

# Understanding teachers' concerns and negotiating goals for teaching: Insights from collaborative lesson planning

Ruchi S. Kumar & K. Subramaniam  
Homi Bhabha Centre for Science Education

[ruchi@hbcse.tifr.res.in](mailto:ruchi@hbcse.tifr.res.in)

[subra@hbcse.tifr.res.in](mailto:subra@hbcse.tifr.res.in)

# The Study

- Collaborative lesson planning (3 teacher educators) through 6 one day workshops over a period of 4 months with 2 groups
  - 4 middle school teachers (integers)
  - 4 primary teachers
- Part of larger study for developing a model of professional development involving collaborating with teachers



# Research Questions

- **Research question 1:** What learning opportunities arise during collaborative lesson planning?
- **Research question 2:** How teachers select pedagogical approaches and its relation with teachers' knowledge and beliefs about mathematics?

# Collaborative lesson planning

- Research on lesson study shows:
  - Teacher learning through anticipating student thinking (Fernandez, 2005; Hart, Alston & Murata, 2011)
  - Learning opportunities constrained by subject matter knowledge (Fernandez, 2005)
  - Focus on planning more important than direct implementation (Hart and Carriere, 2011)



# Theoretical framework

- Three important aspects in design and implementation of Teacher professional development program
  - Situatedness (using activities situated in the work of teaching)
  - Challenge (providing challenge to enable teacher to reflect on their beliefs and knowledge)
  - Community (providing support to teachers to share their beliefs and knowledge and building them)

# Activities during workshops

- Discussion of students' difficulties and teaching approaches
- Finding examples of situations where integers are used in different senses of “state, change and relation” (Vergnaud, 1982)
- Developing lesson plans through discussion
- Sharing of experience of teaching with other teachers



# Methodology

- Teachers nominated by their principals for participating in study.
- Data collected in form of audio recording, lesson plans
- Data analysis:
  - Segments of audio recording identified for teachers' expression of their beliefs and knowledge for teaching integers
  - Selected segments transcribed
  - Emergent open coding approach (Miles and Huberman 1994)

# Findings



# Teachers' views about student errors

- “Student reverse the order of numbers while solving the question: subtract 7 from 3”
- “When solving  $3 + (-7)$  student add first and then put minus sign giving the answer -10”
- Belief about mathematics as procedures
- Belief about learning mathematics through memorisation as student have to keep “things in mind” which they “forget”.

# Discussing students' meaning making

- Teacher educator: What the word “subtract” might mean to students
- Teacher responses
  - Minus sign
  - Finding the difference
  - Giving/ taking
- Developing alternative explanation for student errors: subtraction of smaller number from bigger number might be meaningless to some students



# Consistency of mathematics across grades

- Discussion with primary teacher group
  - “Undue emphasis on telling students to always subtract the bigger number from the smaller number in primary”
  - “without telling this rule it would be difficult to explain borrowing”
- Lead to discussion on “regrouping” and how mathematics can be made consistent across grades

# Tension between using rules and models for teaching mathematics

- “Students ultimately need to know rules”
- “Representations cannot be used to solve integer problems with large numbers”
- Mathematical rules as 'laws' of mathematics
- Teachers realised that student face difficulties in interpreting integers and thus used situations like borrowing, increase/decrease in level
  - Used as unconnected examples
  - Translation between situations and mathematical expression was not made



# Developing teacher autonomy

- Initial resistance for engaging with approaches not given in the textbook
- Discussion on senses of integers: State, Change and Relation
  - Rich variety of notions used by teachers: position, change in quantity, direction, opposites
  - Provided theoretical integration of examples used by teachers
  - Critical analysis of textbook

# Analysing student meanings

- Comparison of situations used and student meanings
  - Comparison of integers using temperature to denote negative state
  - Comparison of integers using marks after giving negative marks for wrong answer



# Conclusion

- Learning opportunities for teachers when engaged in activities situated in work of teaching:
  - Sharing of common mistakes and developing alternative explanations
  - Sharing and evaluating pedagogical approaches
  - Articulation of beliefs, tensions and dilemmas

# Conclusion

- Challenge arise due to
  - Differences in beliefs and content knowledge of teachers
  - Making mathematics consistent across grades
- Developing communities of teachers, teacher educators and researchers
  - Supporting sharing and construction of knowledge about teaching
  - Shared value of making mathematics accessible to students
  - Bridging the research-practice divide





**THANK YOU**