JOHN ELLIOTT

7 Science 5–13

Basic information

Sponsor Schools Council

Grant £137,200 (+£18,000 from Nuffield Foundation, £10,340 from Scottish Education Department +£2,000 from Plastics Institute)

Location School of Education, University of Bristol, 1967–74

Project team

Len Ennever	Project Director
Albert James	Deputy Project Director
Wynne Harlen	Evaluator
Roy Richards	
Sheila Parker	
Don Radford	
Mary Horn	

Materials Teachers' guides, published by Macdonald Educational, are listed in the Bibliography

Introduction

What follows is the story of a project in action through the eyes of three members of its central team. When there is a difference in emphasis or interpretation I have done my best to represent it. The views expressed have been selected from tape-recorded conversations with Wynne Harlen (project evaluator) and Sheila Parker (a team member), and the project director, Len Ennever's, taped reply to some questions I sent him through the post. The material was gathered during the summer of 1976. My selections from it are inevitably guided by my own views about what is significant for understanding the process of curriculum development. The story presented here is far from clear and complete in places, but I hope it will stimulate the reader to further inquiry. With this in view I have cited at the end some further sources of information about the project.

Basic ideas

Before the story of the project can begin I must briefly try to summarise its basic ideas as they are described in *With Objectives in Mind*, a project publication aimed at helping teachers to understand these ideas. The passages attributed to Len Ennever are either actual quotations from this book or comments made by him after reading a draft of this chapter.

ASSUMPTIONS

1. In general, children work best when trying to find answers to problems that they have themselves chosen to investigate.
2. These problems are best drawn from their own environment and tackled largely by practical investigation.
3. Teachers should be responsible for thinking out and putting into practice the work of their own classes.
4. In order to do so they should be able to find help where they need it.

PROBLEMS

Within this framework the project team urged that they sought answers to the following problems:

1. What kind of science is right for children?
2. What do we want them to achieve through learning about science?
3. How can we best help them achieve it?

SOME ANSWERS

What kind of science?

Ennever: Exploration of the environment is certainly involved – the examination of what is there.... There may be experimenting, there may be measuring, but much of the work will be finding out.

They will organise their experience into some pattern personal to themselves ... most of our children will be happier talking about the speed of cars, falling stones and moving planets than about velocity and acceleration which are abstractions drawn from experience of moving objects.

To a discerning teacher those who have such powers (of abstraction) and those who have not, reveal themselves through the kind of problem that they choose to tackle, and the kind of answer they propound.

The project team defined development in terms of Piaget's pre-operational, concrete operational, and formal operational stages. They warned teachers to be careful: that our own ideas about science and our own ideas of what they

might achieve through it do not dull our perception of the individual natures of these children and what they need to develop their different potentials.

What do we want children to achieve?

The team believed that science could contribute to educational ends which transcend subject boundaries, e.g. 'self-realisation', 'broadening experience', 'educating the whole child'. Scientific learning may not always contribute to such aims, because these general ends give no indication of the particular contribution science activities can make to them. The team concluded that they give no help in planning day-to-day work in science.

Ennever: . . . We must add to them others that are sufficiently specific for the purpose. This was a task that occupied us for some time.

We discussed with panels of teachers in different parts of the country what might be their aims and objectives for children when working with them in the field of science. In the light of these discussions we shaped aims and objectives for children learning science that were acceptable to us and, broadly, to the teachers with whom we had talked. At their suggestion we wrote them down in a form that we thought useful in schools, well aware that this pattern of guidelines was only one of many that could be equally satisfactory and useful.

They started on this task by defining an *overall aim* of '*Developing an enquiring mind and a scientific approach to problems*'. The overall aim was then broken down into eight *broad aims*:

1. Interpreting findings critically.
2. Developing interests, attitudes, and aesthetic awareness.
3. Observing, exploring, and ordering observations.
4. Developing basic concepts and logical thinking.
5. Posing questions and devising experiments or investigations to answer them.
6. Acquiring knowledge and learning skills.
7. Communicating.
8. Appreciating patterns and relationships.

The final stage of the specification process was to break each of these broad aims into the specific 'behavioural objectives' appropriate for children at different developmental stages. The complete list of objectives is published in *With Objectives in Mind*, and at the end of the other units.

How can we best help children achieve the objectives?

Ennever: They [objectives] do not indicate to teachers anything about the materials or apparatus their children should use or about the experiments or activities they should undertake. Whether or not children achieve certain

objectives in a situation in which these objectives potentially could be achieved depends on the way the situation is managed.

