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ABSTRACT

This report documents the development, implementation, and evaluation of an inservice program designed to facilitate a non-sexist approach to the teaching of science in primary schools. Ten matched pairs of teachers were selected on the basis of a survey questionnaire to participate in the study. Teachers were given help in the teaching of electricity and subsequently taught this topic to their year 5 classes. The project was evaluated by pre- and post-questionnaires to teachers and students, and classroom observation during the teaching of the electricity topic. Apart from describing survey data about teachers' attitudes, preferences, teaching methods and reasons for teaching science, and children's interests and attitudes about science, the project found that teachers reported increased confidence, knowledge, and skills in teaching electricity and changes in their awareness of the problems of girls in science. In those classes taught by the experimental group of teachers, children's attitudes became less sex-stereotyped, and interactions in mixed-sex groupings enabled girls to participate more equitably in science activities. Appendices are: (1) Teachers' initial and final questionnaires; (2) children's initial and final questionnaires; (3) class activity schedules; (4) sample worksheet used for inservice; and (5) problems experienced during the teaching of electricity, and feedback on inservice. (Author/JAZ)

Research Report Number 12

The Effect of Inservice Training on Teacher Attitudes & Primary School Science Classroom Climates

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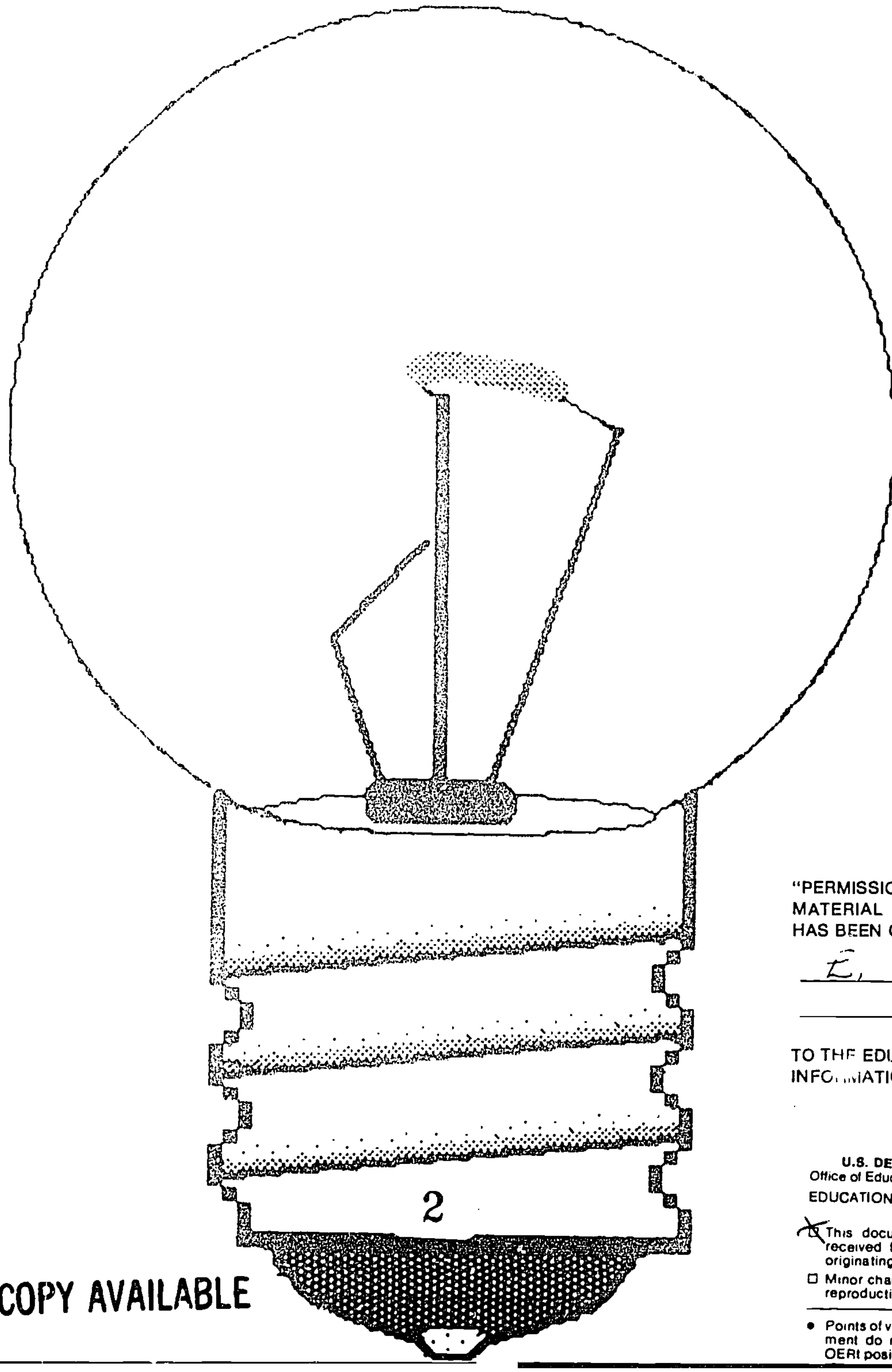

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The Effect of Inservice Training on Teacher Attitudes and Primary School Science Classroom Climates

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A Project of National Significance

Funded by the Commonwealth Schools Commission

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THE EFFECT OF INSERVICE TRAINING ON TEACHER ATTITUDE
AND PRIMARY SCHOOL SCIENCE CLASSROOM CLIMATES

ABSTRACT

This report documents the development, implementation and evaluation of an inservice program designed to facilitate a non-sexist approach to the teaching of science in primary schools. Ten matched pairs of teachers were selected on the basis of a survey questionnaire to participate in the study. Teachers were given help in the teaching of Electricity and subsequently taught this topic to their Year 5 classes. A randomly selected half of the teachers (the "experimental" group) were also inserviced to assist them to acquire skills in creating and maintaining a non-sexist environment in their science classrooms. The project was evaluated by pre- and post-questionnaires to teachers and students, and classroom observation during the teaching of the Electricity topic. Apart from describing survey data about teachers' attitudes, preferences, teaching methods and reasons for teaching science, and children's interests and attitudes about science, the project found that teachers reported increased confidence, knowledge and skills in teaching electricity and changes in their awareness of the problems of girls in science. In those classes taught by the experimental group of teachers, children's attitudes became less sex-stereotyped, and interactions in mixed-sex groupings enabled girls to participate more equitably in science activities.

PREFACE

The research reported here was carried out under a grant to the Educational Measurement and Statistics Laboratory, Department of Education, The University of Western Australia (c/- Dr D Andrich). The grant was part of the Special Projects Program of the Commonwealth Schools Commission in the "Education of Girls" section of Projects of National Significance. The project was carried out during 1983-1984 by the authors of the report.

