

7. INDIA
THE BOMBAY SCIENCE
IMPROVEMENT PROJECT 1970-1974

Background

India is committed to a programme of scientific advancement as a major means to national development and thus to raising the standards of living of its people. Consequently the improvement of science education at all levels is a matter of high priority.

In Greater Bombay, the Education Department of the Municipal Corporation set out in 1970 to prepare and implement an enriched, child-centred, science curriculum for its 1,100 primary schools catering for some 600,000 children in the 5-11 age range. Inevitably, a major element in such a programme was a massive re-training exercise for the 15,000 teachers concerned. (A roughly equal number of children existed in private schools).

Such a programme, had of necessity to be a long-term one requiring both professional expertise and very considerable administrative and financial support.

Aims

The overall aim of the project was to prepare a suitable primary science curriculum with supporting teachers' and pupils' materials, including science kits, and to try it out under classroom conditions with a view to eventual implementation in all the city's schools.

The particular objectives of the in-service training programme were stated as:

- (a) to acquaint the teachers with the methodology and philosophy associated

(b) to train the teachers in the classroom use of materials produced by the project.

(c) to help teachers in preparing audio-visual aids and models.

(d) to raise the teachers' level of understanding of basic scientific and mathematical concepts and skills by stressing logical reasoning, patterns and relationships, and by involving them in activities through the use of enquiry methods.

Needs and priorities

In terms of teacher training the first priority was seen to be the changing of teachers' attitudes to the whole business of learning and teaching at the same time as deepening their own scientific knowledge. As a project report put it: "The traditional method ... is "chalk and talk". Very often there are no facilities for teachers even to demonstrate phenomena, let alone allow the children to have the opportunity of finding out things for themselves. The idea that children can make their own observations, form their own hypotheses, then test them and so discover many of the laws of nature, has been completely alien to the teachers".

The immensity of the re-training problem necessarily meant a carefully phased long-term programme with concern in the earlier years to develop both practicable curriculum materials and effective forms of in-service training.

Resources

The agencies involved included the Municipal Council of Greater Bombay, the National Council for Science Education, the Government of India, the British Council and the National Science Foundation of the USA providing consultants.

The teaching staff of 24 included an equal number of full-time and part-time members.

The full-time members comprised selected teachers who had received special training in 1971 and 1972 to enable them to work as supervisors in the Project.

Participants

Those who shared in the project were the 15,000 teachers and 600,000 pupils in Bombay's municipally governed primary schools.

Content of the course

Teachers and children were introduced to and exercised in fundamental scientific skills such as observation, classification, inference, hypothesizing, etc.

Modes and methods of training

In 1971 one hundred and twenty teachers from the five major language groups were trained in the use of the materials for Standards I and II. In 1972 a further 250 teachers received similar training, plus an additional 40 who concentrated on the new materials that had been produced for Standards III and IV. Each session consisted of a three-week intensive workshop followed immediately by a one-week workshop for the production of teaching aids. These workshops were held during the school summer holidays, and finally, half way through the school year, short follow-up workshops were held for discussion of problems encountered. Also, all the teachers involved met once a month in their own language groups to sort out difficulties.

Later, the workshops were extended to six weeks in order to prepare teachers for work in the whole Standard I to Standard IV range.

To reach the objectives of the workshops work was carried out at two different but related levels. First, materials in the processes of science were given at the teachers' level and secondly these were related to the classroom situation.

A series of activities was designed to illustrate the many processes of science,

e.g. Observation

- (a) looking at a sugar cube coated with alum powder.
- (b) describing a Rs.5/- note, from memory.
- (c) observing copper chloride and aluminium foil, followed by the action of one on the other.
(all designed to illustrate the use of the five senses)
- (d) the many activities included in the teachers' guide 1 and pupils' book 1 - "Using our Senses".

Using this idea of the various processes involved in scientific method, further activities, with teachers working in small groups, were carried out in classifying, inferring, and hypothesizing at their own level followed by experiences using activities contained in the teachers' guides that could be done with primary school children.

