Mathematical Beliefs and Practiceso of Trained Graduate Teachers of JNVS of Bihar

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Abstract- *Mathematics occupies an essential place in the school curriculum. The present study involved the exploration of mathematics teachers' beliefs about teaching and learning of mathematics at the upper primary stage. The participants' were ten TGTs of JNVs of Bihar. The open-ended questionnaires, rating scales, and classroom observations were conducted in five JNVs with two female and eight male mathematics teachers. The open-ended questionnaire focussed on the pedagogical beliefs about mathematics and examined whether these beliefs are related to the traditional, process, or constructivist approaches. Classroom observations allowed the researcher to visualize whether mathematics teachers' beliefs about teaching and learning implemented in the classroom. The rating scale was analysed to identify and assess common themes among their beliefs as well as associations between their beliefs and classroom practices. The findings revealed that most of the mathematics teachers' beliefs about teaching and learning represented the process approach or constructivist approach. The study shows a significant shift toward the process approach in upper primary mathematics education. Pedagogical implications have been suggested by the researchers based on the findings of the study.*

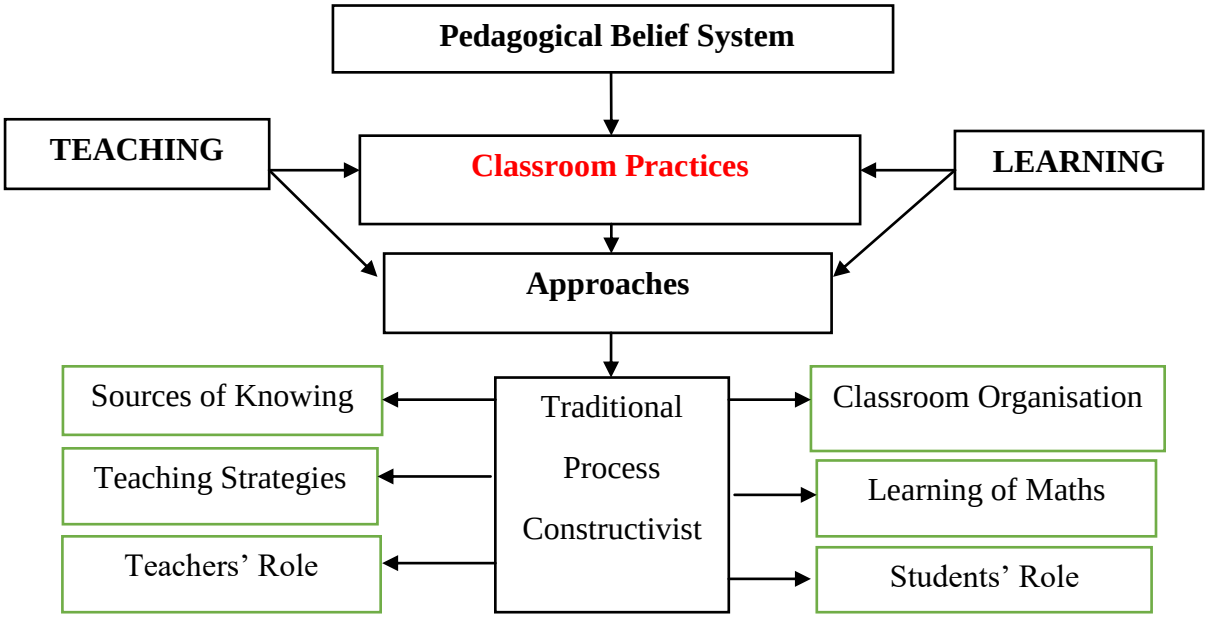
Keywords*: Mathematics teachers' beliefs, Mathematics education, Pedagogical beliefs, Upper primary school mathematics, Classroom practices.*