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CHAPTER 1

SUMMARY AND RECOMMENDATIONS

Overview

This report documents the development, implementation and evaluation of an inservice program designed to facilitate a non-sexist approach to the teaching of science in primary schools. The report is intended to serve as an information base and guide to educational practitioners and researchers concerned with the classroom teaching of science in primary schools and with related inservice and curriculum advisory work. Further, many aspects of this inservice program, and its outcomes, can be generalised readily to other inservice programs, particularly those focussing on the teaching of hands-on activities to girls, or those aiming to increase girls' participation and interest in technological areas. Hence, the program is of much wider interest and has much wider application that its specific focus might suggest.

As is indicated in Chapter 2, the research project documented here was conducted in a context of reported under-participation and under-achievement of girls, relative to boys, in the physical sciences, and the subsequent disadvantage at which this places girls in relation to the pursuit of occupations and careers in a technological society. Essentially this study examines the potential of teacher inservice programs to increase the participation of girls in science and technology. Increasingly teacher inservice has been used as an avenue to address the issue of non-sexist education in general, and the participation of girls in mathematics and science in particular. Unfortunately few of these inservice efforts have been documented thoroughly, and fewer still have been evaluated. By contrast, in the case of this project, evaluation was an integral part of the design and implementation of the inservice program, and data from a number of sources are presented in this report as evidence of the efficacy of the program.

Chapter 3 describes the overall design of the research and the selection of the sample of participating teachers. The latter was carried out on the basis of responses to a questionnaire administered to all Year 5 teachers in one region of the Perth Metropolitan Area. Ten matched pairs of teachers (five male and five female) who had relatively low self-perceptions of their skills and confidence in teaching physical science topics, were selected to participate in the study.

Chapter 4 provides details of the development and use of all instruments used in the study. These were the initial and final teachers' and children's questionnaires and three classroom observation schedules. The actual instruments and associated coding notes are included as Appendices to the report.

The inservice program is described in Chapter 5. The aims of this program were to raise teacher awareness of the adverse long-term effect on girls produced by the general tendency in the community to see physical science as an almost exclusively male domain, and to present skills for non-sexist teaching, and skills for teaching the physical science topic Electricity. Ten teachers, one selected randomly from each pair, were designated as the experimental group and participated in a two-day inservice course addressing all of these aims. The other ten teachers, designated as the control group, participated in a half-day inservice course which focussed only on skills for teaching the Electricity topic. Thus the experimental design controlled for any changes which might have been due to extra inservicing in science-teaching skills.

Following the inservice courses, the teachers taught a sequence of six lessons on Electricity following the syllabus, approach and procedures presented at the inservice. One male and one female teacher from the control group elected not to teach this topic and took no further part in the research. The remaining eighteen classes were visited and observed by the research team as part of the monitoring of the effects of the inservice. Additional information was gathered from a second questionnaire administered to the teachers after the completion of the Electricity topic, and from initial and final questionnaires administered to the children in the research classes. The results from the teachers' questionnaires, the children's questionnaires, and the classroom observations are reported in Chapters 6, 7 and 8, respectively, and are summarised below.

Summary of Findings

Results from Teachers' Questionnaires

The Initial Questionnaire to teachers elicited responses from 34 male and 26 female teachers, all but six of whom had five or more years' teaching experience. On average these teachers reported that they taught science for about one hour each week, which amounts to approximately four percent of the total available time. More than half the teachers aimed at a balance overall of topics relating to animals, plants, matter and energy. However, one half of the female and one quarter of the male teachers preferred NOT to teach topics about matter and energy. Only about 10 per cent of teachers preferred NOT to teach about animals and plants. When asked to rate their interest, background knowledge and skill in teaching these four areas of science many teachers, both male and female, indicated low perceptions of their teaching skills in the areas of matter and energy. Female teachers rated themselves higher than did male teachers for plants and animals, but lower for matter and much lower for energy.

The large majority of teachers thought that all of the four areas of science were useful and relevant to both boys and girls. With regard to difficulty, matter and energy were perceived to present more difficulties for children than animals and plants. Female teachers perceived matter and energy to be more difficult for girls than for boys. When asked about children's self-confidence in science, teachers perceived boys and girls to be equally confident in biological science, but girls to be less confident than boys in physical science. Boys were perceived to be interested in, and perform well in both physical and biological sciences. Girls, however, were perceived to be more interested, and to perform better, in biological than in physical science.

These results show some similarity to those from other research. Generally speaking, in Australian primary schools, relatively little science is taught: estimates vary between three and eight percent of total time, compared with areas such as mathematics which are allocated around 15 per cent of classroom time (Education Department of South Australia, 1982; Rowe, 1983). Furthermore, primary school teachers, particularly female teachers, tend to have depressed perceptions of their own background knowledge and skills, especially in physical science areas and many would prefer to avoid teaching these areas if possible. Clearly this situation is far from ideal in a world which is requiring in its citizens ever increasing skills and understandings in relation to many different areas of science and technology. Recommendations 1, 2 and 3, shown on page 14 and 15, address the areas of need discussed above.

As indicated above, another early finding of this research was that the teachers reported sex differences in science. In particular the impression of most teachers was that girls show less interest, experience more difficulties, perform less well and have lower self-confidence in physical science than in biological science, and that, in the physical science areas girls' interest and confidence were less than those of boys and their experience of difficulty greater than that of boys. A considerable amount of research has established that perceptions and expectations such as these are in danger of becoming self-fulfilling, and thus of actually helping to create a reality of sex differences in science. Teachers need to be alerted to the possibility of this kind of self-fulfilling effect and provided with skills to eliminate it. Recommendation 4 addresses this need (page 15).

The Teachers' Final Questionnaire was sent to the ten teachers in the experimental group and the eight teachers in the control group who taught the Electricity topic. A completed questionnaire was not received from one female teacher in the experimental group. The responses of the seventeen teachers were analysed and comparisons made, where appropriate, with their responses on the Initial Questionnaire.

Teachers were first asked about their interest, background knowledge and skill in teaching the Electricity topic. Their responses were generally positive. Compared to the same questions for the energy area on the Initial Questionnaire, male teachers reported an increase of about half a point, and female teachers an increase of over one point on the three-point scales for interest and skill in teaching. The increments for background knowledge were smaller, with some teachers still feeling an inadequacy in this area.

Teachers from both the experimental and the control groups perceived the Electricity topic to be useful and relevant to both boys and girls. The easiness of the topic was judged to be similar to the easiness of the energy area in general. Most male teachers perceived it to be equally easy for boys and girls, but some female teachers thought it harder for girls than for boys. Teachers were also asked about their perceptions of the self-confidence, interest and performance of boys and girls in the Electricity topic. There were no systematic differences between the two groups of teachers in their responses to these questions. Generally, teachers' perceptions were very positive, more positive than their perceptions of similar items for physical science on the Initial Questionnaire. However, boys were still perceived to have significantly more confidence and a higher performance than girls. Both sexes were rated very highly on interest and enthusiasm.

The Teachers' Final Questionnaire was also used to obtain feedback about the inservice course they had attended. There were clear indications that more of these inservice opportunities should be made available, and Recommendation 5 (page 15) has been framed accordingly. Teachers were unanimous about the usefulness of the inservice program. They appreciated the opportunities to work through the learning experiences associated with the Electricity topic and the help given with lesson programming and equipment. They reported that the inservice had made them more knowledgeable and given them the confidence to try a "hands-on" approach to science. Some mentioned help received through discussion of other teaching strategies, such as questioning techniques. Their comments indicated that more time for inservice, including more than one science topic, and increased emphasis on teacher involvement in programming would be useful.

