

Cross-cultural Research in Learning Hurdles in Science and Mathematics

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Science and mathematics are taught as core subjects in school education all over the world. Taking into account recent scientific and technological advancements school curricula prescribed for these subjects have been modified considerably. Systematic efforts are being made in many countries to teach both these disciplines on a compulsory basis to all the students up to school leaving stage. This expectation is not easy to achieve if one wants to ensure that the teaching should go beyond scientific and mathematical literacy. School students face a variety of difficulties in comprehending and applying concepts in science and mathematics. A systematic research study to understand these difficulties and deliberate efforts to design appropriate remedial programme would enable us to teach these subjects effectively.

Homi Bhabha Centre for Science Education (HBCSE), a national centre of the Tata Institute of Fundamental Research (TIFR) for science and mathematics education, has been engaged in understanding learning hurdles faced by the first generation learners. Since its inception in 1974 HBCSE has undertaken projects both in urban as well as in rural areas to understand students' learning difficulties. Based on this understanding it has embarked on developing suitable methods/materials to facilitate learning of science and mathematics. Among others things learning difficulties are found to arise out of socio-cultural deprivation, linguistic underdevelopment and lack of educational opportunities. Negative attitude of students toward these subjects supported by irrelevance of school content to daily lives add to the poor scholastic performance of students. When field-tested the remedial measures designed to overcome these hurdles were found to be quite effective. All the student-batches that underwent remedial instructional programme showed significant improvement in students' performance at the school leaving public examinations.

A programme was undertaken in rural secondary schools of the state of Maharashtra to test the utility of Remedial Instructional Strategy on a large scale. It was found that teacher training supported by follow-up activities and print material can equip the practising teacher to implement this strategy in a typical rural

school. It remained to be seen if the strategy developed at HBCSE can be used in different cultural settings. This issue could be settled only if one finds that learning problems faced by the students from different cultures are qualitatively the same. It is with the purpose of understanding universal as well as culture specific problems across-cultural study was undertaken. It aimed at comparing learning difficulties faced by students from two different cultures.

The cross-cultural study was conducted taking samples from the schools in India and United Kingdom. Indian sample was chosen from schools in Mumbai and Vadodara. Both are industrial towns with metropolitan populations. The UK sample was chosen from schools in Milton Keynes, Luton and Bedford. All these towns are located in the central part of England and have multicultural population. In order to collect relevant data questionnaires were designed for students, their teachers and parents. A questionnaire for students sought their opinions about the areas of difficulty they face in studying science and mathematics, their attitudes towards these disciplines, the nature of help they get from their parents, their interests to pursue professions based on these disciplines, etc. A separate questionnaire was prepared for science and for mathematics teachers. These questionnaires attempted to know teachers' opinion regarding the underachievement of their students, nature of difficulties faced by students, their own viewpoints about the importance of these disciplines, plausible ways of improving the situation, etc. Similarly, the questionnaire for the parents sought their opinions about the importance of these disciplines in school education, their viewpoints about the roles these subjects play in the building students' personality, their use in day to day lives of their wards, etc.

The student-questionnaire was administered to students studying in grade 7 of the chosen schools. Their teachers were requested to complete the questionnaire meant for them. The students who took the questionnaire were requested to take parents' questionnaires home and get them filled from them. The analysis of the data reveals that the problem areas lie both in cognitive as well as in affective domains. As seen in the earlier studies of HBCSE the problems in concept formation arise mainly

out of cultural deprivation, indifference towards these disciplines and lack of learning prerequisites. Students from different cultures display different beliefs and attitudes. Teachers' from different cultures also have different views on the underperformance of their students. Similarly, there is a significant difference in the ways parents from different cultures look at the scholastic performance of their wards. Nevertheless, there are a few common difficulties faced by students from both the cultures. These difficulties can be called as universal problems. One can thus design common methods and materials to overcome universal problems so that students' scholastic attainment in these disciplines is enhanced. Some hurdles are bound to be culture specific. The remedial instructional strategy has to take into account those differences and provide for suitable inputs to students, teachers and parents.

The cross cultural study discussed in the paper throws light on the universal as well as culture specific learn-

ing difficulties faced by the school students in mastering the disciplines of science and mathematics. They could certainly be overcome by modifying teacher-pupil interaction in the classroom. Such a change could be brought about through teacher training programmes. The study provides concrete guidelines for the in-service training of practising teachers. It also suggests inputs to be given to parents to utilise students' spare time fruitfully. The proposed presentation will outline the design of the study, method of data analysis and salient findings of the study along with their global implications. [The author wishes to acknowledge the help received from the colleagues at Centre for Curriculum and Teaching Studies (CATS), Open University, Milton Keynes, UK and Centre for Advanced Study in Education (CASE), University of Baroda, Vadodra, India in the development of the questionnaire, data collection and data analysis of the cross-cultural study.]