According to the team, teachers can best help pupils by selecting activities which *match* the levels of development individuals are at. Two kinds of knowledge are required for *matching*. First, knowledge of the level of development pupils are at and secondly, knowledge of activities which are appropriate at the different levels.

TEACHER SUPPORT

The team believed that they could help teachers help pupils to 'develop an inquiring mind and a scientific approach to problems' firstly through analysing their overall aim into specific behavioural objectives, and secondly the production of units which suggest learning activities through which these objectives can be achieved at the appropriate levels of development.

How objectives can help teachers

The team believed that 'our broad aims apply to all children but they have little practical application unless they are further broken down in ways which take into account the age of the children and, most importantly, their stage of mental development'. They also argued, again on grounds of practicality, that specific objectives should be expressed as desired and observed changes in pupil behaviour (behavioural objectives).

Ennever: Having an aim cannot lead to satisfaction unless it is possible to recognise its achievement. So aims are most effective when they are expressed in terms of expected changes in children, and changes which can be observed.

The function of the team's statements of objectives appears to be four-fold:

Ennever: 1. . . . being conscious of them helps the teacher to take advantage of the potential elements of science which are in any of their activities.
2. Working with objectives takes some of the insecurity out of discovery situations.
3. . . . Teachers who consider these objectives in relation to individual children . . . will find out what ideas the children already have so as to frame objectives for them accordingly and they will therefore know how firm a foundation, if any, they have upon which to build.
4. To help teachers assess whether activities have been matched or mismatched.

SUGGESTIONS FOR LEARNING ACTIVITIES

The team have produced detailed suggestions for activities through which their objectives might be achieved in the form of published handbooks for teachers arranged in a series of sets. Details of these are given at the end of this chapter.

Each unit in the first four sets was written in skeleton form after work on the theme in a few volunteer schools. The units were then commented on by all team members and by some teachers, were expanded into a trial edition, sometimes of 4,000 copies, and were used for trials and evaluation, first in 12 pilot areas, later in 27. After being evaluated the trial units were rewritten for publication.

The team argued that from their experiences at the trial stage a good unit must satisfy the following criteria:

1. *Attractiveness* to children and teachers.
2. The content must possess *relevance* for children inasmuch as it engages their attention and provides opportunities for inquiry.
3. It can be *implemented* in schools.
4. It is *open* to further development by the teacher.
5. It must *demonstrably further the teacher's objectives* for the children.
6. It must *give the teacher the help he needs*, both long term – citing realisable objectives, and short term – with methods and apparatus.

Ennever: These units do not in any way constitute a course or even part of a course. They are illustrations of ways in which a teacher might go about helping children to achieve objectives she has in mind for them.

. . . the evaluation of the pilot trials was aimed at revealing the extent to which the trial unit helped teachers to consider profitably the objectives for children learning science and to implement them. There is positive evidence that the units are of value in doing this.

There were no books for children, since by their terms of reference the team were bidden to produce books for teachers. One of the project's tenets was that teachers could best help children to learn science by selecting experiences and activities appropriate to their abilities, and engaging the attention, of individual children.

There has been strong and continuous pressure at home and abroad for the project to produce materials for children. A proposal to do this, and to establish a national dissemination centre has been accepted by the Schools Council.

The project in action

THE ORIGINS OF THE PROJECT

Wynne Harlen (Project Evaluator): The project began in September 1967, about 18 months after discussions had begun between the Schools Council and the Nuffield Foundation about the possibility of setting up a jointly sponsored project in primary science. It was originally conceived as a continuation of the Nuffield Junior Science Project (January 1964–August 1966), with the Nuffield Foundation contributing a fixed sum, but the continuing responsibility for support resting with the Council. Shortly after the start of the Science 5–13

Project the Scottish Education Department was welcomed as a third sponsor, contributing 10 per cent of the Schools Council grant in return for the participation of Scottish schools.

Len Ennever (Project Director): It was thought that the Nuffield O-level projects would be more firmly established if there was a foundation of science in primary schools on which to build. So the Nuffield Junior Science Project was set up in 1963. I was at that time an HMI concerned with the Nuffield programmes and also with the general area of science in primary schools. I was asked to make liaison between the Nuffield Primary Science Project and the Ministry as it was then. The Nuffield Foundation provided funds for the curriculum development but said that not one penny was to be used for teacher training. However, the Schools Council, which was founded in 1964 – a year later than the Nuffield Junior Science Project – said that they would provide courses for the teachers from the twelve Nuffield pilot areas if the local education authorities would pay the teachers' costs, give money for trials expenses, provide apparatus and provide a centre for each area where teachers could meet and discuss. That was the start of the train of Teachers' Centres set up around the country.