One question on the Teachers' Final Questionnaire asked what difference the inservice program had made to the ways they dealt with boys and girls. Although this question was expected to evoke different responses from the control and experimental groups, three teachers from the control group mentioned increased awareness of the needs of girls. Nearly all the teachers in the experimental group considered that the inservice had made a difference to the way they treated girls and boys. Most saw themselves as more conscious of girls' presence and girls' science-related needs, and as manifesting this increased awareness in more equitable discussions, and less paternalistic treatment of girls. Some had altered the seating patterns in their classrooms to facilitate greater involvement of girls. One teacher noted that initially girls lacked confidence and familiarity with the materials compared with boys, but once they settled in they became "more like the boys". During classroom visits, other teachers made similar comments to the researchers.

Results from Children's Questionnaires

The first part of the Children's Initial Questionnaire was a general interest scale for science-related activities. Responses to the items on this scale revealed that contrary to conventional wisdom, girls and boys actually had similar levels of interest in science. Their patterns of preferred activities, however, differed. In very general terms, boys had more interest in science about matter and energy, and girls had more interest in science about plants and animals. There were, however, some important exceptions to this pattern, an examination of which revealed that boys' and girls' levels of interest in various topics or activities appear to reflect quite closely their likely previous out-of-school experiences. These are clearly important findings for teachers to take into account when programming for science.

The second part of the Initial Questionnaire described activities relating to Electricity. Boys had a greater preference for these activities than did girls, the differences being statistically significant at the .01 level. The final section asked whether the children thought they could be a scientist. About 55 per cent of boys and 48 per cent of girls responded positively to this question, and a wide variety of reasons were given. Most children gave a reason relating to their interest in science and experimenting or to their perceived ability to do science well. There was some tendency for boys to say they liked science or were good at it, and for girls not to like science and think they would not be good at it. Girls' basic lack of self-confidence in their own scientific potential has been revealed by other studies (e.g. Peterson *et al*, 1980; Dynan *et al*, 1979) and is clearly a problem teachers should attempt to address.

The Children's Final Questionnaire was used to measure their enjoyment of, and perceptions about, the Electricity topic. Its analysis was based on results for classroom groups, rather than for individual children. All classes enjoyed the Electricity topic, and in a comparative analysis with identical items on the Initial Questionnaire, the differences between boys and girls in liking the activities were much reduced. In the experimental group, the differences averaged zero, but in the control group the differences were statistically significant even though they were much less than the differences on the Initial Questionnaire.

This finding, when taken in conjunction with that related to the importance of previous out-of-school experiences, appears to be of considerable practical significance. In this study girls did not *expect* to enjoy the Electricity work very much, possibly because they did not *know* what to expect having had little previous experience in this area. However, having tried it, they liked it and found it interesting. Thus if teachers select science topics mainly on the basis of students' expressed or expected interests, there is a risk that some students will never find out that they have a liking or an aptitude for certain areas. It seems likely that in the past this may have been the case for girls and physical science topics. Recommendation 6 (page 15) therefore recommends raising teacher awareness of this issue.

Children were asked about their perceptions of competence in working with the electrical equipment (wires, batteries and globes). Boys perceived "most boys" to be good at it and perceived themselves personally to be nearly as good as "most boys". They perceived "most girls" not to be as good as "most boys" nor themselves. In contrast, girls perceived "most girls" to be as able as "most boys" at working with the equipment, but they saw themselves personally as being less able than "most girls". This is again, a clear indication of low self-confidence among the girls in relation to this area of science. Aligned with this result are two other results. First, girls found the Electricity topic a little harder than did boys, and although these differences were small in the experimental group, there was no statistically significant group effect here. Second, when children were asked whether women could learn to become electricians, and whether they themselves could become electricians, fewer girls thought they could become electricians than thought women could become electricians. The differences here were much smaller in the experimental group - about ten per cent fewer girls thought they could become electricians than thought women could take-up this occupation. In the control group, the difference was over 20 per cent. Also, more boys than girls thought they could become electricians, and the difference was more pronounced in the control group.

In sum, the children enjoyed the work in Electricity and they found it easy most of the time. On the issue of handling equipment, boys thought "most boys" were good at it, and they themselves were nearly as good as "most boys", but they thought girls were less able. Fewer boys than girls in each class grouping thought that women could become electricians, and more boys than girls thought they could become electricians. These results reveal that boys see themselves and other boys as being more capable than girls in the traditional male field of Electricity. Girls generally saw other girls and women as capable in this field but saw themselves as being less capable.

It is interesting to compare these results with those of Guttentag and Bray (1976). These researchers concluded that children are generally non-sexist about themselves, somewhat sexist about same-sex peers, and very sexist about opposite-sex peers. The present research has found support for these conclusions for boys, but not for girls. Girls seem to be non-sexist about other girls, but whether their comparative lack of self-confidence stems from sexist attitudes about themselves or a genuine belief that they can cope less well on average than same-sex others, is not clear. In either case, it is a cause for concern. Recommendation 7 addresses this concern (page 16).

An important finding of this study is that the differences between boys and girls on nearly all items were smaller in the experimental group than the control group, although these differences were not always statistically significant. It does seem that, on average, teachers in the experimental group were more able than teachers in the control group to teach the Electricity topic in a non-sexist manner, a finding which is also supported by evidence from the Teachers' Final Questionnaire. Given that this inservice program appears to have enhanced teachers' skills in non-sexist classroom management, Recommendation 8 (page 16) recommends the inclusion of such skills in all inservice courses.

Results from Classroom Observation

The lessons observed in the eighteen classrooms engaged in the Electricity topic were generally very successful, with children participating for about one-third of the lesson in whole-class instruction and about two-thirds of the time in "hands-on" activity work in groups. Overall, children were on-task an average of 95 per cent of lesson time.

During whole-class instruction, thirteen of the classes had question and answer sessions, during which teachers tended to ask fewer questions requiring knowledge or factual response than questions requiring an answer of a higher cognitive level. Girls were asked slightly more questions than boys but were a little less likely than boys to receive a positive response from the teacher. Girls received about 55 per cent of the questions, getting about 70 per cent correct, compared to 80 per cent correct for boys. Children rarely initiated an interaction with the teacher during whole-class instruction.

During group work, children worked in pairs or threes, and for most of the time were actually working with and manipulating equipment. Boys generally had the same pattern of time spent in watching/listening (about 10 per cent) reading/writing (about 15 per cent), and manipulating equipment (about 60 per cent) in same-sex and mixed-sex groups in both experimental and control classes. The same pattern of activities was found for girls in same-sex and mixed-sex groups in the experimental group.

In the control group, however, while the patterns of activities for girls and boys were fairly similar for same sex groups, this was not the case for mixed groups. In mixed groups, girls were watching/listening for 24 per cent of the time, which was four times as long as the boys in these same groups, and manipulating the equipment for 38 per cent of the time, compared to 62 per cent of the boys' time spent with the equipment. It is important to note that girls were able to complete the given task just as well as boys when they were allowed more equal access to the equipment.

