Impact on mathematics teachers’ beliefs, knowledge and practice through Lesson Study on teaching of fractions and proportions

Dr. Ruchi S. Kumar
Centre for Education, Innovation and Action Research
TISS, Mumbai

Objective
The objective of this research is to

- engage teachers in a collaborative action research through Lesson Study
- support development of knowledge and practice for teaching of fractions and proportion using ICT based resources
- study the interaction between teachers’ beliefs, knowledge and practice during the period of the study

Significance/ Rationale
There are few studies in India which have tracked the beliefs, knowledge and practice of teachers as they engage in teacher professional development program. Lesson Study as a form of inservice professional development has not yet been tried out in India but has been established as a promising practice for developing teachers’ knowledge as well as practices. The longitudinal study of teachers’ engagement in lesson study will help to develop deeper understanding of the social process of teacher learning and the role of a community in supporting teachers’ learning.

Lesson study as a professional development has many advantages over other ways of in-service professional development and researching in-service learning. It has been recognised that most in-service programs have little or no impact on classroom practices as the opportunity to integrate the new ideas in teachers’ practice are not provided with support. However, the lesson study uses the classrooms as the site for teacher learning about and through practice while studying teaching in all its complexity. Rather than adopting a deficit perspective on knowledge of teachers, this type of in-service program allows teachers to use their knowledge of teaching acquired through years of experience and reflect on the beliefs held and practices preferred in
teaching while revising their content knowledge. Instead of research being conducted on the teachers, Lesson study provides a meaningful opportunity to develop partnerships between schools and university.

**Review of literature**

Lesson study as a professional development practice originated mainly in Japan and has been considered as one of the factors leading to high scores of Japanese students in TIMSS (Stigler & Hiebert, 1999). It has been adapted in many countries to design in-service teacher professional development in which the university and the schools collaborate and deliberate about the pedagogical practice. Why lesson study has been considered as promising to be adapted in range of countries like USA, Africa and Indonesia is that it helps directly in exploring and promoting shift in practices (Lewis & Tsuchida, 1998; Murata and Takahashi, 2002; Chokshi & Fernandez, 2004; Lewis, Perry & Murata, 2006), developing knowledge of mathematical content and teaching (Fernandez, 2005; Fernandez, Cannon & Chokshi, 2003; Yoshida, 2008), developing connections between craft knowledge and scholarly knowledge (Murata, Bofferding, Pothen, Taylor and Wischnia, 2012). Three major areas that develop through the process of lesson study are teachers’ knowledge, teachers’ commitment and community, and learning resources (Lewis et al. 2006).

Although lesson study is promising, there are challenges in implementing it as a professional development practice. Main challenges are faced as such a practice of working on lesson together is not part of the culture and teachers rarely get the chance to see practice of others or of experts. Fernandez and Cannon (2005) identified that teachers new to such practice may focus only on the content goals and teacher actions, ignoring students’ disposition. The teachers’ disposition for research and Inquiry can be developed through participation through iterative cycles. The other issues that are faced related to implementation of lesson study is the cost and planning involved in getting teachers together releasing them from teaching. Lesson study requires consistent and regular engagement unlike other modes of professional development. Although, some studies have found that lack of teacher knowledge acts as a constraint, other studies have reported the potential in supporting the development of teacher knowledge (Fernandez, 2005). Further, careful documentation and analysis is needed of how teachers’ engagement is supporting student learning.

**Research Design**

The research design for this study is a collaborative action research using mostly qualitative methods for data collection and analysis. The teachers will be engaged in Lesson Study course of RTICT on TISSx in which they will document their experiences and reflections from the lesson study cycle, the lesson plans, student artefacts and the revisions made in lesson plans. The teachers would be engaged in exploring CLIx proportional reasoning module and how it tries to address the difficult concepts. However, for planning teachers would be free to chose an activity from the module or any other ICT based resource (open educational resource) for planning their lesson across the grades. Permissions for meetings would be taken from the school principals after discussing with the teachers. The teachers will work in groups according
to their grades and then will share their plans and findings across groups in common meetings. The groups would be facilitated by the researcher and would provide them academic inputs on the lesson plan.

**Sample**

This study would be conducted in two schools with their mathematics teachers. A total of 4 to 6 mathematics teachers would be selected to participate in the study from the same school, making the total sample of around 8 to 12 teachers. In each school, at least 1 teacher would be selected from 4th or 5th grade level, 1 teacher from 6th or 7th grade level and 1 teacher at 8th or 9th grade level.

**Data collection and Analysis**

An intensive and long term engagement over 5 months in the professional development activity through the Lesson Study course on TISSx will be used to collect data about teachers’ beliefs, knowledge and preferred practice as they engage in both the professional development context and the school context. Further data would be collected through the modes of participant observation in workshops and classroom observations (audio and if possible video would be captured), face to face interviews, focus group interviews and member checking. Data about the in-service trainings that teachers are going through would be collected in teachers’ interview to get a sense of inputs contributing to teachers’ practice.

