Professional Development of Secondary Mathematics Teachers in India and China: A Comparative Study

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Abstract

The present study examined the major practices of the professional development of secondary mathematics teachers in India, China and presented a comparison. The methodology of the study is an interpretative and analytical study of documents. Promotion system and teaching research are the fundamental infrastructures developed by China to support secondary mathematics teachers' professional development. Teaching in China refers to a public enterprise. This study found that India lagged behind China in secondary mathematics teacher professional development. The study presented what could learn India from secondary mathematics teacher profession development system prevailing in China. Some recommendations were also provided.

Key words: Professional development, Mathematics teacher, Professional ranking system, Secondary mathematics teacher, Teaching research system

Introduction

NPE (2016) commented that "The key to improvement in quality of education is to have better qualified, better trained, better motivated and more accountable teachers. The poor quality of school education is a direct result of poor quality of teacher education and teacher training" (NPE, 2016, p. 179). This observation is reflected in Indian poor performance in International Student Assessment (PISA), 2009 (PISA, 2009). Two Indian States, namely Tamil Nadu and Himachal Pradesh participated and obtained 72-nd and 73-th positions in the ranking of 74 participant regions in mathematics. Astonishingly, instead of learning from the experience India boycotted PISA 2012 and 2015. As a result India could not measure its trends in performance in mathematics internationally. Various studies (Pratham, 2009-2010; NCERT, 2008) revealed that very poor learning levels among children in both language and mathematics in primary and elementary classes exist in India. In primary classes, understanding of mathematics is largely confined to procedural or rote-based learning' (Education Initiatives, 2010). The study of

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Education Initiatives (2010) also indicated the increase of incomprehension of mathematics from the primary to the elementary classes. The study conducted by Pratham (2017) found that in the age group 14-18 years

- Above 50% of the age group had problem to solve division problem with three digits by one digit.
- Correct answer came from only 43% candidates.
- Eight years of schooling did not ensure that a candidate obtained foundational skill of mathematics. A significant proportion of the age group having eight years schooling lacked foundational skills of mathematics.

It ensures the reflection of the Indian performance in PISA 2009. Shanghai and Hong Kong regions of China obtained the first, and third ranks (OECD, 2010). In the Assessment of PISA 2009, Shanghai-China demonstrated an outstanding performance obtaining top position that reflects "what can be achieved with moderate economic resources and in a diverse social context …Overall, PISA shows that an image of a world divided neatly into rich and well-educated countries and poor and badly-educated countries is out of date" (OECD, 2010, p.3).

The outstanding performances of China in mathematics learning drew much attention of the researchers to investigate the Chinese education systems. Minxuan, and Lingshuai (2012) postulated three traditional factors and nine modern factors including teacher professional knowledge for outstanding performance of Shanghai-China. China and India had intimate connection in mathematics (Yadav & Mohan, 2011) from ancient period. China and India developed themselves as the most populous nations in the globe with fastest growing economics. Also they do compete with various fields in economics and power gaining. China performs extremely well in all international level in mathematics competitions. So the comparative investigation between mathematics teacher professional developments is extremely important for India as India is a developing country and hopes for becoming a powerful country in science and technology. The comparative study on Professional Development of Secondary Mathematics Teachers between India and China is an endeavour to promote and develop a broad understanding about the problems, challenges and emerging issues.

2. Literature review

McKinsey's report mentioned that "Top-performers took professional development inside the classroom" (Barber and Mourshed, 2007, p. 20). Continuous Professional Development (PD) is one of the certain factors for quality of teachers (Mullis, Martin, Foy, Arora, 2012). In USA, O'connell (2009) found that activities of PD improve students' learning, but the study could not fix the cause effect relationship between them. Unal, Demir, and Kilic (2011) established that teacher PD did positive impact on pupils' performance.

The study on teacher PD (Avalos, 2011) caught attention of the researchers. Liang, Zhang, Huang, Shi, and Qiao (2015) found that the correlation between teacher PD and increment in students' achievement existed.

Huang, Peng, Wang, & Li, (2010) presented some unique characteristics of mathematics teacher PD system prevailing in China. The characteristics are :

- "ranking and promotion system" (Li, Huang, Bao, & Fan, 2011),
- "institutionalized teaching research system" (Yang and Ricks 2012), and
- "public lesson development" (Huang, Li, Zhang, & Li, 2011; Liang 2011).

