JOURNAL OF EDUCATIONAL AND INSTRUCTIONAL STUDIES
IN THE WORLD
November 2012, Volume: 2 Issue: 4 Article: 09 ISSN: 2146-7463

PREPARATION OF EFFECTIVE TEACHERS OF MATHEMATICS FOR EFFECTIVE TEACHING OF MATHEMATICS

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Abstract

In Pakistan, Mathematics' teachers use different techniques and strategies for effective teaching of mathematics. Teacher's dynamic participation and active role in the mathematics' classroom can make it more effective and interesting. Effective teaching of mathematics can be done only when teacher has subject matter knowledge and know the ways to transfer knowledge. It is a common observation that students feel mathematics a dry subject as teachers remain failed in making mathematics an interesting subject. It is also argued that mathematics courses in teacher training program do not prepare student-teachers for conceptual teaching and these student-teachers join their job with poor content knowledge and pedagogical skills, there teaching depend on their academic qualification rather than professional qualification. National Educational Policy (2009), claims that in-service teachers training in mathematics shall be provided, with due attention to developing conceptual understanding, procedural knowledge, problem solving and practical reasoning skills. The objective of the study was to explore the opinion of the teachers about the content of the mathematics courses in teacher training programs. The research question was: what is the impact of job category (Primary, Middle, and Secondary) and gender on total score of teachers' satisfaction about content of mathematics course in teacher training programs? The sample for the study was the mathematics' teachers who have mathematics background and have taken mathematics as a subject in teacher training program. A questionnaire was developed on five point Likert scale for knowing the opinion of the teachers. ANOVA was used for finding the impact of job category and gender on teachers' satisfaction about content of mathematics course in teacher training program.

Key Words: Effective Teachers, Effective teaching, Content of Mathematics course in teacher training programs.

INTRODUCTION

Currently, Teaching does not mean to transfer some information or facts to the students; rather teaching has become more comprehensive, multifaceted and complex phenomenon, in which the roles of teacher and students have been changed. In the new paradigm of teaching-learning process, teaching means to prepare students for future where they will met more complicated situation that will force them to think in some different ways to stay with change. Effective teaching is the only way that can prepare students to meet the challenges of such situation. Effective teaching means, teaching through which desired objectives may be achieved and students may learn with fully understanding. It is effective teaching that prepares the students to absorb new knowledge, connect it with previous knowledge and make a chain of knowledge for working in the changing environment.

Among all subjects of school, mathematics is one of the subjects that always challenge the students' abilities of thinking and understanding. Mathematics is the subject that demands conceptual knowledge, procedural knowledge and a connection between existing knowledge and previous knowledge. Any poor domain of knowledge can cause the problem in learning of mathematics. Effective teaching of mathematics requires effective teachers of mathematics and for effective teachers, it is necessary that teachers must have subject matter knowledge and a good hand over passing his/her knowledge effectively to the students. If a mathematics teacher has subject matter knowledge and does not know the way to transfer that knowledge

effectively to the students, cannot teach mathematics effectively. Effective teaching of mathematics demand perfect relationship between subject matter knowledge and its delivery to the students.

National and International reports claim that in Pakistan, the curriculum of teacher education has less potential to prepare the teachers for the challenges of 21st century. It is also said that there are many gaps between the curriculum of teacher training programs and the classroom situation. Government of Pakistan is committed to minimize these gaps and to improve the situation of curriculum of teacher training programs, in this regard; several steps have been taken from revision of curriculum to teaching practice with the only aim to produce effective teachers who have knowledge, skills and potential to meet the challenges of the changing environment.

Generally, at school level, mathematics is taught by the teachers who have academic background in mathematics and have learnt mathematics in teacher training program. It is a common perception that in the mathematics classrooms, teachers utilize their academic qualification and less importance is given to the pedagogical skills. Teacher training institutes are giving due attention to overcome the deficiencies pointed out by the research and are trying to produce effective mathematics teachers who have ability to teach mathematics effectively.

Literature

Shellard & Moyer (2002) identified following three critical components to effective mathematics instruction:

1. Teaching for conceptual understanding
2. Developing children's procedural literacy
3. Promoting strategic competence through meaningful problem-solving investigations

Protheroe (2007) suggests that Instruction at the middle grades should build on students' emerging capabilities for increasingly abstract reasoning, including:

1. Thinking hypothetically
2. Comprehending cause and effect
3. Reasoning in both concrete and abstract terms

The Education Alliance (2006) identified the following factors could be considered for effective teaching of mathematics:

- Focus lessons on specific concept/skills that are standards-based
- Differentiate instruction through flexible grouping, individualizing lessons, compacting, using tiered assignments, and varying question levels
- Ensure that instructional activities are learner-centered and emphasize inquiry/problem-solving
- Use experience and prior knowledge as a basis for building new knowledge
- Use cooperative learning strategies and make real-life connections
- Use scaffolding to make connections to concepts, procedures, and understanding
- Ask probing questions which require students to justify their responses
- Emphasize the development of basic computational skills (p. 17)

Department of Education and Training of Australia (n.d) believe that Effective teachers have a thorough knowledge of their subject content and skills.… Effective teachers use their knowledge of learning processes to determine which will be most effective to help the particular students in their classes learn successfully.