Wynne Harlen: While sharing many of the educational convictions of the Nuffield Junior Science Project, the new team naturally wanted to form its own ideas about how it would try to help teachers, rather than continue the production of the kinds of materials developed by the earlier team . . . Soon, the new project developed its own line of approach to the solution of the problems it confronted, and it was appropriate that it should drop its initial name 'Junior Science Project', which linked it rather too firmly with the Nuffield Junior Science Project. The title 'Science 5–13' was chosen at the first meeting of the project Consultative Committee. (Harlen 1975).

Len Ennever: The Nuffield team were repeatedly asked by the chairman of their consultative committee – Professor Kerr – to say what their objectives were. They were reluctant to do this because they said that the objectives were inherent in the work. After the team's secondment period of three years was up in 1966, the project was declared closed. I was then asked if I would resign from the Ministry having reached the minimum retirement age and run a new project covering the same age range as the Nuffield one and taking into account amongst other things the areas of difficulty they had revealed. I was appointed in April 1967.

STAFF APPOINTMENTS

Wynne Harlen: I remember reading in the project archives [after her appointment as project evaluator] correspondence between the Nuffield Foundation and the Schools Council about the need for further work – even before the Nuffield project ended – and my impression was that there was a preference for

starting with a completely new team. The Nuffield team were idealistic, they didn't receive our ideas about objectives very favourably at first. It seemed to them to be likely to prevent or destroy the lively open-ended work which they were promoting. We wanted this open-ended work too, but felt teachers needed a lot more help; more structure of ideas. I think the value of this has now been appreciated by the Nuffield team as well as by others.

Len Ennever: My experience with the Nuffield projects had convinced me that project staffs would be far more effective if they could be housed together in the same building and could work in more or less daily contact but with some measure of independence. The University of Bristol provided a house and, though advertising for staff and providing an appointments committee, gave me practically complete freedom of choice in selecting staff members. In general the University could not have been more helpful to the project.

Wynne Harlen: I was appointed by Len. We got to know each other because I was working in Bristol the year before the project started and he was already there. We met very formally [at a staff meeting in Bristol]. I showed him what I was doing on the Oxford Primary Science Evaluation, and everything went from there.

Len Ennever: Before starting work, the general lines of the project were settled by preliminary discussion between the Schools Council staff, the staff HM Inspector for Science, and myself . . . The Schools Council had insisted that one member of the team should be an evaluator; the first ever. We were lucky enough to find Wynne Harlen on the staff of the School of Education and ready for a change. She was appointed and was not to produce units of work as the other members of the team were, but was to be accorded a considerable measure of independence in how she approached her work. Yet she was to work with the team in order to understand what their intentions and aims were. This turned out to be a very happy arrangement which, having worked in such a way as an HMI for 18 years, I found it very easy to foster and maintain.

Wynne Harlen: I had been working on the Oxford Primary Science Project which didn't spell out its aims at all. I came to it in its fourth year trying to ask questions about what they thought they were doing and meeting a great deal of resistance. I told Len about this . . . Len didn't give definite guidelines but he must have had something like this role for me in mind.

Len Ennever: The terms of reference for the project, which were modified after discussion with the Schools Council, and stated by them, were not definite as to the necessity for the project to state its aims explicitly, but every body concerned with the design of it was convinced that it was necessary to do so.

Wynne Harlen: Len knew everyone [team members] before. Sheila Parker he knew of I think, Don Radford he knew from being an inspector . . . Albert James and Len had met on courses; he came on the scene later. There was only

Sheila, Don, and I for the first year . . . so that was the initial core. Yes it was very much by recommendation . . . I had to have an interview actually. So I suppose he had to go through the procedure.

CONSULTATION PROCEDURES

Len Ennever: The Consultative Committee had on it Professors William Taylor, Kevin Keohane, Geoffrey Matthews, and Peter Kelly; also some teachers, and members of related projects; there were 25 or so members in all. They met regularly, once or twice a term, and their influence was entirely beneficial. They were critical in a friendly way of what we did but they, by their terms of reference, imposed no restraints on the way we carried it out. We listened to each other and the dialogue that took place was wholly helpful.