The difference between boys and girls in time spent working with the equipment was always greater when teachers formed new groups. When children worked with their chosen friends, or their usual seating partners, they worked more efficiently and in mixed-sex groups they shared more equally. The observers noted a frequent pattern of events in teacher-formed mixed-sex groups. Boys tended to take the equipment and work on the task until they had finished. When the boys put the equipment down, the girls picked it up and began the task for themselves.

Overall, participation by the experimental group of teachers in the inservice course was associated with the more active involvement of girls in activity work particularly when work groups were mixed-sex. The observers noted that teachers in the experimental group supervised the mixed-sex groups very closely, perhaps accounting to some extent for the higher levels of active involvement by girls in the experimental classes, compared to the control classes.

The observational records show that teachers tended to initiate teacher-student interactions with all-boy groups, while students tended to be the initiators of interaction with all-girl groups. The girls appeared to lack the confidence to go about their set task without reassurance and/or help from the teachers. This is consistent with the lower levels of self-confidence reported by girls in the Children's Final Questionnaire, and matches the lower levels of self-confidence in girls perceived by teachers in the Teachers' Initial Questionnaire. The findings from the observational phase of the research form the basis of Recommendation 9 (page 16).

Concluding Comments

The feedback from teachers, the results of the children's questionnaires, and the observation of classroom interactions, indicate that the aims of this inservice program were achieved, at least in the short term. The authors of this paper (who *inter alia* were the organisers of the inservice program) feel that it is possible to suggest some reasons for the success of the program. This program addressed systematically the crucial area of teacher attitudes. The approach adopted bore some similarity to the model of Shrigley (1978, 1983), based essentially on the concept of persuasive communication. Shrigley's model includes the three components of "persuade", "mandate" and "reward". Certain elements of the "persuade" component appear in the case of the inservice to have been critical to the success of the program as a whole.

First, this component of the program employed a variety of highly credible personnel - an Education Department science advisory teacher, a Superintendent of Equal Opportunity, two qualified science teachers and a selection of researchers in the areas of attitudes to science, subject choice, classroom interaction and girls and science. As Shrigley has noted (1983): "An expert and trustworthy source will be more effective in changing attitudes in the direction advocated than a less credible source". Second the "persuade" component contained a variety of activities which placed the issues addressed in a broader context, through audio-visual aids developed elsewhere in Australia and overseas. Third, the immediate local relevance of the issues was emphasised, illustratively through the use of local research data on sex differences in subject choice and achievement, and practically through the session focussing on hands-on activities in an actual syllabus topic.

Fourth, the "persuade" component contained what emerged to be a critical period for reflection, self-analysis and observation. The reactions of teachers to this reflective period were very positive. They seemed, as a consequence of it, to find the remainder of the inservice more personally relevant and exciting and most teachers became very committed to the program.

The necessity for the program to contain incentives for the teachers to change their attitudes and behaviour was also recognised, and, in this sense provision was made for Shrigley's "mandate" and "reward" components.

The mandate was provided through the inbuilt processes of evaluation associated with the program. All teachers knew from the outset that they were going to be observed and questioned to determine the extent to which the inservice course was successful. Potentially this could have been seen by them in a threatening or coercive light. However, all teachers appeared to accept the mandate in a mature and relaxed way. This seems to have been due partly to the non-threatening nature of the "persuade" component and the attempt during the one week period of reflection to help teachers feel a sense of ownership of the program.

Finally, with respect to "reward" component, there appeared to be a variety of ways in which the teachers gained pleasure and satisfaction from participating in the program. One of these was simply the opportunity to discuss important issues with colleagues and experts away from the everyday pressure of the school and classroom. Other rewards came to the teachers through their increased feelings of competence and confidence in relation to the skills and issues addressed in the program, and through the feedback about themselves and their students provided at regular intervals throughout the monitoring of the program.

The inservice program described in this research was based essentially on the importance of the teacher as an influence on students' attitudes towards science and technology. The authors feel justified in claiming a modest degree of success, at least in the short term, in changing teacher attitudes so that there were positive subsequent effects on teacher behaviour and on student attitudes and behaviour. This approach to inservice seems promising. There appears to be no reason why the approach taken here cannot successfully be implemented in other related curriculum areas, particularly those such as computer education, which, like many physical science topics, tends to be stereotyped as a male domain.

The findings of this research project are important. Very little research evidence is available about the relevant teacher, child and classroom variables which shape the person-to-person interactions and climate when physical science is taught in Year 5 classrooms. Members of the research team have (prior to the date of this report) made presentations to seven conferences and seminars and further papers are in preparation. These presentations have aroused a good deal of interest, and the researchers have been invited to address several inservice programs in one Metropolitan Region. Encouraging feedback has been received - for example, one country teacher who took part in a workshop presented in July, 1984 by the researchers on teaching Electricity, recently reported that having tried Electricity in her Year 4 class, she rated it as her "most successful science project". Although the research team are doing as much as possible to disseminate the findings of the project, help is required to make the information accessible to every primary school teacher. Those teachers who can make use of the information deserve to have it.

Recommendations

This report recommends:

1. *That greater emphasis be placed on science in the primary school curriculum, so that the areas of science and technology occupy not less than 10 per cent of the total teaching time.*

2. *That primary school children be exposed to a reasonable balance of physical and biological science in science lessons.*

3. *That a variety of opportunities to increase background knowledge and skills for teaching in all areas of science be made available to primary school teachers. Such opportunities could include the traditional avenues of inservice education (as described in this report) and preservice education, together with special courses offered outside of school time by the various tertiary institutions or professional science teachers' associations.*

4. *That teacher inservice discuss the possibility of self-fulfilling effects pertaining to sex differences, especially in relation to science subjects, and provide teachers with skills to eliminate these effects.*

5. *That science-related inservice opportunities for primary school teachers focus on practical activities and lesson planning, and that such inservice be targetted initially on the least confident teachers and on topics in which the greatest need exists.*

6. *That teachers be made aware of the possible limitations placed on students if science topics are selected mainly on the basis of students' expressed or expected interests.*

7. *That teachers be made aware of areas, such as the physical sciences, in which girls tend to lack confidence; and that teachers develop strategies and techniques for raising girls' self-esteem in these areas.*

8. *That all inservice courses in any subject area, but particularly in those areas stereotyped typically as "boys" or "girls" subjects include a component on the awareness of, and strategies for, maintaining a non-sexist classroom climate and the positive results of doing so.*

9. *That teacher inservice focussing on practical activities carried out in [illegible] alert teachers to the following findings in the context of Year 5 classes:*

   (a) *Single sex groups produce a more equal use of equipment and a more egalitarian working environment.*

   (b) *Groups chosen on the basis of usual seating partners or student-selected groups work more harmoniously and effectively than teacher-selected groups.*

10. *That the findings and recommendations of this report be disseminated so that they are accessible to all primary school teachers.*

CHAPTER 2

Context and Aims of the Project

Context of the Project

Research conducted in Australia (Brown & Fitzpatrick, 1981; Parker, 1982), Britain (Kelly, 1981) and the United States (National Science Board Commission, 1982) has established beyond doubt that many more boys than girls participate in the physical sciences at the secondary and tertiary levels of education. Some researchers also claim that girls underachieve in the physical sciences (see, for example, Kelly, 1978). This is, however, not so clearly established, partly because the term "underachievement" is open to several different interpretations and is rarely defined unambiguously, and partly because many of the studies do not control for the differences in previous science experience (in terms of school courses in science) of the girls and boys comprising the sample for study (Parker, 1982).