This paper aims to offer an overview regarding in-service PD of mathematics teachers in China and India.

In India, in-service mathematics teachers pursue PD through workshops (Kumar, Subramaniam & Naik, 2015). Kumar and Subramaniam (2015) presented an example of pursuing PD activities of four in-service mathematics teachers. Kumar and Subramaniam (2017) reported an experience of a woman mathematics teacher who pursued a PD program.

Leong, Kaur, and Kwon (2017) revealed some characteristics of mathematics teacher PD programme of five Asian Countries including Indian which includes:

- *In-service teachers do participate,*
- *Place of PD in classrooms,*
- *Hybrid model*
- *Situated learning and*
- *Community of practice*

Kumar and Azad (2016) presented some policy issues and challenges of teacher education and mentioned that training programme did not offer proper opportunities to student teacher to develop their competency in India.

Research gap

No comparative study of secondary mathematics teacher PD was done between China and India.

To fill up the research gap, we initiate to present a comparative study between China and India for secondary mathematics teacher PD programme.

Objectives of the study

• To examine the major practices of secondary mathematics teachers PD and their developments in India and China.

• To compare the two systems of secondary mathematics teachers PD in India & China.

• To present what can India learn from China?

Methodology of the study

This study employs an interpretative approach where qualitative data were collected and analyzed by document study of the research papers from journals, books, edited books, reports, online documents. Methodology of the proposed study is based on document-based analysis.

• **Methodology employed**

❖ It is based on qualitative research.

❖ It is also based on a comparative and document-based analytical study.

❖ It has the chief characteristics of recent document-based analytical research.

• **Research Materials**

❑ Original government documents,

❑ Books, journals, magazines,

❑ On-line documents from some relevant and reliable internet sources.

• **Data Collection Process** Multiple procedures have been employed including studying international and national journals, library consultation, online journals, periodical, news papers and documents.

• **Data Analysis**

Current document-based analytical approach is employed for data analysis. Historical and sociological approaches have also been adopted for analyzing the collected data. No statistical analysis has been furnished.

Major Practices of Secondary Mathematics Teachers PD and Their Developments in India and China

Qualification

In China, teacher for secondary school, 4-year bachelor's degree is required. Some high schools require Post Graduate (PG) degree (Wang, 2009). In India, National Council for Teacher Education (NCTE) is responsible to prescribe required qualifications for school teacher. According to NCTE (2014), required qualifications are:

i. Graduate/ Post Graduate (PG) degree from any recognized university with at least 50% marks in either Graduation or PG (or its equivalent)

ii. Bachelor of Education (B. Ed.) degree obtained from an NCTE recognized institution

Or

i. Four years degree of B.A. Ed. /B.Sc.. Ed. Obtained from an NCTE recognized institution.

License

In China, to obtain a teaching license after earning a bachelor degree (in any areas), aspiring teachers are required to pass both written and oral exams (MOE, 2011; 2013). In India, no license system exists for secondary school teachers. Teacher Eligibility Test (TET) (NCTE, 2010) pass certificate is required for aspiring candidate who wants to be a teacher in classes I to VIII. In India, for teachers NPE (2016) suggested for mandatory compulsory licensing or certification.

Acts

China has teacher Acts 1994. In -service teacher does at least two forty hours PD related work over a five years span (Leong et al., 2017).

India does not have such an act.

Ranking and Promotion System

In China, professional promotion system (MOE, 1995) for secondary teachers does exist for decades with three professional ranks such as "senior-rank teacher", "secondary level1", and "secondary level 2". It also offers as honorary rank such as "exceptional teacher". In 2015, China modified teacher ranking system (MHRSS &MOE, 2015). For secondary teachers, there exist three professional ranks (see Fig. 1).

- "senior-rank teacher" ("senior-rank level"),
- "secondary level 1" ("The intermediate-rank level"), and
- "secondary level 2 and secondary level 3" ("primary-rank level").

In India, no promotion ranking system for primary or secondary education does exist.

