Aydin, 2016). Teachers need to consider themselves as lifelong learners in addition to having teaching competencies (Kallio et al., 2018). In short, expert teachers are required in teaching practice who, simultaneously, are excellent learners. (Matsumoto-Royo et al., 2022).

The structure of pre-service teacher education differs widely across countries. High-income, high-performing countries participating in the Program for International Student Assessment (PISA) have pre-service teacher education lengths from three years (Flanders, Belgium) to as long as seven years (Germany). In LMICs, pre-service teacher training is often two to three years, India's two-year diploma in education. Pre-service training is sometimes shorter, however, while Sri Lankan institutions offer a one-year diploma in teacher education. Types of pre-service training to be available at present are: Universities may also offer bachelor's degrees in education, in addition to shorter pre-service programs offered by colleges or vocational training institutions. Bachelor's degrees are more commonly required for secondary teachers. Regardless of their length and structure, pre-service programs should be designed to connect theory and practice. While there is no standard curriculum for pre-service teacher training, new teachers need to understand the content of the subjects they teach, how to teach specific subjects to students, and how to teach well in general, including classroom management and student engagement.(*Pre-Service Teacher Education in Nepal: A Qualitative Case Study*, n.d.)

Teacher education has always been a priority in Nepal. The Government of Nepal has made teacher education mandatory for all school teachers since 1971. To become a teacher one must have three qualifications. One, minimum qualifications; two teaching license; and three the success in teacher employment examinations. Pre-service teacher education is provided by the universities, license and teacher entry exams are conducted by the Teacher Service Commissions. Teachers have an instrumental role in enhancing the overall development of students by nurturing their interests and sharpening their instincts. Mainly there are three phases in teacher education. The first one is the prior to their teaching career, which is called the pre-service teacher education. The second phase is very short, that induction training where the new teachers are oriented about school atmosphere, the classroom environment, nature of the students and other pedagogical aspects. The third one is the professional development opportunities provided to the working teachers is also called the in-service teacher education. Pre-

service teacher education has its own importance in teaching. Many countries around the world including Nepal have made it mandatory for entry positions as teachers.

Pre-service teacher education in Nepal

The structure of pre-service teacher education differs widely across countries. High-income, high-performing countries participating in the Program for International Student Assessment (PISA) have pre-service teacher education lengths from three years (Flanders, Belgium) to as long as seven years (Germany). But, In Nepal there is a similar pre-service teacher education system. The secondary school education board (SSE) provides education courses to prepare primary level teachers and the universities prepare secondary and university level teachers with their four-year B. Ed. Programs and masters' in education Programs (semester based in four semesters) respectively. In matters of contents, the curriculum for pre-service teacher training programs consists of three parts as Lynd (2005) presents: Academic studies/subject matter, which can result in a degree or diploma of specialization in at least two school related subjects. Professional preparation, usually comprised by the study of educational theory, foundation of education courses, professional studies such as pedagogy and methods courses, child development, and training linked with teaching skills necessary to be efficient and effective as a teacher in school, and School practice/practicum: This may vary from short practical periods in school to larger periods of internship.

Nepal has a history of eight decades of teacher education. Basic teacher education started as early as 1948. Formally the initiation of pre-service teacher education started in Nepal after the establishment of College of Education in 1956, five years before the establishment of Tribhuvan University (TU). This indicates that the then government was anxious about quality education of children in schools. In the beginning the program concentrated on primary teacher training called normal teacher training. Secondary teacher training Since 1996 Tribhuvan University (TU) has been implementing three-year Bachelor programs with an annual examination system in Faculties of Education (FOE)but since 2072 BS to till now it is four years with an annual examination system and there is system of peer teaching, micro teaching and in the last of fourth year there is 15 days school teaching program is called teaching practice. Teacher educator's program (M. Ed) is running in semester base. The purpose of teacher education was to make teachers competent both in content and pedagogy to help students learn better.

Training and development describes the formal, ongoing efforts that are made within organizations to improve the performance and self-fulfillment of their employees through a variety of educational methods and programmes. It is also considered as a tool for HRD. Training has immense potential in transfer and utilization of latest technical know-how, Leadership development, organization of people, formation of self-help-groups, mobilization of people as well as resources, empowerment of resource-poor rural mass, entrepreneurship development, etc., which are considered essential components of HRD. Teacher Education (TE) or teacher training refers to the

policies, procedures, and provision designed to equip teachers with the knowledge, attitudes, behaviors, and skills they require to perform their tasks effectively in classroom, school, and wider community. Specific training for teachers was originated in France (1685) by St. John Baptist de la Salle. Teacher training spread rapidly in Europe as a result of the work of August Hermann Francke and Johann Pestalozzi. Formally the school education in Nepal was initiated with the establishment of "Durbar school" in 1910 BS and formally teacher training program in Nepal was started with the establishment of basic teacher training center (BTTC, 1947).