There are several reasons for concern about girls' underparticipation in the physical sciences. From the point of view of personal development it is desirable to assist all students to develop their innate potential and girls have been shown to possess scientific potential which is not being developed (Parker, 1982). It is also important, in terms of the national interest, to conserve and nurture scientific talent, given our increasingly technological society (Parker, 1984). In addition it is now known that science, particularly physics, and mathematics comprise a critical filter in relation to students' progression to many occupations and areas of further study. The Myers Report (Myers, 1978) was one of the first official Australian documents to note that all but a small proportion of girls are particularly disadvantaged in terms of the labour market because of a poor background in science and mathematics. There is also concern that because of such background women tend ultimately to feel incompetent and powerless when faced with problem solving, with computers and with technological change generally (Parker, 1984).

There are many reasons put forward to account for the fact that an alarmingly high proportion of scientifically able girls opt out of the physical sciences as soon as they are given the chance. These include a lack of self confidence among girls and a fear that science is too difficult; an image of physical science which is masculine; and an apparent remoteness of science from girls' everyday concerns (Kelly, 1981; 1982). Recently it has been suggested that the primary school experiences of girls may have an important influence on their attitude to, and participation in, science at the secondary and tertiary levels (Kelly, 1982). Ormerod and Wood (1983) point out that without attention to the primary level, "secondary science is merely conducting a somewhat forlorn rearguard action to divert girls' interests towards physical science". The project described in this report was therefore designed to focus on the teaching and learning of physical science concepts in the primary school.

The work of McMillan and May (1979) has emphasised that teachers' attitudes and behaviours in relation to science and technology are a critical influence on the attitudes of their pupils. Similarly, Simpson (1978) has noted that the teacher "... is probably the most important factor in influencing the minds and feelings of students towards science". In addition the need for teacher training curricula focussing on girls' special needs in relation to science and technology has been identified (eg Ferguson, 1984; Raat, 1984; and Whyte, 1984). While the importance of both inservice and preservice teacher education in this regard has been noted, there does appear to be a special case for focussing on inservice education. Ferguson (1984), referring to the declining school enrolment in Canada and its consequences for reduced employment of newly graduated teachers, noted the special need for "extensive, innovative work with teachers already in the system". The latter is also the case in Western Australia, especially at present in the primary school (Years 1-7) sector. Moreover the relatively senior staff already in schools are more likely than beginning teachers to be in positions of influence, both on other members of staff and on teacher trainees who may be placed with them. Thus, while the need for special curricula in preservice education is undeniable, given limited resources in terms of time and money, it may be more rewarding to see teachers already in the schools as the prime target for special programs.

For all these reasons then the program described here focussed on the inservice education of primary school teachers specifi .lly in relation to the physical sciences. A research proposal submitted to the Special Projects Program of the Commonwealth Schools Commission was funded under the "Education of Girls" section of Projects of National Significance.

Aims of the Project

The general aim of the project was to devise, implement, and monitor the effects of, an inservice program devoted to the teaching of a primary school physical science topic in a non-sexist manner. More specifically the project aimed, first, to raise teacher awareness of the adverse long-term effect on girls produced by the general tendency in the community to see the physical sciences as an almost exclusively male domain. As a consequence of such raised awareness it was considered that teachers would develop a more positive attitude towards the participation of girls in the physical sciences.

The second objective of the project was to assist teachers to acquire skills in creating and maintaining a non-sexist science classroom environment, while simultaneously giving them the opportunity to update their knowledge and skills in relation to Electricity, the particular physical science topic selected.

A third specific objective was to monitor the effectiveness of the program by

(a) assessing the nature and extent of attitude change and skills acquisition amongst the teachers;

(b) assessing the nature and extent of any changes in attitude towards science amongst the children, with specific reference to electricity; and

(c) observing and documenting the patterns of classroom interaction during the teaching of the topic Electricity.

The research team came together and began the research in August 1983. The collection of data was completed during December 1983. During 1984 the data were analysed and the report written. During this year a number of other papers were written, and presentations made by research team members at various conferences, seminars and inservice courses.

CHAPTER 3

RESEARCH DESIGN

Overview of Research

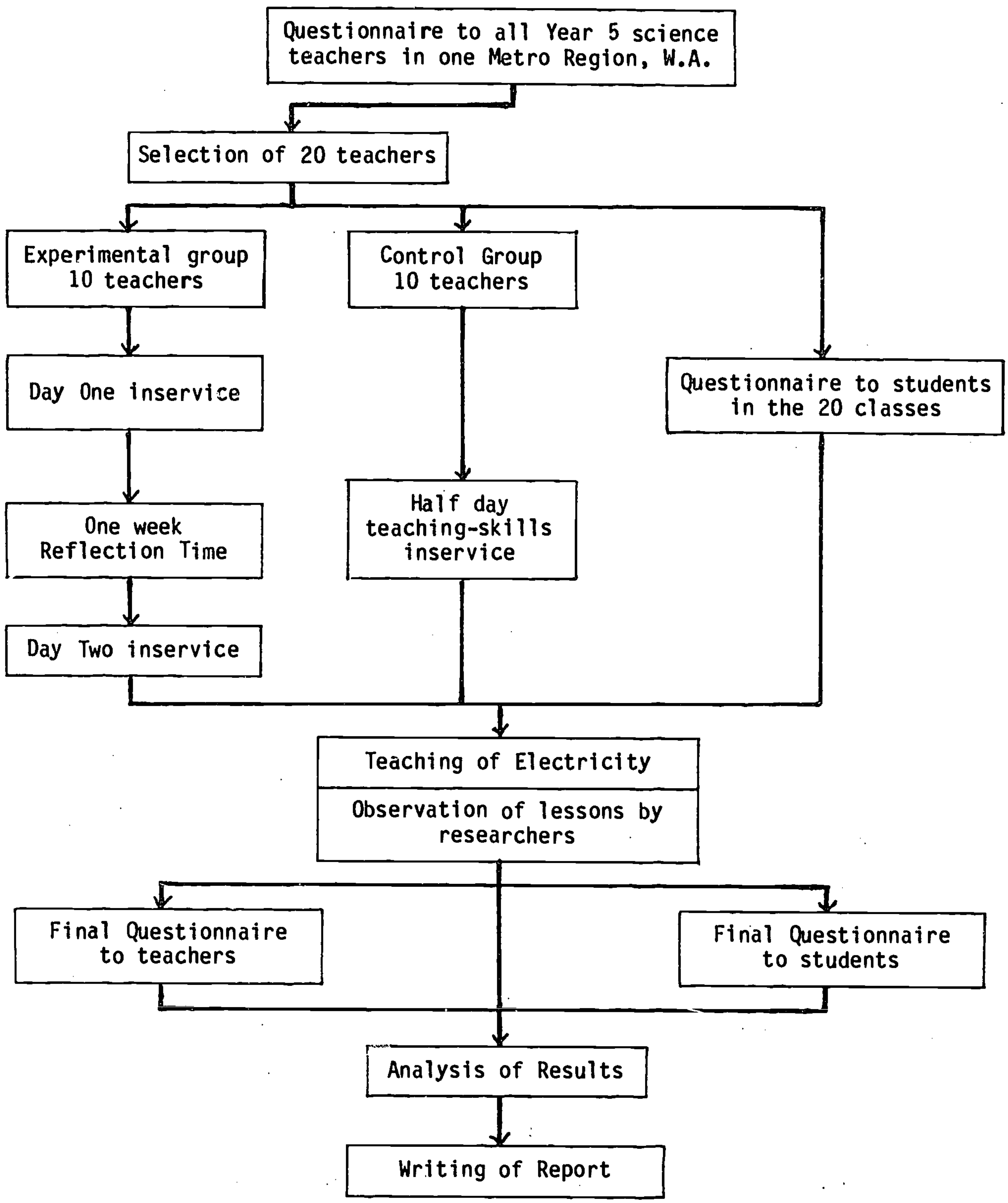
The research was implemented in a field study using two matched groups of ten teachers and their classes. Teachers were matched on the basis of their responses to a questionnaire designed to measure their attitudes and teaching methods in science, and certain biographical data. Once selected, teachers from each matched pair were randomly assigned to an experimental or control group. The experimental group received two days of inservice work, one week apart, comprising half of a day about teaching a physical science topic (Electricity), and one and a half days designed to raise teacher awareness of reported differences in attitudes and achievements of boys and girls in science, the need for all children to develop skills in, and positive attitudes toward, physical science, and techniques to help achieve this goal. The control group received half of a day inservice on the teaching of the Electricity topic. The inservice programme is described fully in Chapter 5.