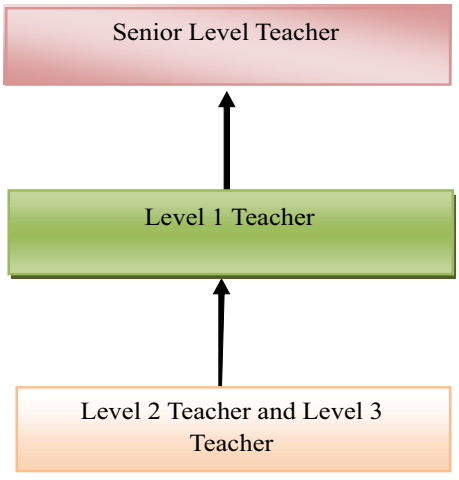

Fig. 1: Rank of Teachers in China

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One-to-One Mentoring Practice

One –to- one mentoring practice exists in China for newly appointed teacher for a period of first two to three years. Formal pacts are signed between mentors and mentees (Huang et al. 2010). In India, mentoring system does not exist.

Practice-Based Teaching Research Activity

In China, "teaching research activities" (Huang, Ye, & Prince, 2017) do exist firmly and comprise of PD activities. "Teaching research activities" are monitored by hierarchical organizations namely:

i. province/city, ii. district/county, iii. school, and iv. "lesson plan group".

"Teaching research activities" comprise of

i. "Routine teaching research activity" (Huang et al., 2010)
ii. "Various competitions focusing on teaching skills" (Liang, 2011; Li & Li, 2009)
iii. "New development" (Huang, Su, & Xu, 2014)

Routine Teaching Research Activity

The "routine teaching research activity" comprises of "school-based teaching activities" and "across school teaching activities". The school-based teaching activities are performed by two groups namely:

i. 1st group: "Mathematics Teaching Research Groups (MTRGs)" and
ii. 2nd group: "Grade-based lesson plan groups".

The 1st group takes the responsibility to design and implement the schedule of the teaching and research activities. The 2nd group takes the responsibility to organize and guide of lesson plans. Different teaching research activities (Huang et al., 2017) are conducted in the city, district/country levels.

In India, no routine teaching research activity exists for secondary mathematics teachers. Secondary mathematics teachers do research based on their own interest and motivation. Two annual increments were offered in some states in India for obtaining Ph. D. degree for secondary school teachers.

Various Competitions Focusing on Teaching Skills

Competitions (Huang et al., 2017) are organized at local and national levels with

I. "Lesson competitions" (Li & Li, 2009),
II. "Explanation lessons" (Peng, 2007), and
III. "Explaining problem solving" (Ye, Shi, & Zhang, 2011).

In India, such competitions do not exist.

Recent Development

China adopted the "communities of practice" of Wenger (1998) in teaching research activities and focused on school-based study. Huang et al. (2017) mentioned clearly that the school-based research focuses on:

i. to form teaching culture and community
ii. to study of pupils' learning and teachers' behaviours,
iii. to cultivate of teaching research awareness,
iv. to upgrade educational ideas and cultural reconstruction.

India does not adopt school-based research activities by the secondary mathematics tesachers.

Open lesson study and parallel lesson study

China developed open lesson study and parallel open study (Huang et al., 2014) which help them in developing competence in all aspects of teaching and professional vision.

India does not adopt lesson study and parallel open study.

Training Expert Teacher Programmes

China developed:

i. Upgrading education degree programs (Huang et al., 2010)
ii. Training expert teacher programs (Quan, 2009).
iii. Backbone teacher training program (MOE, 1999)-
iv. Master teacher training program (Quan, 2009)

In China, training programs for developing master teachers become popular (Huang et al., 2017). University and school partner organize these programmes. Master Teacher Work-station (MTW) also leads the programme. The notable activities in an MTW consist of master-led activities, collaborative teaching research, reading and reflection and project-driven activities.

The current structure of secondary teacher professional rank for China due to Huang et al. (2017) is shown in Fig. 2.

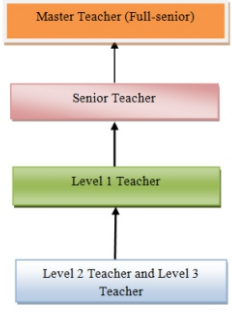

Fig.2: Rank of Teachers in China

In-Service Training in India

In India, development of teacher education policy is based on recommendations presented in the reports of the Commissions or committees that have implications in teacher professional development. The following commissions and committees have made impacts on evolution of Indian education.

