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## FINDINGS

A teacher plays a significant role in stimulating thinking and reasoning among students and integrating the 'everyday concepts' with the scientific concepts to build a coherent system of ideas (Howe, 1996). Teachers' knowledge of students empowers them to pick a representation from their representational repertoire that creates dissatisfaction among her learners about a particular topic with their existing conceptions, thus, creating conditions for conceptual change. Although the importance of strengthening teachers' topic-specific knowledge about students' conceptions has been acknowledged in recent curricular and policy documents, no clear pathways have been formulated to develop their *knowledge-of-practice* (Cochran-Smith & Lytle, 2000). The overall purpose of the study was to promote a shift in teachers' practice that is more responsive to student understanding. This study involved inviting teachers to participate in a research-based programme designed to strengthen their understanding of students' conceptions related to Thermodynamics and Kinetic theory of gases.

Situated within the interpretivist framework, this study was conducted in four phases. **Phase-I** involved analysis of 160 students' constructs (across 19 schools) with regard to Thermodynamics and Kinetic theory of gases through two questionnaires that led to identification of their conceptual gaps and alternative conceptions. **Phase- II** of the study involved explorations into teachers' beliefs about students and knowledge of the students' conceptions identified in the previous phase. This involved teachers' reflections about their classroom experiences, anticipating students' alternative conceptions and conceptual gaps, representations and activities designed to elicit and address students' ideas. For this purpose, researcher conducted semi-structured interviews with 30 physics teachers teaching in the 19 schools chosen for phase-I of the study. Also, a questionnaire was given to these teachers to gain insights into teachers' implicit beliefs related to students' thinking about scientific concepts as well as students' role in selection of the pedagogical strategies for the teaching of these topics. To understand how teachers' understanding of learners is constructed and manifested in the classroom, **Phase III** of the study focused on exploring teachers' beliefs about students' thinking in the context of a classroom during teaching of the two topics. Out of the 30 teachers interviewed in phase-II, classes of 10 teachers were observed during the teaching of Laws of Thermodynamics and kinetic theory of gases. **Phase IV** included designing and enactment of a workshop with the 30 teachers to strengthen their knowledge and beliefs about learners' ideas. The method for data collection involved participant and non-participant observations which were analyzed qualitatively along with quantitative assessment of the post-workshop belief questionnaire.

The findings of Phase-I of the study showed that students possessed alternative conceptions regarding laws of Thermodynamics which prevented successful application of these concepts to various contexts presented in the questionnaires. It also revealed that students constructed wrong microscopic models and the explanations offered by them were an attempt to justify their incorrect assumptions. Comparison of teachers' response to conceptual problems to those of students' received in the phase-I of the study indicated strong linkages between teachers' and students' conceptual ideas. Many of the alternative conceptions held by students closely mirrored those held by the teachers. The study identified practices that were central to teachers' teaching-learning and adopted regularly by them. These central practices included teachers' failure to acknowledge students' prior ideas, following the textbook, avoiding students' mistakes, no space for critical voices and lack of experiential learning experiences. On the other hand, practices that were rarely preferred by teachers or peripheral practices included shared control of classroom processes and student negotiation. The central beliefs about

students underlying the central practices showed an alignment with transmission-view of teaching-learning and indicated teachers' failure to take a step towards developing student-centered approaches that account for students' pre-conceptions and provide meaningful contexts to initiate conceptual change.

It was also found that despite several years of teaching experience, teachers possessed an incomplete knowledge of students' thinking about thermodynamic concepts. A weak relationship between teachers' knowledge of students and classroom practices was observed. There was an emphasis was on 'telling' the correct answers to students as most of the teachers denounced any possibility of doing hands-on activities to illustrate thermodynamic concepts and laws.

The workshop designed to strengthen teachers' topic-specific knowledge for teaching and provided opportunities to reflect on their beliefs involved analysis of students' responses to various thermodynamic concepts, reflecting on their own beliefs and conceptual knowledge, identifying critical features of concepts and supporting discernment between concepts through appropriate tasks and hands-on activities. Teachers' responses to the post-workshop questionnaires as well as their verbal feedback revealed significant learning gains from the workshop.

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