Introduction

Such theoretical perspectives have influenced recent reforms in mathematics education as constructivism, which have reconceptualised teaching and learning. Some literature indicates, to help foster students' learning and to improve their motivation, teaching may have to change. However, the author realized that despite efforts to strengthen instructions – such as development in curriculum and professional development for teachers – teachers rarely change their classroom practices (Adam, 2012). The hostility to improving practice may be due to the beliefs teachers hold about teaching and learning mathematics, or there may be other factors influencing teachers' instructional practice. Understanding teachers' beliefs and practices are essential for improving their instructional practice and to help teachers implement reform agendas'. For developing or promoting instructional practice often need teachers to abandon some of their beliefs and current practices (Little, 1993). Teachers' beliefs and practices need to be compatible with the ideas behind the curriculum or with concepts underlying the reform effort; once they

believe in it, they "will lead the way in implementing it" (Battista, 1994, p. 462). According to Handal (2003), even if teachers' beliefs match the ideas underlying the reform, often the traditional nature of educational systems makes it difficult for teachers to translate their beliefs into practice, making studies on teachers' beliefs and instructional practices very important to consider when implementing reform agendas. Most of the research on teachers' beliefs and practices have been conducted in developed countries. There is a strong need to explore the b eliefs and practice of teachers in developing countries because many of these countries are going through reforms in education that have been influenced by learning theories such as constructivism.

The theoretical framework of the study



The framework of the pedagogical Belief System

Source: Koballa et al. (2000), Tsai (2002) and Markic and Eilks (2010)

The pedagogical belief system is the belief about the nature of teaching and learning in the classroom context. The teacher- dominant classroom (the traditional dimension teaching) is a central element of transmission based on a behaviourist approach to teaching and learning. In the behaviourist approach, learners are perceived as passive, and they are tested to see where he or she falls on the curriculum expectation. Whereas, cognitivist look at the learner to determine his/her predisposition to learning. On the other hand, the learner-centred classroom is centrally based on the constructivist approach to teaching and learning. In the constructivist approaches, the students construct their understandings and the new researches that students build rest on the basis of knowledge and understandings that they already exist. The framework of this study derived from Koballa et al. (2000), and Tsai (2002) categorized student teachers' beliefs about

teaching, learning, and mathematics as traditional, process-oriented, or constructivist. The framework included three categories that can be applied to teachers' beliefs about all these areas. The categories were 'traditional,' 'process, and 'constructivist.' The 'traditional' category perceives teaching mathematics as transferring knowledge from teacher to students and learning mathematics as acquiring or 'reproducing' knowledge from credible sources. The 'process' category perceives teaching maths and learning mathematics as an activity focusing on the processes of mathematics or problem-solving procedures. The 'constructivist' category views teaching mathematics as helping students construct knowledge and learning mathematics as constructing personal understanding (Tsai, 2002).

Koballa et al. (2000) developed a framework for representing teachers' beliefs by categories as 'traditional,' 'process,' and 'constructivist' that could be applied to teachers' beliefs about teaching and learning. Similarly, Tsai (2002) studied explores the relationships among teachers' beliefs about teaching and learning mathematics through interviewing 37 Taiwanese mathematics teachers and were categorized as either 'traditional,' or 'process,' or 'constructivist.' This study found that most of the maths teachers had 'traditional' beliefs, and more than half of the teachers held views about teaching and learning maths that were closely aligned named as 'nested epistemologies.' This indicates that although maths educators have proposed the practice of constructivism for more than 15 years (Tsai 1998b, Tobin 1993) but still few teachers had practices in the classroom context. Moreover, these categories also develop three philosophies of mathematics, i.e., the 'traditional' category is supported by empiricism and logical positivism; the 'process' category is sponsored by naive realism, while the 'constructivism' category is supported by constructivist philosophy (Tsai, 1996).

The rationale of the study

Theories and beliefs are an essential part of a teacher's general knowledge that is used to process and perform in the classroom (Clark and Peterson, 1986; Munby, 1984). Pajares (1992) asserts that attention to beliefs can inform practice in ways that current research on teachers' cognition has not and will not. Beliefs are more important than knowledge in determining how individuals organize and define tasks and problems; therefore, to understand teaching from a teacher's perspective, it is crucial to understand the beliefs which govern their work (Nespor, 1987). There is a strong relationship between teachers' beliefs, judgments, and perceptions; these in tum affect planning, instructional decisions, and classroom practices (Pajares, 1992). Most of the researches agreed that each mathematics teacher has personal beliefs about teaching and learning of mathematics, which influence all of his/her teaching strategies and behaviours. When the constructivist approach comes in today's educational scenario, the teacher becomes the facilitator of knowledge, which in turn increases more responsibility on teachers.

