Developing a Framework of Pedagogical Content Knowledge on Arithmetic for the Primary School Teachers of Mizoram

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Introduction

In order to live life to the fullest and in an effective way, quality of education is very important. Teachers are liable for delivering best knowledge for the welfare of people, society and the whole nation. Pedagogical Content Knowledge (PCK) helps teachers to transmit their knowledge to the students in an effective way. Having in-depth knowledge and understanding about the content is not enough to be a good teacher, they should be able to communicate it with the students effectively. Therefore, the knowledge of pedagogy is crucial for classroom instruction. Teachers should possess the skills to deliver the content in the most simple and easy way that can be understood by the students. In the process of teaching and learning it's not only students whose lack of understanding of concepts sometimes create misconception, it may also be due to the teacher's wrong delivery of concepts, especially in subjects like arithmetic. Misconceptions are not new in arithmetic but in-depth understanding and vigorous skills of teachers will help to eliminate those misconceptions. According to Shulman (1987, p. 8), PCK is that special amalgam of content and pedagogy that is uniquely the providence of teachers, their own special form of professional understanding. PCK identifies the distinctive bodies of knowledge for teaching. It represents the blending of content and pedagogy into an understanding of how particular topics, problems, or issues are organised, represented, and adapted to diverse interests and abilities of learners, and presented for instruction. PCK is the category most likely to distinguish the understanding of the content specialist from that of the pedagogue. Arithmetic

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is a part of primary school curricula. In the technological era it is an applied subject. The usefulness of arithmetic for daily life is important, its instrumental role in other disciplines, the need for a basic knowledge in many professions and the important role of arithmetic in developing critical reasoning cannot be ignored. There is increasing emphasis on the importance of teaching arithmetic skills in primary schools. Today's mathematics teachers are experiencing major changes not only in subject content they teach but also in the way they teach.

The present research focused on developing a framework on pedagogical content knowledge for primary school teachers teaching arithmetic. Pedagogical Content Knowledge (PCK) is a set of special attributes helping someone transfer the knowledge of content to others. It entails knowledge of how to structure and represent academic content for direct teaching to learners, knowledge of learners thinking, including the common conceptions, misconceptions, and difficulties learners encounter when learning particular content and knowledge of the specific teaching strategies that can be used to address learners learning needs in particular classroom circumstances.

Objectives of the Study

The study was undertaken with the objectives:

1. To analyse the competence, confidence and preparedness of primary school teachers in Mizoram for teaching the arithmetic.
2. To identify the difficulty in arithmetic faced by the teacher.
3. To identify conception, misconception and alternative conceptions of teachers on arithmetic.
4. To analyse and explore the special characteristics of PCK contributing to it being better teacher knowledge for primary school teachers of Mizoram in arithmetic.
5. To design and develop a framework to guide and inform the development of PCK for primary school teachers of Mizoram on arithmetic.
6. To understand the effect of emerging framework for the development of PCK for primary school teachers of Mizoram on the their classroom experiences.
7. To analyse the challenges in the implementation of the new PCK framework.

Method

From all the primary schools in the eight districts of Mizoram, 20 primary schools and 160 primary school teachers (one from each school) were selected to participate in the study. Also, eight teacher educators who were dealing with the pedagogy of mathematics from eight DIETs were included for the study. Further, one best school from each district was selected for implementing the framework on an experimental basis. The questionnaire was used to examine the competence and the confidence of teachers in the teaching of arithmetic. After that, based on the data that emerged from the baseline study, a PCK framework was developed for arithmetic in a workshop. The observation method was followed to understand how the emerging framework for the development of PCK for primary school teachers impacted the teacher's classroom experiences.

Findings of the Study

Findings from this research indicated that the complexity in teaching arises due to a lack of conceptual understanding of the teacher, lack of interest, and extended syllabus. It was also found that there is a need for regular curriculum revision from time to time so that problems faced by the teachers and students can be resolved. The research highlighted that pedagogical content knowledge plays a vital role in preparing teachers for effective teaching and learning. It further revealed different areas in which the students were having alternative conceptions. Majority of the teachers in the study expressed that they try to clear student's misconceptions or alternative conceptions while teaching arithmetic in the class. Chances of arithmetic errors depended both on teacher and student, teachers are required to have conceptual understanding about the content they were dealing in the class in order to avoid ambiguity. When asked about different procedures to clear student's misconceptions or alternative conceptions, majority of teachers responded they use different methods of teaching in order to clear the doubts of the students.

Results showed that teachers were more comfortable with an activity based approach in teaching arithmetics. It involved students as active participants rather than passive learners and focused on learning by doing. It made the classroom environment more vigorous and fruitful that might be the reason teachers were more comfortable with this approach to teach in the actual classroom situation. It highlighted different basic strategies used

by the teachers to help students to overcome their misconceptions or alternative conceptions. These strategies included lesson plan, re-plan, probing student's thinking, variety of teaching and learning strategies to explain concepts, skill in questioning techniques, usage of language of teaching and learning, time utilisation (flow and pacing according to learner ability). All these strategies were used by the teachers at one or the other point of time, but majority of the teachers opined that they used a variety of teaching and learning strategies to explain concepts to the students. The use of different teaching aids in the class helped to create and draw student's attention in the lesson especially at the primary level. It was found that schools should provide financial support for developing teaching-learning materials which would make the classroom environment interesting and effective.

The study further revealed that the majority of teachers perceived that there was less need to emphasise on basic computational skills in teaching arithmetic due to calculators. While some primary teachers emphasised on computational skills and use of their ability and experience in teaching arithmetic rather than using calculator in solving basic mathematical problems. Lastly, the research clearly showed that the majority of teachers expressed low confidence in dealing with certain concepts of arithmetic. Though in some areas like, addition and subtraction, multiplication and division, and tables, etc., teachers expressed high confidence but there were teachers who showed their unwillingness to teach some areas of arithmetic if given an option. When a teacher teaches a particular topic that is out of the interest or having less knowledge of content, there is a chance of error. Specific training on arithmetic is needed as revealed in the previous findings in order to eradicate the errors in the learning teaching process of arithmetic.

Policy Implications

The research recommended teachers' orientation and refresher programme with the right kind of pedagogy to handle difficult areas of arithmetic. Further, it recommended the inclusion of pedagogical content knowledge framework in pre-service and in-service elementary school teacher training programmes. The research suggested that the professional development programmes must provide atmosphere allowing autonomy to both teachers and learners to make teaching-learning interesting and fruitful.

References

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