The other committee was the area representatives committee, consisting of LEA advisers and others, drawn in the first place from those who were helping to conduct the evaluation procedure, originally to discuss evaluation procedure and iron out difficulties. This was very much down to earth; much more coal-face work was done by the members and it proved extremely valuable. It was through this committee that we operated a system of help to uncommitted areas. When requests for lectures or help on courses and so on came in we would write to members of the area representatives committee who would find someone to make the necessary response. It was through influences such as these that the work of the project spread beyond the pilot areas; some of the new areas became sufficiently well organised to send members to the area representatives committee. Later regional Science 5–13 groups were organised to provide mutual help for regional groups of LEAs. There are eight of these and they cover most of England. Scotland, which is very active, bases its work on colleges of education. North Wales looks to Liverpool for help. South Wales runs its own courses for teachers, but has not formed a group. Many countries abroad run courses and ask for help from the project team. As the project drew to its close [it ceased to be funded in September 1975] the consultative committee and the area representatives committee met jointly and from them emerged the 'after-care committee' which still exists. It meets regularly but less frequently than the original committees, and is largely self-supporting. Of late, the financial climate has taken a turn for the better.

THE AIMS OF THE PROJECT TEAM

Stenhouse draws a distinction between the aims set by a project for its teachers and its aims as a team, e.g. research, reform, development. I probed the latter with members of the project team.

Len Ennever: They were embodied in our terms of reference and were shaped in team discussions about teaching aims. These regular and formal as well as

irregular and informal discussions gave us clearer ideas as to the project's own aims. Among these an important one was 'to help teachers identify their own aims and objectives, relevant to their own circumstances'. Of necessity this was a long term project aim. High priority was given to personal contact between members of the project team and teachers who were making trials of project materials. Contributory to this was the desirability of setting up working groups of teachers to give each other mutual help in implementing aims. We did this at first in the pilot areas we had chosen, and then in wider and more loosely joined areas.

Wynne Harlen: We never really spelled out the aims of the project team as distinct from the teachers. They were not explicitly talked about at all. Looking back on it, what is one to say? My role in it was always someone who was to put a structure on what teachers were doing and might already be doing.

Len always described us as 'pulling out science from what was already done' rather than pushing a new kind of subject to go into the curriculum. I think he had a pretty good idea of what he was doing although he never made it explicit. I'm not sure that was shared by everyone.

Sheila Parker (team member): Our self-image as a team was perhaps to do with helping teachers to be professional by looking through what they were doing to try and have some rationale for why they did things. Did children make progress and all that sort of thing? structuring it a little bit. That wouldn't necessarily be the views of every single person in the team; we started with four people, then it became five, then six, and finally $6\frac{1}{2}$.

DEFINING TEACHING AIMS

Len Ennever: Teaching aims were discussed in a preliminary way by the team but it was realised early on that teachers' views should be sought. So discussion groups were set up in different areas and the business of objectives for children learning science were hammered out. At the teachers' request these were printed; their basis is discussed in *With Objectives in Mind* and they are printed in every unit.

Wynne Harlen: I had just been writing science items for the Bristol Achievement Tests. For that I had to think out for myself what you would want children to achieve at different stages. And it wasn't too difficult then to say 'Well, look I can produce a document – a grid of things that I think we should be working towards with children. Let's discuss it.' I did this. It isn't anything like what came out in the end because I remember it had five stages and a different number of headings. But it was a matrix: stages of development with objectives linked into the stages.

That's where it all started. Len went to America for a month and he left us with the problem of putting this into shape and talking to teachers about it.

We had meetings with teachers in the teachers' centre in Bristol, and I did some near my home. Gradually my document was torn about and changed, but the idea of objectives was accepted by Len very early on. I always give him credit for this. He seemed to see where an idea was going even when the person who had the idea couldn't. He was the one to pick out the good ideas and to encourage people to develop them.

It was with Sheila and Don that I had to thrash out what this idea of objectives meant.

Sheila Parker: Curriculum evaluation is a sign of the times . . . We faced the problem of 'what kind of structure can we offer to teachers', knowing that some of the criticisms of the preceding project were about the lack of structure, and we played around with content and method . . . and arrived at objectives at a stage when Wynne was very anxious that they should be there. That's the origin of 'objectives'. Some statements about childrens' behaviour were implicit in the developers' minds and Wynne really crystallised them in terms of statements that could be used in the evaluation. I am not saying that the project team arrived at objectives, that's not true. We arrived collectively through the evaluator . . . but the individuals in the development team certainly had different views about the function of these objectives . . . One objection was that 'they destroy everything we are trying to do in the classroom', that 'one was making precise what was not precise', that 'where you were making statements about objectives you were fitting on a veneer of structure which was inappropriate in the classroom situation.'