- Kothari Commission (1964-66)
- National Policy on Education (NPE, 1968)
- Chattopadyay Committee (1983-85)
- National Policy on Education (NPE 1986),
- Acharya Ramamurthi Committee (1990)
- National Policy on Education (NPE 1992)
- Yashpal Committee (1993),
- National Knowledge Commission (2009)
- National Policy on Education (2016)

Teacher Education Curriculum Framework (1978), National Curriculum Framework (NCF, 2005), National Curriculum Framework (NCF, 2009) have implications in secondary mathematics teacher professional development in India.

India established the "National Council of Educational Research and Training (NCERT)". India also established five "Regional Institutes of Education (REIs)" for developing professional competence with other objectives. North East (NE-RIE), Shillong offers only the in-service education. These RIEs provide PD activities for school mathematics teachers. These institutions are responsible for conducting mathematics teacher PD activities. "National University on Educational Planning and Administration (NUEPA)" also offers institutional support.

India has 29 states. Each state has the "State Councils of Educational Research and Training (SCERT)". Secondary mathematics teachers do PD activities through workshop or training programme organized by SCERTs. Secondary mathematics teachers also participate in PD works through training programmes, workshops and seminars organized by the "Colleges of Teacher Education (CTEs)" and "Institutes for Advanced Learning in Education (IASEs)".

But the main problem is the coordination between the head of the school/institution and organizer of the training programmes. The teachers remain deprived of getting PD programmes in India. As there is no law, participation in PD programmes depends on teachers' motivation, interest and desire and opportunity to participate.

What can learn India from China?

China developed a well- structured instructional teacher PD system. In Chinese educational setting, teaching refers to a "publicly scrutinized enterprise" (Li & Huang, 2008). In China, since mathematics teacher PD is compulsory, teachers pursue "teaching research activities". These include:

- Presenting open lessons
- Observing lesson
- Evaluating lesson
- Reflecting on lesson

China developed a "systematic ranking promotion system" and "hierarchical teaching research system". The studies of Li, Huang et al. (2011), and Li, Tang & Gong, 2011) revealed that the ranking system succeeds in China addressing various perspectives.

India can learn from secondary mathematics teacher professional development system of China. India can adopt from China:

- New rules and regulations or act for compulsory PD programme for secondary school mathematics teachers
- Teaching as a public enterprise
- One-to-one mentoring practice
- Open lesson study and parallel lesson study
- "Systematic ranking promotion system" and
- Hierarchical teaching research system.
- Compulsory renewal of license for every five year
- High respect for the teachers

Discussion and Recommendations

Recommendations: NPE (2016) suggested licence or certificate for both government and private schools. Renewal for every ten years subject to independent external examination. Ten years is very long period. Our recommendations are:

- Govt act for compulsory PD activities with for the secondary school teachers
- Mentoring system for the newly appointed teacher for two years
- Open lesson study and parallel lesson study
- Lesson competition with prestigious award from local level to national level
- Ranking promotion system with three ranks: assistant teacher, associate teacher and master teacher
- Teaching research activity funded by government

- Inspire to collaborative research works with foreign countries
- High respect for the teachers similar to respect for university professor
- Better salary and other living facilities for the teachers
- Teacher selection strategy should incorporate the current intuitionistic fuzzy set based strategy (Pramanik & Mukhopadhyaya, 2011), neutrosophic set based strategy (Mondal & Pramanik, 2014), neutrosophic number based strategy (Pramanik, Dalapati, & Roy, 2016), rough neutrosophic hyper-complex based selection strategy (Mondal, Pramanik, & Smarandache, 2016) to form an efficient panel of alternative candidates.

Conclusion

We presented the comparison between secondary mathematics teacher professional development existing in India and China. The study showed that China has performed better than India in professional development. Chinese culture of mathematics teaching led its performance in international level. Several recommendations have been provided for betterment of secondary mathematics teacher professional development in India. India needs urgently to adopt teaching research, ranking promotion system for school teachers and mentoring system for newly appointed teachers. In future, we shall extend our study to higher education level for professional development.

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