After inservice, and before teaching Electricity, teachers gave their classes a questionnaire to establish a baseline for children's attitudes and interests in science in general, and Electricity in particular. During the teaching of Electricity, the researchers visited each classroom to record observational data of the children and teacher at work. On completion of this topic, both teachers and children completed a second questionnaire about attitudes and interest in the Electricity topic. The effectiveness of the inservice was judged on the basis of classroom observation data and responses to the teachers' and children's post questionnaires.

A flow chart of the project indicating the sequence of events is shown in Figure 3.1.

Figure 3.1

Flow Chart of Project



Selection of Sample

The research was carried out in the metropolitan area of Perth, Western Australia. Rather than randomly select schools, all schools in one of the four educational administrative regions were included in the initial sample, in order to facilitate administration of instruments, school visits, and inservice arrangements.

The initial teacher questionnaire was posted to all 68 teachers with straight Year 5 classes; responses were received from 34 male and 26 female teachers.[1] On the basis of their responses to this questionnaire teachers were matched in pairs on the basis of their sex; teaching experience; perceived motivation, background knowledge and skill in teaching physical science; and reported teaching methods. Ten pairs of teachers (five male and five female), together with two "emergency" pairs of teachers, were selected as being representative of the range of teaching experience and teaching methods used in the whole sample, and also from schools which were representative of the socio-economic balance of the region. The selected teachers reported relatively low levels of motivation and skill in teaching physical science, thus allowing for the possibility of maximum impact of the inservice work on Electricity. One teacher from each pair was randomly allocated to the experimental group, and the remaining teachers formed the control group. Participation in the study was invited through the principal of the school, and as two principals were not in favour of participation, both "emergency" pairs of teachers were included in the final sample of twenty teachers.

1. Five teachers (three male and two female) did not respond and one teacher was absent on sick leave. Three male and three female teachers did not take the science in their class and passed on the questionnaire to the teacher who did. Four of these teachers responded, but one teacher was on exchange and did not wish to respond, and another was already responding on behalf of her own class.

The twenty teachers selected for the inservice courses attended all sessions of their particular course. The ten teachers assigned to the experimental group and eight of the teachers assigned to the control group taught the Electricity topic to their classes. One male teacher and one female teacher from the control group chose not to teach the Electricity topic. Both teachers had already completed their science programmes for third term and did not wish to change their planned courses. Thus the final sample participating in the research involving the Electricity topic included eighteen teachers and their classes.

Time Plan of the Research Programme

The research programme was planned to cover the last six months in 1983, and Table 3.1 shows the timing of the various stages of the research.

Table 3.1

Time Plan of Research Programme

Data	Stage	Measuring Instrument
July	Measurement of Teachers' Attitudes and Teaching Methods	Teachers' Initial Questionnaire
August	Analysis of Teachers' Questionnaire and Selection of Research Sample	
September	Inservice Programme	
September-October	Measurement of Children's Attitudes to Science	Children's Initial Questionnaire
October-November	Teaching of Electricity Topic and Classroom Observation	Classroom Observation Schedules
November-December	Measurement of Teachers' and Children's Attitudes after Electricity Topic	Teachers' Final Questionnnaire Children's Final Questionnaire

Feedback to Teachers

A feature of the research programme was the provision of comprehensive feedback to participating teachers after each phase of the research. Overall results for both teacher questionnaires were provided, including comparative data on the final questionnaire for questions similar to those on the initial questionnaire. The feedback for the children's questionnaires gave average results for boys and girls, and included the separate results for the teacher's own class. A general summary of the observational data was included in the final batch of feedback. In all cases, confidentiality of results was maintained, and results were reported in a way which preserved anonymity of participating schools and teachers.

CHAPTER 4

DEVELOPMENT OF MEASURES

Teachers' Questionnaires

Teacher's Initial Questionnaire

The initial teacher questionnaire was designed to measure those variables assumed to be important in effective science teaching, to measure teachers' perceptions of sex differences in children's behaviour in science lessons, and to obtain sufficient biographical data to enable teachers to be matched on sex, teaching background and experience. The extent and nature of this information necessitated the development of a comprehensive questionnaire to meet the needs of the study.

An indication of those teacher characteristics considered relevant to teaching performance is given by Centra and Potter (1980, p. 274) who list eight characteristics in an interrelational model of school learning. More appropriate to primary science, however, is a list of seven 'course variables' considered by Hodson and Freeman (1983, p. 116) to be important in determining the quality of primary science offered to students. It is also necessary to take into account evidence from Australia (Appleton, 1977; Riley, 1983) and New Zealand (Biddulph et al., 1983) that primary teachers frequently have a poor science background, particularly in physical science, and a corresponding lack of confidence in their ability to teach it. Further, in some cases, there may be little commitment to teaching science.

With these issues in mind, and after discussions with persons involved in primary school science, including teachers and tertiary educators, the teacher questionnaire was devised to answer eight questions.