THE DEVELOPMENT OF MATERIALS

Q.: The project's units were written for teachers, not for pupils. Why?

Len Ennever: The project produced a considerable body of materials willingly, by intention, and these were materials for teachers, which is what our terms of reference demanded.

Wynne Harlen: The project wanted children to propose their own inquiries and tackle their own problems, and we felt that this was impossible if you presented ready-made problems to children.

Q.: How did the team set about developing the units?

Len Ennever: During the trials of our units in the 12 pilot areas in England, and the several added to them in Scotland, members of the project team. each assigned to two or three areas, discovered for themselves what HMIs had known for years; namely, that for most teachers the printed word was not sufficient and that personal contact with originators of ideas and materials was essential. The need was partly to have someone's hand to hold, and someone with whom to discuss problems. As a result project members profitably spent a

high proportion of their time in pilot areas and among other things helped the promotion of teachers' groups and their work. During these visits team members made detailed reports on the work seen, the comments made, and the judgements of those who commented. Thus a bank of informed criticism was built up on the draft editions of the units that were put out to trial. These comments and their graded values were of tremendous use when rewriting the trial units for final publication. Close personal contact helped us decide which teachers' comments carried most weight. During the whole of its period the project held regular meetings of team members to discuss materials and the reception of them by teachers. Responses to the demands made by teachers were constructed and thus the project became one of organic design in which the original aims and intentions were modified by the experience we gathered.

Wynne Harlen: I suppose our main arguments in the team were about the kind of unit we should be producing . . . what sort of help should we be giving. We tried a lot of times to look to see what topics ought to be covered and whether we were covering them. And this always ended in failure. We never managed to agree on the main topics. I suppose we were looking for a core and never agreed about it . . .

Len Ennever: Others studied the same problem and we did not agree about their solutions either. There is no single solution.

Wynne Harlen: The topics were very much related to those that wrote them . . . the way they were developed reflects this. Sheila definitely worked from groups of teachers. I went to lots of her meetings. She would throw in ideas and she would somehow manage to enthuse them and they would come back with loads of work that she could then put into the unit. Another member wasn't like that at all. He would write the unit probably using books . . . and then the teachers were allowed to try it and he would modify it a little bit. But he didn't actually draw on their resources for ideas for the first draft.

Q.: How did the project's units differ from the teachers' guides produced by the Nuffield Junior Science project?

Wynne Harlen: First of all the statement of objectives was intended to give a lot of support in terms of what you should be aiming for in suggested activities and what the children should be getting out of them.

Secondly, in giving the background information that we did for each topic. We changed this a bit. In the beginning all the units were going to have a book for teachers and a background book. As time went on that background tended to be absorbed into the book for teachers, but it is still there.

Thirdly, I think giving much more specific help with activities, giving many more examples of the way things had been done and organising these under headings. Although it isn't a programme, of course, there is far more chance of a teacher picking up 'coloured things' and being able to do a term's work on

that and feel very secure with it, than there is in picking up a Nuffield teachers' guide.

Q.: How did the publishers influence the production of the materials?

Wynne Harlen: The publisher came in very late. No, I don't think they influenced . . . I'm trying to think . . . because they did in fact produce trial units for our first trials. They kept us waiting for ages for them and in the end we went back to doing them ourselves for later trials. So they were on the scene earlier than I thought. They must have been on the scene by the end of 1968 actually.

Sheila Parker: They irritated initially because of the constraints they put on us with changes of editors.

Len Ennever: The method of publication was the standard Schools Council method; namely, of invitation to many publishers, discussion with them and with the team, and finally acceptance of one form of publishers by both the Schools Council and the team itself.

The publishers were very slow to produce trial editions and held up the work for many months. In the end we produced them ourselves and had them replicated by the university. Later, however, when the several changes that had taken place in the publishers' firm had sorted themselves out, we settled down to a friendly relationship. A good designer was engaged and gradually the form of the publications emerged and received a very warm response from the teachers. We know now that the appearance of the books and the good quality of their design is an important factor in their acceptance by teachers . . . half our sales, which are considerable, are exported.

THE EVALUATION OF THE PROJECT

Q.: Was it an independent evaluation?

Wynne Harlen: No, I never thought of it as independent. It was intended to be supportive and therefore there was a very close interchange between me and members of the project.