Further, it was seen that the quality of teaching and learning depends upon the different ways the teacher teaches and the different ways learners learn. The character of these beliefs is comprehensive and multi-dimensional, which influences all interactions between teachers and pupils. So it is important to study the why and how beliefs of a mathematics teacher which make

differences in the classroom. The belief of the teacher does not vary only from discipline to discipline rather than from person to person. It means the same subject teachers may have different beliefs about teaching and learning of mathematics, and it makes it truly interesting to the researcher due to its diverse nature. Therefore, research on teachers' beliefs has thus become one of the major concerns for studies of teaching and teacher education. Many studies have investigated mathematics teachers' beliefs about what mathematics is and how it should be taught (Hewson and Hewson, 1988; Bryan, 2003; Tsai, 2002). However, little insight has been given to the teacher's beliefs about teaching and learning of mathematics and relationship with actual classroom practices.

Although much research has indicated that their teachers' beliefs influence teaching and learning mathematics and their actual classroom practice, there is still a need to examine mathematics teachers' beliefs to clarify how they affect their practice. The researches highlighted that the life experiences of teachers play a significant part in contributing to the formation of their beliefs and influence their practices. Therefore, there is a need to undertake an in-depth discussion about disciplinary influences on the beliefs and practices of the teachers. Moreover, no study has focused on the links between teachers' beliefs and classroom practices in the domain of mathematics. Therefore, there is a time to explore the degree of discrepancies or consistencies between teachers' beliefs about teaching and learning mathematics and their actual practice in the classroom context. No doubt, there is an essential need to find out whether there is a correlation between teacher's beliefs about teaching mathematics and their actual classroom practices. This study was guided to find out the beliefs of mathematics teachers about teaching and learning, which influences in their classroom practices. Hence, the problem for the present study is entitled as "**Mathematical Beliefs and Practices of TGTs of JNVS of Bihar.**"

Objectives of the study

This research aims to investigate the mathematics beliefs and teaching practices of TGTs. Specifically, the purposes of the research are:

- To study teachers' mathematical beliefs of TGTs of JNVs.
- To study teachers' beliefs as 'traditional,' 'process' or 'constructivist' perspectives.
- To examine teacher beliefs and practices in the classroom context.

This research aimed to explore the impact of teachers' beliefs on teaching and learning of mathematics and the interconnections between teachers' beliefs and their practices in mathematics classes. In addition to the factors that underpin these beliefs.

Research questions

1. What are the mathematics teachers' pedagogical beliefs about the way mathematics should be taught?
2. What are their actual classroom practices in teaching mathematics?

3. How do mathematics teachers' pedagogical beliefs influence their actual classroom practices?
4. How do mathematics teachers maximize student learning in their classrooms?

Methodology

The research is based on a qualitative research framework. The study is an exploration of the mathematics teachers' beliefs about pedagogical beliefs of mathematics at the upper primary stage. A descriptive survey method was used to investigate mathematics teachers' beliefs about teaching and learning of mathematics. An open-ended questionnaire (which includes four dimensions, i.e., nature of mathematics, Teaching of Mathematics, Learning of Mathematics and mathematical assessment and evaluation) was developed to elicit teachers' beliefs, and a 5-point rating scale (which include two dimensions, i.e., teachers' beliefs about mathematics teaching and teachers' beliefs about mathematics learning) was conducted to clarify the participants' answers. Ten classrooms were observed by using observation schedules (which include two dimensions, i.e., strategies used by the teacher in the school and the involvement of the students in classroom activities) to know actual classroom practices of the respective teachers.

The study explored in-depth the mathematics teachers' beliefs about teaching and learning Mathematics at the upper primary stage. The survey was undertaken to select five JNVs of Bihar (out of 39) purposively. Ten upper primary teachers of the sampled schools teaching Mathematics of classes VI-VIII was chosen out of expected 78 number TGTs of the region. Among them, two were female, and eight were male. The teaching experiences of participants ranging between one (1) to thirty years (30) with an average of 16 years. Formal education of the participant teachers lay in between bachelor and master with B.Ed. and even up to M.Ed.

Data collection

The data were collected individually from the teachers. The researcher that their responses would be kept secret, and that would be used only for research purposes assured the respondents. They were requested to complete the questionnaire within a limited time and then return it to the investigator.