Teacher Training Programs in Pakistan

Primary Teaching Certificate (P.T.C.)

This was one year teacher-training programme. The admission criterion for this certificate was matriculation (mathematics is a compulsory subject at this level). The objective of this certificate was to produce teachers for grades I-V.

Certificate in Teaching (C.T.)

This was one year teacher-training programme. The admission criterion for this certificate was 12 years of schooling. The objective of this certificate was to produce teachers for grades VI-VIII.

Bachelor of Education (B.Ed)

This is one year teacher-training programme. The admission criterion for this certificate was bachelor degree. This program is offered in arts and science. The students take up the subjects they have learnt in their bachelor program, i.e arts or science.

The objective of this certificate is to produce teachers for grades XI-X.

It was observed that the duration of these teacher training programs is short as compare to other countries, in order to improve the quality of teacher training programs, in 2001, government of Pakistan bring reforms in teacher education programs. Report on the System of Education in Pakistan (2006) states that:

Under this reform, admission to primary school teachers' colleges (Grades I - VIII) will require either 10 or 12 years of schooling. The students with a matriculation background are required to complete a 3-year teacher training programme, while students who have passed Grade XII require 1½ years. Candidates obtain a Diploma in Education (p.24).

Teaching of Mathematics in Pakistan

In Pakistan, it is believed that mathematics is a key subject for many fields and can contribute maximum in the overall results in different forms. Mathematics is the subject in which students can earn 100 % marks and can make their marks sheet more attractive. But in reality, students do not rank it at top among their favorite subjects. Results show that this is the subject in which students face many problems and majority of the students drop it as they get option for selection.

School administration and teacher training institutes consider mathematics an important subject and treat it differently. For mathematics, most experienced and well qualified teachers are deputed with the objective of effective teaching. Khan and Jumani (2008) conducted a study entitled "Teaching of Basic Concepts at Secondary School Level" and concluded that the existing syllabus [of mathematics] is tough and teachers do not have command over the subject due to lack of proper training. National Education Policy (2009) states, in-service teachers training in mathematics shall be provided, with due attention to developing conceptual understanding, procedural knowledge, problem solving and practical reasoning skills.

Amirali and Halai (2010) conducted a study on teachers' knowledge about the nature of mathematics with 174 mathematics teachers taken from private and government schools of Karachi (Sindh) and found that 63% of these teachers irrespective of whether they are professionally qualified or not or whether they are novice or experienced teachers considered mathematical knowledge as 'truth' where mathematical rules can never be proved wrong.

This situation shows that teachers work on mathematics in a traditional ways as they believe that mathematics rules are fixed then why struggle hard for them, while effective teaching of mathematics demands critical and out of box thinking for effective learning of mathematics.

The objectives of teaching mathematics in pre-service teacher training programs are to train student-teachers for effective teaching of mathematics and to prepare student-teachers with critical thinking. Shahid (2007) advocates, the effective pre-service professional preparation leads to professional commitment and excellence in teaching.

Kiani, Malik and Ahmad (2012) in their study entitled "Teaching of Mathematics in Pakistan -Problems and Suggestions" recommended that although most the of the teachers have the professional qualifications of B. Ed, and M.Ed., it is recommended that curriculum and training programs may be revised time to time for the teachers.

Teacher Training Institutes are trying to improve the existing system of teacher training through reforms in curriculum, teaching methods and quality assurance, so that effective mathematics teachers may be produced for effective teaching of mathematics.

METHODOLOGY

Objectives of the Study

The objective of the study was to explore the opinion of the teachers about the content of the mathematics courses in teacher training programs (PTC for primary teachers, CT for elementary teachers and B.Ed for secondary teachers).

Research Question

The research question of the study was: what is the impact of job category (Primary, Middle, and Secondary) and gender on total score of teachers' satisfaction about content of mathematics course in teacher training programs (PTC for primary teachers, CT for elementary teachers and B.Ed for secondary teachers)?

Delimitation of the Study

Mathematics in teacher training programs is divided into two parts; first part is about teaching methods, merits and demerits of these methods and second part dealt with mathematical problems and match the content of school mathematics, the objective of this part is to train the teachers for solving problems in different forms. The present study was delimited to second part i.e content of mathematic in teacher training program.

Sample of the Study

A total of 300 mathematics teachers of public schools (middle and secondary schools with primary sections) were selected through cluster sampling technique from Tehsil Bahawalnagar (District Bahawalnagar). The selection criteria were:

1. For B. Ed, having mathematics (A & B) or general mathematics at bachelor level, for C.T, having mathematics in higher secondary school certificate.
2. Completed their teacher training program after 2001 with mathematics as an optional subject in PTC, CT or B.Ed.
3. Minimum 6 months teaching experience in public schools.