Sheila Parker: Well I don't think it was independent . . . it was part and parcel of project development.

Q.: What were the aims, methods and outcomes of the evaluation?

Wynne Harlen: It was aimed mainly at revising materials. But I remember meetings where we discussed the results of trials, but because they are never cut and dried there were members of the team who wouldn't take the indications. You couldn't prove that it was better to rewrite it in another way and so if you couldn't prove it you may as well leave it. That was the line that was taken by some but not all. Sheila, for example, rewrote her earlier unit completely but I'm not sure the evaluation had a major role here because she had seen the main issues for herself.

Sheila Parker: Yes, but it was nice to know that all of this 'great thing' was saying what you yourself subjectively thought . . . Initially the evaluation was very much concerned with the respectability of evaluation and a concentration on measurable results . . . in terms of the classic model of evaluation . . . But Wynne changed her mind. As I remember it, the change was part expediency, the cost of this great superstructure. But it was also taking into account the teachers' comments about the difficulties they had with this procedure. It wasn't just expediency but the realisation that the task wasn't merely saying to teachers that if they used this particular material the children would get such and such, but that one wanted to encourage teachers to talk about outcomes.

Wynne Harlen: The evaluation was a team thing really. We didn't feel we got much out of the test results . . . Oh, it was a terrible business and also when it was reported to teachers I felt that we'd put far too much credence on the sorts of figures we got. They couldn't take them as mere indicators to put with a whole lot of other evidence . . . They were really reading too much into them.

The approach eventually adopted was to collect information about the way the units were being used by observation in the trials classrooms, and to combine this with comments from teachers gathered by questionnaire and direct discussion. In this way particular criticisms or suggestions could be interpreted in the light of the teaching methods and working context of the teachers making them.

Wynne Harlen: I was struck by the emphasis teachers put on a need for help with organisation and some of the things which you would regard as their normal teaching style. They felt uncertain about these things. A lot of the subsequent rewriting of units tended to help with these problems.

Sheila Parker: In our particular team Wynne was the kind of person who, although she was helping and *with* the team, one felt she was objective enough to pull you up by your boot-straps.

Wynne Harlen: It maybe that we did have more reflective discussions because there was an evaluation. It might have been very easy to have got along without them otherwise, because the team were busy producing activities and so on.

DISSEMINATION

Q.: Was there a plan?

Len Ennever: Right from the start dissemination (publicity it was called then) became a built-in quality in the project. It happened this way. It was clear to us that the ideas we had to offer to teachers were deep-rooted as far as their effect on the understanding of children's education was concerned and as far as classroom practice was involved. It appeared that these ideas would be slow to

gain acceptance. Therefore it seemed necessary to us that an early start be made on helping teachers and others to become familiar with them. Thus when we produced trial editions of our units as far back as 1969, instead of producing sufficient just for the trials we would produce 4,000 or so of each unit. These materials we gave to the pilot areas for work that they were doing for us, but we let it be known that schools, LEAs or colleges could purchase the trial materials and comment on them if they wanted to. Thus the view we took was the opposite of some; namely, instead of playing the cards close to our chest, we said 'These trial editions represent our thinking at the present stage and we hope you'll help us modify and improve them'. Well, the sale of these trial editions was quite considerable and represented an important source of income to the project; indeed, it was largely because of this income that we were able to support so many activities, courses, and visits etc. We ran many residential courses for teachers that we could not have done without this financial help.

As dissemination was seen at the Schools Council, and elsewhere, to become more and more important in the design of projects, a number of studies were conducted and plans for dissemination were made. In our case we extended and varied them so as to further our long-term objective of leaving behind us, when the project finished, local groups examining their own objectives and implementing them in their own circumstances with mutual help. Mostly the activities that we undertook were based on the pilot areas, or the associated areas that had grown up to join them. A map of centres of dissemination of one sort or another showed that practically the whole country was covered.

Sheila Parker: There was no grand strategy for dissemination to my knowledge. You can identify after the event what you want to see in it as it was.

Wynne Harlen: We talked about courses, and held many of them, local and national.

Sheila Parker: . . . The concept of dissemination was new at the time . . . you've got to remember that Len was a very experienced HMI who used the old boy network to a large extent.

Wynne Harlen: And he knew that if he invited certain people to meetings, courses, or conferences, that things would get going. And he knew where to hold these to get them going and it was using all that sort of thing . . . maybe there was a sort of strategy in his mind but it wasn't ever put down on paper . . . We would hold x number of conferences and courses during the lifetime of the project; eight or ten, or something like that for about 100 people each time in selected centres you see . . . colleges of education, mainly colleges of education . . .