1. What is the teaching background and experience of this sample of teachers with particular reference to science?

2. How is science programmed into the Year 5 curriculum?

3. Do teachers have a preference for teaching particular topics in science?

4. What are teachers' perceptions of their own interests, background knowledge, teaching skills, and are adequate resources available for teaching the Animals, Plants, Matter and Energy areas of science?

5. How relevant and how difficult do teachers perceive the four science areas to be for boys and girls?

6. What are teachers' perceptions of the interest, self-confidence, and performance levels of girls and boys in lessons in the physical and biological sciences?

7. What teaching methods typically occur in lessons in the physical and biological sciences?

8. What reasons for teaching science are important to Year 5 teachers?

A draft questionnaire was prepared in which information to answer the first three of the above questions was obtained from carefully structured open ended questions. The fourth and fifth questions were represented by items with a three-choice response format. For the information required in the sixth question, teachers were asked to estimate the proportion of boys and girls who displayed certain behaviours described by a number of statements about science lessons. Teachers were asked to estimate, for the seventh question, what proportion of time they spent on described teaching activities. Finally for the eighth question teachers were asked to rate a number of reasons for teaching science, and to add any others of their own. The reasons listed were a consensus of those espoused in statements about Primary Science (Pearce, 1981; Education Department of Western Australia, 1973, 1983; Education Department of South Australia, 1983).

The draft questionnaire was trialled with several teachers not involved in the study. After discussion with these teachers, several items were reworded, and the response format for describing teaching methods was changed from amount of time spent on different teaching activities to a format requesting frequency of occurrence of these activities. This change is in line with evidence that teachers tend to misperceive their own behaviour and are more likely to report accurately whether or not the behaviour occurs rather than the proportion of time it occurs (Good & Brophy, 1973). A copy of the Teacher's Initial Questionnaire is included in Appendix A.

Teachers' Final Questionnaire

The final questionnaire for teachers was designed to measure teachers' attitudes, perceptions about their own abilities in teaching Electricity, and their perceptions of children's responses to the topic. This questionnaire was also used to obtain formal responses from teachers about the value to them of the inservice courses. Specifically, the final questionnaire was designed to answer six questions.

1. What are teachers' perceptions of their own interest, background knowledge and teaching skills in the science topic of Electricity?

2. How relevant and how difficult do teachers perceive the Electricity topic to be for boys and girls?

3. What are teachers' perceptions of the interest, self-confidence, and performance levels of girls and boys in lessons in the Electricity topic?

4. What problems did teachers experience during the teaching of the Electricity topic?

5. What parts of the inservice courses did teachers find useful and not useful?

6. Did the inservice make any differences in the approach of teachers to the Electricity topic in relation to content, teaching strategies, and the ways the teachers dealt with boys and girls?

The first three of these questions were answered using items similar to those on the initial teacher questionnaire. For the fourth question, teachers were asked to rate the difficulty in overcoming certain problems and any other problems which arose. Responses relating to the inservice course (the fifth and sixth question shown above) were elicited by a series of open-ended questions. A copy of the Teachers' Final Questionnaire is included in Appendix A.

Children's Questionnaires

Children's Initial Questionnaire

The major purpose of the Children's Initial Questionnaire was to establish a baseline for their attitudes about Electricity, a topic which they had not yet studied at school. In addition, the questionnaire provided an opportunity to obtain data from a large sample of children measuring their interests in science, and their self-perceptions about their ability to become a scientist.

The children's questionnaire was designed to have three parts, the first being a general science interest scale comprising sixteen items utilizing a modified Likert-type response format. Children were asked to respond according to whether they liked the item content not at all - a little bit - a fair bit - a lot. It was considered that the wording of these response choices would easily be understood by 10-year-old children. To further enhance understanding the response categories were matched with a series of four circles of increasing diameter, as used successfully by Harvey and Edwards (1980). The use of a response format asking for degrees of "like", rather than responses ranging from dislike to like with a middle, neutral category, was intended to avoid the problems often associated with the meaning of the middle category (Du Bois & Burns, 1975). Further, as children generally like science (Beck, 1978; Johnson, 1979; Makins, 1980) the four "like" categories would reduce the risk of a "ceiling" effect.

The items in this scale were written after consideration of science-based hobbies likely to be engaged in by primary school children, and after examination of items in other scales used for children of similar age in Australia (Dawson & Bennett, 1981), England (Ormerod & Wood, 1983) and the United States (Palmer, 1977; Sullivan, 1979). The content of items was finally decided after examination of the primary school science syllabus

(Education Department of Western Australia, 1973). In this way, topics were selected which children were likely to have met in their science at school, or in their every day activities.

Because children have been shown to respond differently to items written as passive or as active statements (Skinner & Barcikowski, 1973), four different item stems were used. These were "like to find out how...", which referred to research or reading activities; "like to do experiments with..." and "like to do science work about...", which covered topics likely to be done at school; and "like to [do a particular activity]" which referred to science-based hobbies. For each stem, one item was written for each of the Animals, Plants, Matter and Energy areas of the primary science syllabus. Items were written using specific, rather than general, terms. For example, the word 'animal' was not used because there is evidence that many young children associate this word with pets and farm animals, and do not know that spiders and other invertebrate creatures are also animals (Bell, 1981).

The second part of the Children's Questionnaire concerned the Electricity topic. Five items asked children how much they would like to do certain activities which would be covered in the topic. The response format was the same as that used in the general science part of the questionnaire.

The third and final section of the Children's Questionnaire asked students whether, if they wanted to, they could be a scientist when they grew up. They were asked to write a reason for their yes or no response.

A draft version of the questionnaire was administered to one Year 4, one Year 5 and one Year 6 class. No difficulties were found with the content nor the response format of any items. However, several items had small standard deviations because of a high mean score, and the wording was changed slightly in an attempt to increase the spread of responses.

In the research study, the questionnaires were administered by the class teacher who read each item to the class. This ensured that any child with a reading problem could respond in a meaningful way. Children were asked to write "boy" or "girl" on the questionnaire, and in those classes taught by teachers in the research groups for the study, children were given a code number so that their initial and final questionnaire responses could be matched. Names were not requested although research has shown that children of this age respond in the same way whether or not their responses are anonymous (Francis, 1980). A copy of the Children's Initial Questionnaire is included in Appendix B.

Children's Final Questionnaire

The Children's Final Questionnaire served to measure children's responses to, and perceptions about, the Electricity topic. It was administered by the class teacher directly after the topic was completed. A copy of the final questionnaire appears in Appendix B.

The first part of the final questionnaire contained four items asking how much the children enjoyed particular activities in the Electricity topic. Three of these items were also on the initial children's questionnaire, and the response format was the same. The next three questions asked children to choose a rating for most boys, most girls and you at working with the electrical equipment. The response choices were: hopeless - not much good - pretty good - really good. Two questions asked children how much they enjoyed Electricity and how hard they found it. The final questions asked whether women could learn to become electricians and whether you could learn to be an electrician if you wanted to.

