Summary of ERIC Projects

Pedagogical Content Knowledge of Science in the Teacher Education Sector: A Developmental and Research Project

PADMA M. SARANGAPANI* AND MYTHILI RAMCHAND**

This study attempted to involve teacher educators and student teachers in participatory planning and development of modular curriculum and resources in science and examined its effect on participants' pedagogical content knowledge. The study had two components: development of a curriculum module and associated resources, and the development of pedagogical content knowledge among the participants (student teachers).

The objectives of the study included the following:

- To develop a source package using a variety of media for the teaching and learning of science at the middle school level (Classes VI to VIII),
- To document the processes of engagement with prospective teachers of science, and
- To study participating student teachers' development of pedagogic content knowledge (PCK).

For studying student teachers' development of PCK, focus was primarily on the following questions:

- Do student teachers' initial ideas on the nature of science change as a result of readings and discussions?
- How do student teachers' ideas on science concepts coalesce

* Padma M. Sarangapani, *Professor and Chairperson,* Centre for Education, Innovation and Action Research, Tata Institute of Social Sciences, Mumbai-400088 (e-mail: psarangapani@tiss.edu).

** Mythiti Ramchand, *Professor,* Centre for Education, Innovation and Action Research, Tata Institute of Social Sciences, Mumbai-400088 (e-mail: mythili.ramchand@tiss.edu).

during their engagement in inquiry-based tasks and discussions?

- What is the nature of change in pedagogic knowledge that student teachers undergo in the course of their classroom engagement?

To track pedagogical content knowledge among the participating student teachers, a case study methodology was used.

The following data were collected in the study:

- Log of planning meetings
- Questionnaire to elicit participants' understanding of science, science concepts and pedagogy
- Notes of sessions
- Student teachers performance in tasks
- Student teachers' participation in group work and classroom discussions
- Inquiry reports prepared by the student teachers
- Notes of student teachers
- Observation of the student teachers classes
- Feedback from teacher educators, practicing teachers and student teachers
- Self reporting on learning from the sessions.

A cycle of plan, implement, assess and reflect was used throughout the project period to engage with the student teachers. The mode of engagement was through a topic from school science curriculum, spanning Classes VI to VIII, in the case of D.Ed students and 6 to 10 in the case of B.Ed students. Each course of engagement was facilitated by— (a) relating to the history of the evolution of the concepts and theories relating to the topic of engagement (b) nature of science and understanding of science processes (c) use of general pedagogical principles useful for science classrooms and the tasks that can be planned to engage children (e) thinking through models and other representations in terms of conceptual understandings they promote and (f) assessment strategies for ascertaining children's initial ideas and map their progress in learning.

To document the processes of engagement, three aspects of pedagogical content knowledge (knowledge of science concepts and nature of science, knowledge of children's thinking, and knowledge of science pedagogy) were used.

A total of 43 student teachers from two teacher education institutes (One D.Ed. college and the other B.Ed. college) were engaged over an extended period of time. The D.Ed students were engaged for 15 hours. The B.Ed students were engaged in two groups: Group 1 for 48 hours and Group 2 for 20 hours.

Regarding knowledge of nature of science and science concepts, the study showed marked shifts in student teachers' understandings. Specific aspects of learning included noting that the following aspects of the nature of science has implications for teaching:

- careful observation is important in science
- inference from observations is based on our previous knowledge
- verification is important for science to accept a statement as truth
- there are systematic processes, which scientists follow to arrive at conclusions and the process is replicable, and
- science also relies on inference and interpretation because all the phenomenon are not directly observable.

The student teachers' emerging understanding of science curricula and pedagogy included— (1) guided inquiry an important pedagogical strategy, (2) need for teachers to use vocabulary accurately (3) familiarizing with pedagogical principles useful for science classrooms, (4) appreciating teacher's role as a facilitator, and (5) use of different assessment strategies (6) importance of engaging with children's prior knowledge.

Student teachers benefited from the collaborative effort of planning and resource creation among a subject content expert, teacher educators and a researcher.