Q.: Who was on Len's informal network?

Sheila Parker: His ASE [Association for Science Education] network was very important, besides that of the HMIs.

Wynne Harlen: And all his contacts with other project people and their contacts whom they knew would help, such as people, who had been on various consultative committees of Nuffield projects. Len was on most of the important consultative committees.

Sheila Parker: And he had made lots of contacts with senior LEA advisers.

Wynne Harlen: He would say 'it's time we did something for college people. Let's have a conference for them'. To some extent that was timed when we had material that was suitable for college people. Before that we concentrated mainly on showing draft materials to trial schools and later it widened as publisher's drafts became available.

Sheila Parker: All sorts of things in that respect were very useful – such as Len's decision to make trial materials readily available and setting up some machinery where people could write in and buy it 'warts and all', as he put it. In the long term this proved to be very, very effective.

Q.: How adequate was the network for dissemination purposes?

Wynne Harlen: I don't know, because it so much depended on people staying put . . . doing certain jobs. A lot of them moved away as a result of local authority reorganisation.

Q.: How successful was the dissemination in getting implementation at the classroom level?

Sheila Parker: Patchy. It's a very interesting example of the kind of curriculum development which inevitably must have some influence on others, particularly something like the Schools Council's History, Geography and Social Studies Project at Liverpool. At that level I think it's had some kind of influence. With respect to the extent to which it has been taken up in schools I think the result has been disappointing overall. There are areas where you can say 'yes, there's another 5–13 happening there' but many of these are in areas where conditions were right before the project came along. I suppose Liverpool would be an exception. There was a particular set of circumstances. They battled against difficulties. I don't know Liverpool directly because it wasn't one of my areas . . . but as I understand it there is virtually no science going on in primary science other than 5–13. Whether that science is 'pure' 5–13 is another issue, but nevertheless there is a real impetus there for developing science in the primary school. But as for the country as a whole, and locally where the project was housed, it is not too encouraging, though understandable.

I'm sure one significant issue in dissemination is personal contact. There is sometimes too much change in terms of the support system for teachers within LEAs . . . I suppose what I am really saying is that it is not just personal contact but that there are no real area networks existing independently of the project itself. There's one developing now in Avon. It's perhaps a bit glorified to call it

a network but there is a sudden surge of 'grassroots' interest in 5–13. I can't speak for the authorities, but I think they are interested in the number of teachers who now want courses about Science 5–13; which is ten years after the project. It is interesting that the stimulus for this was an LEA in-service day in Avon. There was an exhibition of work by some good 'Science 5–13' teachers which was very influential indeed; it appears that teachers have now started the dissemination ball rolling.

Len Ennever: Other areas as active as Avon are Kent, Surrey, South East London, West Yorkshire, South Wales, Nottingham, North Western Counties and parts of Scotland.

Wynne Harlen: You don't see the kind of use of Science 5–13 that we really want. No, leave out Science 5–13, because we do not see much primary science going on at all. And it's still an embarrassment if someone comes up and says 'Can we go to see a school where there is good primary science?' You just can't, unless I send them to Liverpool or somewhere like that. Some people would say that pupil material would be the answer. We have this aftercare committee, and there is still a great division in that. I would hold out against pupil material because I would frankly say that I would rather not have science in the primary school that is going to be the normal kind of stuff that you get from the usual kind of work-card.

Len Ennever: Our objectives of necessity applied to a great deal of what went on in school other than teaching in a classroom and teaching in a particular subject area. And one of the things we saw was that when this was understood and acted upon, particularly by heads and staffs together, the project, its activities and thinking as it were sank into the sands of the school – it became absorbed. There were some schools that arranged the whole of their curriculum on Science 5–13; they used it as the starting point for most things; infant schools in particular. It would be a little difficult after one or two years of such working to say which schools were doing Science 5–13 and which were not. As we saw it, when schools are using Science 5–13 it is very often difficult to know the extent to which they are doing so; good practices spread.