According to teacher convenience, the classroom was observed. The observation schedule was used to know the real reflection of beliefs through their classroom practices. It consists of four dimensions of the pedagogical process as similar to the questionnaire. The observations focused on the way teacher beliefs about teaching and learning of mathematics manifest in teaching practices. All ten teacher's classrooms were observed once to the real nature of their beliefs. During the classroom observations, extensive observation notes were made on TLM, student's prior knowledge, learners' engagement, homework, etc. The collection of data took nearly 15 days. The investigator created a good rapport with all respondents. Then responses of the questionnaire, classroom observation, and rating scale were scored, tabulated, classified, and analysed.

Data analysis

First, data from the questionnaire were organized, which include themes and code identified through several readings. Each response from the rating scale was recorded with a 5-point scale. The classroom observation was coded concerning yes and no. Constant comparison across these preliminary coded responses for individuals and clusters of questions was used to identify significant themes and common elements running through the questionnaire, classroom observation, and rating scale relating to their beliefs about teaching elementary science.

Result & Discussion

1. **What are the mathematics teachers' pedagogical beliefs about the way mathematics taught?**

All mathematics teachers' beliefs that mathematics should provide activities that encourage students to explore, investigate, and construct their knowledge. It shows that they have a student's centred beliefs about the teaching of mathematics.

It was supported for the study that teachers were mediating role that is supposed to monitor student understanding and guide the discussion so that all student have opportunities to express their knowledge in language and engage in activities such as clarifying, elaborating, justifying and evaluating alternative points of view (Tobin et al., 1994).

2. **What are the classroom practices in teaching mathematics?**

The teaching strategies included verbal explanation interspersed with question-answer sessions in the classroom. Occasionally, the teacher explains and demonstrates, and students solve the problems.

The result of the study says all the teachers value the student's ideas, pay attention to the individual, understanding prior concepts of students, and correct/incorrect response was discussed between students. The study supported that in classrooms where constructivism is used as a referent, teachers take into account students' conceptions, maximize social interactions between learners, and provide students with a variety of sensory experiences from which construct their learning (Tobin and Tippins, 1993).

3. **How do mathematics teachers' pedagogical beliefs influence their classroom practices?**

It was widely admitted that participants are aware of contemporary teaching strategies. They believed that pupils are the heart of the instructions, generally called learner-centred teaching and learning. Student-centred learning students to set their own goals, determine resources, and activities that will help them meet those goals.

It was supported by the study that activity is equated with learning, and students rarely have opportunities to make personal use of mathematical concepts to understand essential aspects of their world (Prawat, 1992). However, activity-based teaching was not reflected in the actual classroom. The research supported that teachers' beliefs about mathematics pedagogical

practices may not directly translate into their classroom practice (Abd-El-Khalick and Lederman, 2000; Tsai, 2002; Waters-Adams, 2006).

4. **What do mathematics teachers know to facilitate students' learning in the classroom?**

Most of the mathematics teachers' beliefs that mathematics is best learned through exploring and investigating mathematical ideas. The most encouraging result of the present study is that the participants are aware of contemporary teaching strategies. They believed that pupils are the heart of the instructions, generally called learner-centred teaching and learning. Student-centred knowledge requires students to set their aim, determine resources, and activities that will help them meet those goals (Jonassen, 2000).

Educational Implications

This study has significance to motivate mathematics teachers to know about their beliefs about teaching mathematics and their influence on their instructional practices. It has the potential to help to raise the educational standard of Mathematics teaching by enlightening the importance of knowing ones teaching belief and making an effort for improvement. Teachers, teacher trainers, principals, students, and the whole educational system would benefit from this study because it studies the influence of teachers' beliefs on their classroom practices and encourages teachers to change their present ideas to improve their instructional practices

- Mathematics teachers should know that the significant part of the teaching and learning performance is providing opportunities for students to practice mathematical concepts and to make those ideas their own.

- Mathematics teachers should know how to help students to develop the knowledge, skills, and attitude. Also, need to know that change in their teaching practices requires them to experience a conceptual shift in their beliefs about student learning,
- Mathematics teachers' preparation programs and training sessions should enable them to know and fill the gap between beliefs and classroom practices.
- Mathematics teacher's beliefs influence their classroom practices and this may prompt them to have interest in the professional development to enhance their knowledge or may make them more aware of the effect of those beliefs on their pedagogical decisions, thereby contributing to improving the achievements of their students
- For mathematics educators, understanding the beliefs of teachers is essential and essential if teacher education programs are going to support the on-going development of mathematics teachers.

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