The School Sector Reform Plan (SSRP, 2009) is a long-term strategic plan to achieve the goals and objectives of Basic and Secondary education under the Government of Nepal (GON), Ministry of Education (MOE), is the continuation of the on-going programmes such as Education for All (EFA), Secondary Education Support Programme (SESP), Community School Support Programme (CSSP) and Teacher Education Project (TEP), with the agenda for the school sector reform with an integrated system of 1-8 basic and 9-12 secondary education. The secondary levels, preservice teacher training is offered through university campuses (Faculty of Education) and Higher Secondary Schools (Education Stream) and the National Centre for Educational Development (NCED) was established to conduct training through Education Training Centers (ETCs) with objective: *to enhance teachers' qualifications and professional competencies to better facilitate students learning processes and with the opportunity. The institutional strength in terms of capacity, quality and its coverage throughout the country provides sustainable and cost-effective opportunities for pre-service and in-service teacher training and development.* Completion of a professional teacher training course has been made mandatory prior to entering the teaching profession.

In view of the needs and aspiration of quality education at all level of education, Nepal government has viewed education as an instrument for national development of self-sustainable, competitive, innovative and value oriented citizens for the socio-economic transformation of nation and societal change (SSDP, 2016), with the major organizational restructuring of the Ministry of Education Science and Technology(MOEST), the Centre for Education Human Resource Development (CEHRD) and MOEST's has been initiated. Out of ten objectives of SSDP the objectives related to secondary education and quality education are: *strengthened teacher management and accountability under SSDP's teacher management and professional development strategies for teacher Professional development by running teacher preparation programmes to supply adequate teachers to teach core subjects such as science, Mathematics and science, develop teacher development appraisal system that recognize outstanding teachers, make teacher professional development (TPD)mandatory using recently designed models for teachers of different levels and subjects.*

The upcoming educational policy, School Education Sector Plan (SESP. 2022), aims to ensure all Nepali citizens are able to access quality education to unlock their full

potential and participation in society. The long term goal of SESP is ensuring inclusive access of quality education for all children in Nepal. It was developed under the challenging circumstances of COVID-19 pandemic. SESP with four objectives and twenty- three strategies, having second objective "to enhance the quality and relevance of overall school education by ensuring school readiness, foundational learning and quality achievements for each child*"* with the strategies for achieving goal are*: emphasizing the use of modern and effective methods in the pedagogical process to enhance the quality of learning of all students, and update the teacher competences framework and coordinate with universities for the development and implementation of teacher preparation and pre-service training programmes***.**

(Gautam, 2016) There are two types of teacher training in Nepal and they are conducted by the two different institutions; university and Ministry of Education. Secondary level pre-service teacher training programs are conducted by different universities. Some studies (Bista, 2002 and FOE, 2003) have raised doubts over the performance of the training providers and posed doubt over the quality of their graduates. One can assume that the training should help teachers perform better in the classroom practice. Studies (Thpa, 2007; Bista, 2002; and FOE: 2003: 21) mention that trained secondary teacher have not been able to make difference in their classroom teaching.

Objectives of the Study

The general objective of the study is to observe the preservice mathematics teacher training in secondary level school in Nepal.

The specific objective is: To explore secondary school mathematics teaching needs for preservice teachers.

Research Questions

Research questions are the guiding questions of the study. Generally, objectives are converted into the question form. Research question guide the researcher to reach the findings of the study but it is a valuable defense against the confusion and carrying the whole theme of research. It organizes, delimit, provide a framework and point to the data that will be needed (punch, 2005). The research will provide answer to the below question:

a. What are experience of secondary level mathematics teachers in teaching needs foe preservice teachers?
b. How effectively does the preservice training program prepare them for classroom teaching?

The continuity of teacher training programme in Nepal from basic teacher training center (BTTC, 1947) to School Education Sector Plan (SESP. 2022) in all educational policies the teacher training is in different forms and in nature of conducting. The different government and private organization indicating the need of teacher training. Most of the educational policies suggesting to update the teacher competences framework and coordinate with universities for the development and implementation of teacher preparation and pre-service training programmes, this indicates the need of pre-service teacher training. According to the European Commission (2007 b), The

Mathematics-Pedagogy Tasks (MPTs), The United Nations 2030 Agenda for Sustainable Development, and World Economic Forum, 2020, the teacher training is essential component of quality education, so Teaching Needs of Preservice Teachers' is a rational topic for study.

