

## EVALUATION OF THREE PHASE PRIMARY SCIENCE

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Since mid 1970 an evaluation of the Papua New Guinea Three Phase Primary Science course has been underway, carried out by the Teaching Methods and Materials Centre of the University of Papua New Guinea. This evaluation was requested by the Papua New Guinea Department of Education and has received financial assistance from that Department and from UNICEF. The evaluation has been undertaken in two major parts. The first was confined to Phases I and II (Standards 1-4) and took place during 1970-1972, the second covers Phase III (Standards 5 and 6) and is not yet completed. These two parts of the evaluation are reported in detail in Wilson (1972) and Wilson (1974).

### EVALUATION AIMS AND PROCEDURES

The evaluation, particularly that of Phases I and II, has concentrated on the school and classroom situation. This has seemed appropriate in view of the fact that the pedagogy of TPPS teaching was and is very different from that of other areas of the primary school curriculum. So the first question to be answered was - Does TPPS operate in the classroom as is intended? To answer this question one must ascertain what is intended and then go and see. We have done this by analysing the course, observing on a personal basis and asking others to observe lessons and report their observations to us. For Phases I and II we asked Head Teachers in primary schools to do this using a highly structured, largely objective observation form in classes in their own schools.

This provided reports on 2481 science lessons. Later in the evaluation of Phase III we wanted to look in more detail and depth at what was happening in Standards 5 and 6 classes and so confined observational work to experienced science educators (mainly the research assistant, the writer and Teachers College science lecturers) using a much less structured, largely open ended observation form. So far this has provided reports on 125 Phase III lessons.

Further assessment of the school situation was obtained from discussion with Head Teachers and science teachers in addition to results from a 'Science Teacher Interview Form' completed by 77 science teachers.

In the second part of the evaluation while classroom observations have continued to be important we have also aimed to assess the effects of the course on the children and in particular the extent to which it is achieving its objectives. The objectives are set out briefly in the Teachers' Handbook and stress interest and enjoyment in gaining scientific knowledge and the development of an attitude of enquiry. We have not attempted any objective measure of the development of an attitude of enquiry (lesson observations giving some indications and suggestions about how this might be done

will be most welcome)'. We have much subjective evidence of interest and enjoyment from lesson observations. In addition we have constructed two pupil attitude scales in an attempt to measure:

1. attitudes towards TPPS lessons and
2. understanding of and attitudes towards science itself.

To some extent this goes beyond the stated objectives of the course and we believe that it is quite legitimate for an evaluation to do so.

In respect of cognitive objectives of the course we have analysed the content of each Phase III lesson in terms of the skills and concepts involved and in this way have made a determination of the implied cognitive objectives of the lessons. On the basis of this analysis we have constructed a short series of multiple choice tests for administration to Standard 5 and 6 pupils at the end of each Phase.

Finally two attitude scales for primary teachers relating to science teaching and to science have been constructed, piloted and modified. These are at present being used in an investigation of teachers in the field and at various stages of pre-service college courses but as yet no results are available.

## RESULTS

I present here the conclusions recorded in the reports on the two stages of the evaluation.

First the evaluation of Phases I and II.

"The general conclusion, albeit subject to some important qualification must be that in many important respects it TPPS does fulfil the organisers' expectations. The results from the 2481 Observation Forms and the 77 Teacher Interview Forms show that the position with respect to the supply of necessary equipment by UNICEF, the District Education Offices and the teacher himself is generally good. (More recent evidence suggests that this may not be the case in 1974.) The teacher gets the activity under way without difficulty, although there is some evidence that the initial issuing of instructions is not always effective. During the lesson the teacher supervises and assists the groups but often has difficulty in answering pupils' questions. Meanwhile the pupils themselves normally have little difficulty with the activities which arouse considerable interest and enjoyment. The pupils also talk among themselves, often in the vernacular, particularly in the lower standards. After the activity there is often discussion and sometimes some written follow up work.

From Standards 1 to 4 there is a progressive decline in the use of the vernacular and an increase in written work, in pupil questions and discussion and in pupils' difficulties with the activities. The course appears to be equally successful in rural and urban schools and in Mission and Administration schools, a major difference being the much wider use of the vernacular in Mission schools. A further analysis shows that there is a general, although small, improvement in the success of the course as teachers' experience increases, which augurs well for the future.

The most outstanding success which TPPS has achieved is the interest and enjoyment which it generates amongst the pupils - the weekly science lesson is an eagerly awaited event in most primary schools.