REACTIONS TO THE PROJECT

Len Ennever: By and large the project was very warmly received by teachers and local authorities, and still is at home, and particularly abroad. Such criticism as there was can be seen from Wynne Harlen's *Science 5–13: A Formative Evaluation.* There were one or two bits of criticism from research workers which we thought were unjustified; namely, on the uptake of the project. Mostly it was concerned with the period even before the project had produced any published material, and we thought these criticisms were of no great value either to the general public or to ourselves. It wasn't necessary for the project to

react to these kinds of criticisms; but very careful note was taken of the comments and criticisms that were gathered during the trials, and during the working of the project in its courses and day-to-day associations with teachers and others. They were discussed by members of the team in meetings, and in all cases a considered response was made to them.

Sheila Parker: Initially the project was under quite a lot of criticism, and in some cases hostility [from Ex-Nuffield Junior Science supporters], largely through misunderstandings of what the project was about and particularly about the interpretation of the objectives. There was in some people's minds the feeling that we were an alternative; very, very different from the original Nuffield science, which is nonsense . . .

Wynne Harlen: They felt we were putting a structure on to it, and that we were going to begin to prescribe what primary activities should be done. The only other bit of hostility I remember was from Scotland in relation to our 11–13 Stage 3 material. They didn't like that because 'it didn't have the structure' and we had quite a difficult meeting. . . . They wanted a structure of subject matter. Some of the *Times Educational Supplement* reviews were pretty nasty. We didn't like them.

I don't remember 'pupil materials' being a great issue initially. Maybe we just prevented discussion of it. Because we said teachers have to make the decisions, we didn't raise it then, we put it out of court as a topic. But since then there's been a lot of talk about it.

Len Ennever: There is a collection of press cuttings in the project archives. I don't think they amount to anything of great help. Probably one of the most useful things would be to go through the diaries of the teachers which were written during the period of evaluation. These we found most valuable. We read them again and again and they helped us a great deal in coming to conclusions as to the levels at which we should write our materials.

Sheila Parker: One strength of the project lies in its attempt to bring structure into what was rather a nebulous area. Perhaps its greatest strength was its power to bring teachers together to think about a problem in curriculum terms. Its weakness lay in its tendency to rely on too much assumed intercommunication between people. Certainly its statements of objectives are off-putting in the extreme to many teachers who meet the published materials 'cold' and solely through the written word.

LEN ENNEVER

Science 5–13: A Response

When we began running residential courses for teachers in our trial areas, we started each programme with a thorough-going treatment by lecture and discussion of objectives. A glaze came over the course-members' eyes which was not dispelled until we had started them on some relevant practical work. We got the message; so we changed our tactics and involved them right from the start in interesting practical work related to what might go on in their own classrooms; then we discussed with them what they thought they had got out of it, and what children might achieve if engaged in work of a similar kind.

This was much more profitable; it put objectives in perspective, and they saw them not as a miscellany of discrete ends to be achieved, but collectively as a guide to open-ended work with their children. Ultimately, the statement of objectives made by the project was seen not as a unique solution to a problem – there could be many different statements, all viable – but as a framework to support their own pattern of thinking shaped by their own circumstances and suited to their own children. The individual aims and objectives derived their power from being built into a structure – the better designed, the more powerful – rather as Wittgenstein's hempen rope made of short fibres, weak in themselves, could be built into a hawser strong enough to moor a ship to the quay.

Our aims became, not to tell teachers what to do, but to motivate them to think about solutions to their own problems related to their own circumstances and posed by their own children. The progress towards that end was inevitably patchy and slow; the encouraging thing is that it continues at home and abroad, and shows signs of gaining momentum.

Understandably, sometimes and in some places we were misrepresented and misunderstood. At times some teachers looked to us to tell them what to do: we helped them to take their first steps, and tried to provide help to support them as they went on. Their best help came locally because it was related to their own conditions and available on their own doorsteps; more than that, it could be mutual. In fact it took many forms: local authority courses – science advisers

were invaluable and most helpful to teachers and to us – teachers' centre courses and ad hoc groups to study specific problems and sometimes even to write about them. Abroad, in those cultures where educational organisation is centrally derived and the ground for us is rather stony, some teachers gained new insights from open-ended investigations. True, they are not ready for attitudes that challenge authority of book or person – that is, not ready for whole-hearted acceptance of those attitudes – but some of them use our materials, and in doing so think for themselves.

A new project will start shortly, staffed by some members of the original Science 5–13 team, aimed at disseminating knowledge of Science 5–13 materials and thinking, and at designing materials for pupils to use. It should join on very well because the original project proved to be open-ended itself, and left behind enough residual organisation to be of some value. But the image that remains to us, who fashioned it, is one of new work and hard thinking carried out with dedication and loyalty and above all, with immense enjoyment.