Delimitations

This report discusses University level pre-service teacher education i.e. M. Ed programs. After the establishment of TU all the programs of College of Education were brought under the University. Later Kathmandu University started teacher education programs for Primary teachers (2002) and Early Childhood teachers (2009). Purwanchal University started its preservice secondary teacher education through distance mode in 2005. At present Sudurpaschim University, Mid-Western University also running Bachelor degree in Education. However, the massive teacher education program still is run by TU, so this study is limited in the study of preservice teacher education conducted by TU only in master degree program and only on four students of teaching practice with major subject Mathematics under the supervision of researcher himself as a practical exam finished on 2082|02|09 I Butwal Multiple Campus Butwal. The research is limited on qualitative method with phenomenological design and descriptive analysis of obtained information of in-depth interview.

Methods

A qualitative method was used in the course of information collection, in which 4 preservice mathematics teachers studying master degree in Mathematics education in Butwal multiple campus Butwal and just they finished their teaching practice on 2082|02|09 in Butwal multiple campus Butwal as a practical exam, so the researcher used the phenomenological design because it explores and describes the lived experience of individuals and it helps to revel how teachers experience and interpret the teaching needs for preservice teachers and I focus on common themes and meaning drawn from their experience under internal supervision of researcher-self were interviewed on their mathematics teaching needs based on the experiences, difficulty encountered during teaching practice, program running, content and pedagogy knowledge and and achievement of program objectives.

Findings

The findings of the study are as below: the teaching practice is interesting, we learn a lot, it is memorable and it develops the confidence of the participants. We encountered difficulties due to lack of interest of students, math phobia of students, and lack of good instructional materials. The participants faced difficulties due to lack of content and pedagogical knowledge and lacking in the knowledge of presentation. Students encouragement and motivation is very much important and the objectives of the preservice are achieved by this teaching practice. In summarized form the findings developed on qualitative information analysis that is thematic analysis the, teaching practice is essential because it is helpful for participants of teaching practice in wide angle whatever the conducting process and level of support of supervisor need to rethink.

Discussion

Pre-service programs provide for growth in content knowledge and pedagogical content knowledge. Content knowledge and pedagogical content knowledge is translated into practice through the filter of one's philosophy of mathematics and its learning (Swafford, 1995). Thus, apart from knowledge and abilities, prospective teachers are expected to develop positive attitudes and beliefs related to the task. Teacher education should facilitate trainee teachers to transform and enhance their beliefs in relation to classroom actions, so the study of mathematics teaching needs of preservice teachers' focuses on the five (5) themes generated from the analysis of information obtained from interview protocol. The five (5) themes generated from semi structure interview protocol are: teaching experience, difficulties encountered, how the program should be run, content and pedagogical knowledge, and Achievement of program objectives. (Ibrahim et al., 2020).

Table - 1

Teaching Practice Experience

Teaching Practice Experience of Preservice Mathematics Teachers

Teaching Practice Experience	Preservice Mathematics Teachers
Confidence	PMT1, PMT3, PMT4
Memorable	PMT1,2,3 and 4
Interested	PMT1, PMT2, PMT4
Adequate	PMT3
Learn a lot	PMT1, 2, 3 and 4
Courageous	PMT2
Phobia	PMT2

The above information 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 to University level. All four PMT that responded to interview questions of this study has described their teaching practice experience as memorable event and they accept we learn a lot of things, PMT 1, 2 and 4 the experiences were so interested and PMT 1, 3 and 4 said that the preservice teaching gave them confidence to teach mathematics in school after graduation. But PMT2 said that it must be courageous for us to decrease phobia. *According to* PMT1 *My* teaching *practice was very interested, because I was happy when I teach successfully, and my students understand the topic I taught better than what their mathematics teachers taught them, and I also get confidence from outside when I meet with my friends, they told me you are good mathematics teacher that they never meet before. Other analysis was done under the following aspects:*

Table - *2*

Difficulties Encountered:

Difficulties Encountered by Preservice Mathematics Teachers

Difficulty Encountered	Preservice Mathematics Teachers
Lack of Interest	PMT1, PMT2 and PMT4

Teaching aids/ Instructional materials	PMT2, PMT3 and PMT4
Students Co-operation	PMT1
Poor Students Background	PMT2
Phobia	PMT1, PMT2 and PMT4
Indiscipline	PMT1 and PMT4