A part of each day was devoted to mathematics - mainly new ways of teaching addition, subtraction, sets, area, time etc. The reason for including mathematics was because it was found that the science course needed the support of a practically orientated course in mathematics.

In addition to making their own teaching aids the teachers also made a number of local educational visits - to the zoo, seashore, factory etc. - to help them look at their environment. Materials collected during these visits were used afterwards in the workshop.

The whole programme was thus a very practical and functional one, designed to enable the teachers to implement in their own classrooms a more child-centred, enquiry-based, approach to science education.

Follow-up and evaluation

A great deal of effort was made by the project team in visiting, in their own classrooms,

teachers who had attended the workshops. With so many schools in a densely populated urban area, this was not such a physical, time-consuming, problem as is often the case. Nor was the cost of travel too great.

The purpose of the follow-up visits was:

- (a) to help the teachers over difficulties they encountered in implementing the new curriculum materials.
- (b) to evaluate the suitability and effectiveness both of the curriculum materials themselves and of the in-service training which the teachers had undergone.

A process of continuous evaluation was conducted throughout the life of the project.

In order to observe and measure the attainment of the objectives of the in-service training programme outlined above, two different evaluations were used; one relating to the first three objectives, and the other to the fourth.

The first evaluation exercise was conducted by means of two instruments: a structured personal interview with each participating teacher and an observation schedule completed during a lesson taken by the teacher. The main conclusions reached as a result of this evaluation were:

- (a) most teachers and pupils found the new methods more enjoyable and meaningful.
- (b) the teachers also found them more demanding and time-consuming, especially at first.
- (c) the change to activity-oriented group teaching was difficult, but worthwhile.

(d) there was, however, little evidence that these new methods had affected work in other subjects, even in Standards I and II.

(e) one third of the teachers were teaching the class as a whole; the rest were attempting group and individual work, but most were keeping rigidly to the experiences suggested in the guides and were not attempting to devise activities of their own or to allow children to play with and explore materials in their own way.

(f) most teachers were taking more pride in the appearance of their classrooms and making more use of visual aids.

This preliminary evaluation was followed by a later evaluation of the same group to provide firmer evidence of the project's effectiveness.

This second evaluation exercise took the form of an objective-type test of 32 questions for 280 participants administered at the beginning and end of two six-week workshops in 1973 and 1974. Its purpose was to discover if there was any significant change in the level of basic scientific and mathematical concepts and skills as a result of the workshops.

The general conclusion from this evaluation was that, on statistical evidence, there was a significant difference between pre-tests and post-tests, so that the workshop appeared to be achieving the objective aimed at. It is, perhaps, fair to comment that this might well be expected from an intensive 6 week workshop. It would be interesting to be able to compare the gain made with those from a shorter in-service course of only 1 or 2 weeks - the kind very commonly available.

Special
features

One such feature was the very close inter-relationship between in-service training and curriculum development (of the Caribbean

Mathematics Project); but materials in Bombay were written only by the Project team, who were mainly local teachers.

Also there was the essentially practical nature of the in-service programme though aiming at a change of approach and attitude on the part of the teachers. The organizers' difficulty, in view of the teachers' background, was "what to leave out".

Another feature was the intensity of the follow-up and evaluation exercises, helped by the urban location of the schools.

By June 1973 about 1,000 out of a total of 15,000 teachers had received some in-service training. Clearly a long-term programme was called for. In addition, in July 1974, the State the Maharashtra, with its 60 million people and 55,000 primary schools, decided to adopt the new science programme for Standards I to IV. This necessitated a massive in-service training project.

In a personal communication, the consultant stressed the vital importance of follow-up activity without which courses and workshops, however good in themselves, could be a waste of time. "Schools and headteachers can be cruel places, but at least they are the real situation, not the confines of the workshop."

References

1. The Bombay Science/Mathematics Improvement Project - Teaching Aid Centre, Gilder Tank, Bombay, April 1974.
2. BROOKES, John H. - Bombay Science Improvement Project. Science Education Newsletter, April 1973.
3. Project Profile - Educational Development International, July 1973.