**Procedure**

The research will be conducted in three phases:

1. **Preparatory phase**: In this phase, the researcher will develop the relationship with the teachers, and develop understanding of teachers’ beliefs, knowledge and practice for teaching of fractions. This will involve face to face interviews and two classroom observations for each teacher.

2. **Collaborative planning phase**: In this phase, teachers would engage in the 5 month 2 credit course on Lesson study as part of RTICT post graduate certificate course offered by TISS. Teachers will make a paper-pencil assessment for their classes and will interview 4 students in collaboration with the researcher based on their performance on the test. All teachers will share their findings about students understanding in a common meeting. Subsequently, they will engage in activities like conceptual analysis of fractions, textbook analysis, analysis of ICT base resources, research readings, analysis of student work and collaborative design of tasks for lessons at all three levels and will present their collaborative lesson plan and a demo lesson in a common meeting for feedback. The teachers will make a lesson plan in the groups of 2 based on any one activity from the CLIx Proportional Reasoning Module. Thus three lesson plan for the research lesson would be constructed- one for grade 4/5, one for 6/7 and one for 8/9 grade.

3. **Lesson implementation and observation**: One teacher will implement the lesson in one of the class with others observing. Reflection and debriefing meeting would be held after this, leading to redesign of the lesson and reteaching by one another teacher. The final cycle would involve each teacher teaching the lesson with at least one peer as observer. After the final
lesson the students will be given a post-test to assess the gain in their understanding as well as
the responses and student work from the research lessons. Teachers will write their individual
reports and collate it in form of a group report. Teachers will be interviewed to reflect on their
learning from their engagement in the study.

Intended outputs

**Preparatory phase:** Baseline data about teachers’ beliefs about mathematics, teaching of
mathematics, use of ICT, about students and self using a survey on TISSx. Baseline data about
teachers’ knowledge of fractions and proportions would also be ascertained using an online
survey on TISSx. The classroom observations and interviews will help triangulate the data
about beliefs, knowledge and practice and interactions between them as reflected in practice.
The main output in this phase is the detailed profile of each teachers’ beliefs, knowledge and
practice before intervention. This phase will also provide information about other interventions
that teachers might be engaged in and their possible impact on practice.

**Collaborative planning Phase:** In this phase, capacity development of teachers would take
place for using ICT for teaching mathematics, making lesson plans, analysing students’
thinking and deepening their subject matter knowledge. Teachers will be able to analyse
students’ knowledge about fractions and ratios and proportions before the intervention through
formative assessment and may realise the value of the same. The data across grades about
students’ performances will help in identifying the key difficulty points in understanding these
concepts that are tenacious across the grades and the concepts that students are able to grasp
with age. A major output at this stage are the three lesson plans developed collaboratively by
the teachers which will give them opportunity to be in the role of designers for using ICT
resources in their own classroom.

**Lesson implementation and observation phase:** The major output in this phase would be in
form of teachers’ reflections on their experience, as well as the group report for each level
leading to in-depth understanding of not only the teachers’ knowledge and beliefs and their
development but also the impact of professional development on classroom practice and on
student learning. If teachers consent, the videos of their lesson can be made for use in
professional development of other teachers.

**Time line and activities**

<table>
<thead>
<tr>
<th>Time period</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>April 2019- June 2019</td>
<td>Interactions with schools and teachers for selection of teachers</td>
</tr>
<tr>
<td></td>
<td>Development of tools</td>
</tr>
<tr>
<td></td>
<td>• Interview protocol</td>
</tr>
<tr>
<td></td>
<td>• classroom observation protocol</td>
</tr>
<tr>
<td></td>
<td>Preparatory phase:</td>
</tr>
<tr>
<td></td>
<td>• Classroom observation</td>
</tr>
<tr>
<td></td>
<td>• Teacher interviews</td>
</tr>
<tr>
<td>June- July 2019</td>
<td>• Analysis of data collected,</td>
</tr>
<tr>
<td></td>
<td>• Preparing belief and fraction and proportion knowledge profile of each teacher,</td>
</tr>
<tr>
<td></td>
<td>• Analysis of practices preferred and practices observed</td>
</tr>
</tbody>
</table>
July 2019 - November 2019

Collaborative lesson planning and lesson implementation phase:
- Enrolment in the Lesson Study course of all teachers
- Two meetings (3 hours each) per month for five months = 10 meetings
  (Break up given below)
  - 5 meetings for collaborative lesson planning,
  - 2 common group meetings for peer feedback,
  - 3 lesson implementation and reflection meetings

Ongoing analysis of data collected
- Analysis of discussions in meetings for beliefs expressed and knowledge/practice aspects discussed
- Analysis of classroom interaction for practices used and ways in which main conceptual ideas are discussed, forms of student participation with ICT, teacher support for ICT use

December 2019 - Feb 2019

Analysis of data, Teachers’ report, Making of teaching videos, Report of the study, Presentations in conferences

References