The above information-2, shows the difficulties that preservice mathematics teachers encountered during their teaching practice. All the 4 preservice mathematics teachers that were interviewed on their mathematics teaching needs had differently encountered with difficulties during teaching practice. According to PMT 1, 2, 4 faced difficulties due to lack of interest and mathematics phobia among the students as the major difficulty encountered. PMT 1, states that: "my difficulties during teaching practice is that the students do not have interest in mathematics lesson, because of the persistent phobia of the subject, that is why they don't have mathematical ideas in sequence". PMT 2, 3, 4 they described lack of Teaching aids and Instructional materials as the difficulty they encountered. PMT 1, 4 viewed that, the difficulty encountered due to in-disciplined students. The lack of interest, phobia in mathematics, teaching aids and instructional materials serious matter of causing difficulties. Students co-operation and poor students background are also causing difficulties.

Table -3

Content and Pedagogical knowledge:

Difficulties caused by preservice teachers due to content and pedagogical knowledge

Content and pedagogical knowledge	Preservice Mathematics Teachers
Lack of content knowledge	PTM1, 2, 3 and 4
Overconfident	PMT2
Lack of pedagogical knowledge	PMT1, PMT2 and PMT3
Presentation problem	PTM1, 2, 3 and 4
Preparation	PMT2 and PMT4

The above information table-3, shows the analysis of need of preservice mathematics teachers due to their content and pedagogical knowledge in teaching practice. All the 4 preservice mathematics teachers that are been interviewed on their mathematics teaching needs had a different difficulties caused due to content and pedagogical knowledge in teaching practice. All the teacher accepted that lack of content knowledge and good presentation skill is main difficulties in teaching. PMT1 2, 3 states that "they faced difficulty due to lack of pedagogical knowledge in subject matter" and they accepted pedagogical knowledge is an essential component for quality teaching PMT2, 4 viewed that, the difficulty encountered due to lack of preparation of lesson and overconfident is also cause problem in teaching. *PMT2 explained his experience that, if we are overconfidence about lesson that, it is very easy and no need to prepare the lesson at that day the class is very poor whatever the topic is very easy and interesting also. Therefore, the preparation of lesson and planning of teaching is very important.*

Table - 4

How the Program should be run?

Preservice Mathematics Teachers Teaching Experience for Conducting Program

How the Program Should be run	Preservice Mathematics Teachers
Student Encouragement and motivation	PMT1, PMT2, PMT3, PMT4
Regular Exercise	PMT1
Curriculum Relevant to School Curriculum	PMT3
Include School Curriculum	PMT2
Curriculum Similar to School Mathematics	PMT4

The above information 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 were interviewed on their mathematics teaching needs. The interviewers had a different perception, on how the training should be run, in order to achieve the intended objectives of the training. PMT1, 2, 3 and 4 lecturers of the program accepted that we should encourage and motivate students and supervisor realized that the preservice teachers also need motivation to read beyond their training content by giving regular assignment and exercise on school mathematics curriculum; this could enhance and consolidate preservice teachers' effectiveness. Only PMT3 accepted that curriculum relevant to school curriculum, PMT2 accepted that tis content include school curriculum and PMT4 only accepted that curriculum similar to school mathematics. But most of them accepted if mathematics teacher education training included secondary school mathematics curriculum contents, or curriculum relevant to school curriculum or curriculum similar to school mathematics the objectives of the training can be achieved as stated in the national policy of education. Only PMT1 realized that the regular exercise is needed for students and preservice teacher for quality teacher training.

Table- 5

Achievement of Program Objectives

Preservice Mathematics Teachers perception about achievement of program objectives

Achievement of Program Objectives	Preservice Mathematics Teachers
Not Achieved	No teacher
Fairly Achieved	No teacher
Partially Achieved	PMT3
Achieved	PMT1, PMT2, PMT4

The above information table-5 present preservice mathematics teachers' views on whether the intended objectives of mathematics teacher education training has been achieved or not, based on their teaching practice experienced. The information gathered from preservice mathematics teachers that responded to interview questions. The preservice mathematics teachers had the following views on the achievement of

objectives of the training. PMT 1, 2, 4 replied that the objectives of the training are achieved. PMT3 viewed the objectives of the training are partially achieved.

Conclusion

The present study was designed to explore 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 is not matching with school mathematics curriculum, for which the preservice teachers were being train to teach after competition of masters' program and before beginning of teaching job. Its however, revealed that the teaching practice exercise were organized in such a way that all the preservice teachers have described the experience as so interested, and memorable event that provide them with a lot of learning opportunities and boost their confidence of teaching mathematics. Other more relevant content to school mathematics curricular will need to be included in the training, in order to provide and satisfy preservice teachers need them to function effectively and produce better result.

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