Level, gender and total number of teachers is as under:

Sr #	Level	Gender	Total Number
1	PTC (For primary classes)	Male = 50 & Female = 50	100
2	CT (For middle classes)	Male = 50 & Female = 50	100
3	B.Ed (For secondary classes)	Male = 50 & Female = 50	100

Instrument for the Study

A questionnaire with 15 items was developed on five point Likert scale (from 5= strongly agree to 1= strongly disagree) by the researcher. Before developing the questionnaire, the researcher discussed the content of mathematics of PTC, CT and B. Ed with three teacher trainers, who were teaching mathematics to these levels in teacher training institutes.

Validation of the Instrument

The self developed questionnaire was presented to ten senior mathematics teachers who were teaching mathematics to different grades and having experience of teaching mathematics to primary, middle and secondary level classes. It was requested that point out gaps or irrelevant statements and also suggest some measures for the improvement of the questionnaire. These teachers pointed out three statements which were not relevant with the other statements and suggested to delete them. In the light of their suggestion, these three statements were deleted. There were 10 statements in the final version of the questionnaire.

Reliability of the Instrument

For testing reliability of the instrument, a pilot study was conducted on 50 teachers who were teaching mathematics to different grades. Cronbach's alpha was calculated by using SPSS, it was found 0.64. These 50 teachers were also included in the final sample.

Data Collection and Analysis

The researcher delivered the questionnaire with the help of the colleagues and friends to the sample teachers working in different areas of tehsil Bahawalnagar. There was a covering letter with the questionnaire explaining the objective of the study. The researcher also explains the purpose of the data collection to his colleagues and friends so that if someone asks them about the purpose of questionnaire, they must be able to explain the purpose of the study.

Two-way ANOVA was used to determine the impact of job category (Primary, Middle, and Secondary) and gender on total score of teachers' satisfaction about content of mathematics course in teacher training programs (PTC for primary teachers, CT for elementary teachers and B.Ed for secondary teachers).

RESULTS AND DISCUSSION

Two-way between groups analysis of variance was conducted to explore the impact of job category and gender on total score of satisfaction about the curriculum of mathematics in teacher training programs for male and female teachers. Subjects were divided into three groups (PTC teachers, CT teachers and B. Ed teachers)
The assumption of homogeneity of variances was checked. The sig value was .586, meaning that the assumption of homogeneity of variances was not violated.

Tests of Between-Subjects Effects

Dependent Variable: Totalsatistaction

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	15.187[a]	5	3.037	.901	.481	.015
Intercept	468707.213	1	468707.213	138967.246	.000	.998
Jobcatagory	8.487	2	4.243	1.258	.286	.008
Gender	1.613	1	1.613	.478	.490	.002
Jobcatagory * Gender	5.087	2	2.543	.754	.471	.005
Error	991.600	294	3.373			
Total	469714.000	300				
Corrected Total	1006.787	299				

a. R Squared = .015 (Adjusted R Squared = -.002)

The above table shows that sig value for Gender * Jobcatagory is 0.471, means interaction effect is not significant, F (2,294) = .754, p= 0.471. There is no significant difference in the effect of job category on the total score of satisfaction about the curriculum of mathematics in teacher training programs for male and female teachers.

There is no significant main effect for job category and gender. This means that male and female teachers do not differ in terms of their total score as well as there was no difference in total score for job category.

MAJOR FINDINGS

After 2001, in Pakistan, teacher training institutes made different reforms to improve the overall scenario of teacher education. National Education Policy (2009, p. 43) highlights that pre-service training and standardization of qualifications; professional development; teacher remuneration, career progression and status; and governance and management of the teaching workforce, are the areas where reform is required for improving the quality of teachers. In this regard, higher education commission (HEC) and other supporting agencies come forward and helped teacher training institutes in different forms. Both male and female teachers having mathematics in teacher training programs, show their satisfaction about the Content of mathematics in teacher training programs. There agreed that Content of mathematics in teacher training program enable them to understand the content of school mathematics, provide students strong base foundation and to relate it to the daily life examples. They were of the opinion that Content of mathematics in teacher training program train them in problem solving, provide them core knowledge of mathematics, mathematical principals and their interrelationship, and also enable them to test the mathematical ideas for effective teaching of mathematics.

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Questionnaire

Item #	Statement	SA	A	UNC	DA	SDA
1	Content of mathematics in teacher training program enable the teachers to understand the content of school mathematics.					
2	Content of mathematics in teacher training program trained teachers to link the mathematics with daily life examples.					
3	Content of mathematics in teacher training program train teachers to provide students strong base foundation in mathematics.					
4	Content of mathematics in teacher training program train teachers for problem solving techniques.					
5	Content of mathematics in teacher training program provide core knowledge, concepts, mathematical principals and their interrelationship.					
6	Content of mathematics in teacher training program train teachers to organize mathematical ideas, test them and fill the gaps for effective teaching of mathematics.					
7	Content of mathematics in teacher training program train teachers to make teaching process effective through involvement of the students.					
8	Content of mathematics in teacher training program train teachers to learn mathematical reasoning and skills for effective teaching of mathematics.					
9	Content of mathematics in teacher training program prepare them to explain the mathematical concepts to the students with different learning paces.					
10	Content of mathematics in teacher training program prepare them to explore and explain hidden dimensions of problems in the content of school mathematics.					