The major failure of the course relates to its much stressed aim of encouraging questions and a "spirit of enquiry". Pupils ask very few questions indeed even in Standards 3 and 4. Teachers make only limited attempts to overcome this by encouraging questions. Of course, a "spirit of enquiry" may possibly be abroad in TPPS classrooms without this manifesting itself in questions to the teacher - pupils may for example pursue their enquiries through the activities. There is some evidence however that this does NOT happen to any marked degree. Quite frequently teachers mention that pupils are not fully occupied or that the lessons are too short - thus indicating that pupils are doing little more than simply carrying out the basic activity as instructed by the teacher. One important reason for this failure is no doubt that little that goes on in other areas of the curriculum in primary schools encourages a "spirit of enquiry". It is asking a lot that children be metamorphosed in half an hour of science each week from passive receivers to active enquirers, particularly as the traditional culture and education which constitute the pre-school background of most children demand unquestioning acceptance of adult authority. But an equally important reason is teacher lack of science background and consequent lack of confidence in science lessons. While they can organise the basic activities they feel that they do not understand the science relating to them well enough to answer questions. If they feel they cannot answer questions they will not encourage them. If children are not encouraged they will not ask and if when they do ask it is frequently clear that the teacher cannot help and may even be embarrassed (especially as he is 'The Science Teacher' and teaching a class which is not his own) the children will be inhibited further.

Another area of concern with the TPPS course which is in fact closely related to the above is the evidence from various sources in this evaluation that pupils are not as fully active as one would expect in an activity course. Sometimes this takes the form of waiting around while the other three members of the group have their turn with the mirror, lens, magnet or whatever, sometimes the children have simply finished everything they have been told to do in ten minutes. Occasionally pupils may be seen developing or changing the activity in an interesting direction but they rarely pursue this and even more rarely is it taken up to the teacher. He does not develop and extend the activities on the card for the same reason as he is reluctant to encourage questions - because he does not understand the purpose of the activity or its relationship with things beyond the activity.....

Another area in which the course is not operating as intended is in the use of the vernacular. In Phase II the vernacular is not to be used but is in fact being used in up to one-third of science lessons. This is an area in which in the writer's opinion the teachers' and pupils' usurping of TPPS policy is to be commended. It seems most likely that in many science lessons, particularly those involving a first contact in school with the natural environment which is already familiar to pupils from out of school and traditional activities, the use of the vernacular could do much to bridge the gap between traditional and school

knowledge - a gap which is causing much concern in Papua New Guinea at the present time.

Finally several minor failures should be noted. Firstly many schools have failed to promote the idea of a "science room". This is stressed in the Teachers' Handbook and can do much to extend science teaching beyond the basic one half hour each week. Next there is a small minority of teachers (about 10%) who teach TPPS without understanding or perhaps just ignoring the basic philosophy of the course. They tell children the answers before they have a chance to try to find out for themselves. This may in fact be more widespread than appears from this report as it may well not have been apparent to some observers that it was happening. Finally the one piece of equipment which causes considerable trouble is the spirit burner. More TPPS lessons have been ruined or omitted because of burners which threaten to set fire to the school than by any other cause." (WILSON (1972) pp. 33-36)

This record is on the whole a satisfactory one for the widespread introduction of a radically new curriculum into the primary schools of a developing country.

The conclusions of the Phase III (Standard 5 and 6) evaluation are less encouraging.

"Phase III of TPPS provides experiences related to a wide range of scientific phenomena which generally arouse considerable interest and provide real enjoyment for primary school pupils. But the work reported here shows that considerably more difficulties are encountered with Phase III than was the case with Phases I and II. Lesson observations show that teachers frequently have trouble with the provision of needed materials, with coherent issuing of initial instructions, in understanding what the activity is all about and in stimulating and dealing with questions. Long term experiments and the recording of the outcomes of activities are often neglected. The result of these factors is, as shown by the results of the cognitive tests, that pupils understand only the simplest ideas involved in the activities and that there is little difference between those who have and have not done a particular TPPS lesson. Children enjoy their science lessons but have not fully understood the importance of the activities as a means of finding out for themselves.

There is little evidence of any attitude of enquiry or initiative on the part of either pupils or teachers. At the same time there is evidence of differences in behaviour, attitude and achievement between boys and girls - uniformly in favour of boys. Children have a reasonably accurate and favourable image of science and scientists but tend to believe that science is difficult and wider in power and application than is in fact the case. There is little difference in the image of science of children who have and have not done TPPS.

Some concepts are introduced and developed in such a short time that it proves quite impossible for the pupils to grasp them - the teachers themselves are sometimes not clear of the purpose of an activity and often unsure of the underlying science. There is a very big difference between the level of activity and understanding utilised

in Phase II compared with Phase III." (WILSON (1974) pp. 32-33)

These latter are tentative conclusions based on an incomplete evaluation of Phase III.

Full details of the evaluation procedures, results and recommendations for the development of TPPS are contained in the three evaluation reports listed below.

- WILSON, Michael (1972) An evaluation of Papua New Guinea's Three Phase Primary Science Project. Report of Phases I and II. Teaching Methods and Materials Centre, Research Report 14. University of Papua New Guinea
- WILSON, Michael and  
WILSON, Audrey (1973) Three Phase Primary Science Evaluation of Phases I and II. Report to Schools. Teaching Methods and Materials Centre. Research Report No. 20. University of Papua New Guinea.
- WILSON, Michael (1974) Three Phase Primary Science. Phase Three Evaluation. Interim Report. Teaching Methods and Materials Centre, Research Report 24. University of Papua New Guinea.