Classroom Observation Schedules

The purpose of the classroom observation was to measure the extent and nature of children's participation in the science lessons, and those factors associated with instruction which affect the participation of boys and girls. In this research, participation refers to the involvement of the learner in learning activities. Much research indicates that children's involvement is a major determinant of their learning outcomes. Participation has been measured by several means, usually by observing and recording time-on-task. Research linking student behaviour and learning has established time-on-task as the major variable influencing student cognitive learning (Anderson, 1981; Berliner, 1979; Bloom, 1980). However, the links between time-on-task and affective learning are not well established, and in this research affective changes will be measured by the Children's Questionnaires.

While time-on-task is a useful indicator of participation, it is too coarse a measure for this research because not only the quantity, but the quality of time-on-task is important (Wyne & Stuck, 1982). This research needs to take account of the nature, as well as the extent, of girls' and boys' participation in science so that comparisons can be made on the basis of the kinds of participation which may have implications for affective outcomes. Further, instructional variables which are likely to affect student participation need also to be measured.

How Children Participate

Children can participate in a passive way by attending to what is going on in the lesson, or in an active way, by interacting with the teacher, by interacting with other children, or by interacting with the equipment or other materials. The data measuring children's participation were structured by focussing on the nature of the children's activities for the duration of the lesson, and the nature of the teacher's interactions with the children. The collection of data was facilitated by recognising two instructional contexts: whole-class instruction and group work. Whole-class instruction occurs when the teacher works with the class as a unit. Typical teaching activities include giving information, explanation, conducting a question-answer session, and class discussion. Group work occurs when children interact in small groups with or without equipment and materials. In this context, teachers interact with groups or individual children. Children may work alone for short periods within either context, and in this study individual work was coded as part of group work because it usually involved recording of activities done as a group.

Instructional Variables Affecting Participation

During the inservice stage of this research, teachers were asked to teach the Electricity topic in a certain way. Classes were expected to follow a sequence of activities, a typical lesson consisting of children working in groups with equipment, with perhaps a teacher-led whole-class presentation at the beginning and end of the lesson. This common format reduced the number of instructional variables operating in the research, and in terms of organisational variables, data were collected only on the size and composition of the groups.

Several variables relating to teacher behaviour were observed and recorded. These were the cognitive level of questions asked by the teacher and the kind of feedback/reinforcement given to children during teacher-child interactions relating to discussions and evaluation of children's work and behaviour. In addition, notes were made about the degree of structure in the lesson, that is, how much guidance teachers gave to children before, during and after the activity work.

Development of Classroom Observation Schedules

There is a large body of literature devoted to classroom observation, much of it concerned with attempts to measure teacher effectiveness in terms of student learning, which, in turn, is usually measured as cognitive outcomes in reading and mathematics (see, for example, Borich, 1979). Much of the research has suffered from problems relating to instrumentation and methodology (Berliner, 1976; Dunkin & Biddle, 1974) but there now exists a range of instruments available for use in classroom observation (see particularly Good & Brophy, 1973; Simon & Boyer, 1974). Although few of these instruments were developed in the context of science, most are not subject-specific and could easily be used in science classrooms. Unfortunately, an extensive examination of instruments, including those developed specifically for science (Shymansky & Penick, 1981; Penick, 1981) found none which purported to measure the combination of variables required for this study. It was therefore necessary to develop appropriate measures.

The development of observational schedules made use of ideas from a number of other instruments. In particular, the Brophy-Good Dyadic Interaction Schedule (Simon & Boyer, 1974) served as a basis for the development of the schedule measuring student-teacher interaction during whole-class instruction. For the purpose of this project, instruments measuring only overt behaviour were prepared because the research focussed on Year 5 classrooms engaged in activity-based science lessons in which nearly all participatory behaviour may be expected to be overt.

Measuring Children's Activities

A set of six mutually exclusive categories were used to code children's activities. These categories classified activities as watching or listening; reading or writing; manipulating equipment; planning/discussing; other-on-task; off-task. Planning/discussing occurred during group work as children solved the problem in hand. Other-on-task was used to code behaviour such as waiting for teacher help, talking to teacher, getting equipment or sharpening pencil. Two observation schedules were developed: the Whole-Class Activity Schedule and the Group work Activity Schedule (see Appendix C).

Children's activities were coded by watching each child in turn and categorising his or her behaviour. If the behaviour was ambiguous, the child was watched until the behaviour could be categorised, usually no more than a few seconds. Class sweeps were made at regular time intervals rather than continuously. This was done because it takes less time for a sweep when everyone is writing than when some are watching or listening while others manipulate equipment or are moving about the room looking for equipment. Continuous sweeps would lead to a higher proportion of observations for writing than the proportion of time actually spent.

Coding Teacher-Student Interactions

Interactions between the student and teacher are an important part of the student's participation in the lesson, not only because the student is participating, but because the teacher is able to provide additional cues, reinforcement and feedback to the student to encourage continued participation. It was necessary to code teacher-student interaction in such a way that not only the frequency of interaction but the purpose and context of the interaction were recorded.

During whole-class instruction, the initiator of each interaction was recorded. Teacher-initiated interactions fell into two categories - asking questions or evaluation of work or behaviour. Teacher questions were coded as knowledge questions ("which is the positive terminal?"); understanding questions ("why did the globe light?"); or procedural questions ("where will you get a globe?"). Teacher feedback to student response was coded in five categories: praise ("good answer"), affirmation ("that's right"), no response or ambiguous answer ("perhaps"), negation ("that's not right"), criticism ("that's silly"). Teacher evaluation was coded as either work-related ("untidy work") or related to behaviour ("lovely manners"). The teacher's evaluation of work or behaviour was coded by the same five categories used for teacher feedback.

Student-initiated interactions fitted into three categories - asking a question, volunteering information, or seeking evaluation for work done. Student questions were classified as seeking knowledge or understanding, or as procedural. Teacher feedback to student questions, volunteered information or evaluation for work done, was coded by the same categories used for teacher-initiated interactions.

Teacher-student interactions during group work were coded as part of the Group Work Schedule. Teachers tend to interact with groups or individuals in groups and it was not always possible to hear what was being said. However, it was possible to tell whether the interaction was initiated by the teacher or student, and the interaction invariably involved action relating to group or individual progress in the learning task, or the evaluation of progress or behaviour. Interactions about progress were in the form of discussion, sometimes with the teacher handling equipment and performing the task for the child. This point was recorded. Evaluations of progress and behaviour were coded as positive, or negative.

A draft version of the teacher-child interaction schedule was trialled and discussed by the observers using transcripts of classroom interaction provided by Good and Brophy (1973). All draft instruments were then trialled using several video-recordings of lessons in primary classrooms, and finally three science lessons in Year 5 classes. By this time, the two observers had total agreement on the coding of observations using the final versions of the observation schedules.

Method of Classroom Observation

Collection of data in classrooms had several constraints. First, the children would be involved in the Electricity topic for six one-hour lessons, and probably two lessons would be required to settle into the topic and learn to handle the equipment. The best time for observation would probably be around the third and fourth lessons. Second, the topic would be taught at about the same time in schools up to 20 kilometres apart imposing geographical constraints on the researchers. It became clear that each class could be visited for either two lessons by a single observer, or for a single lesson by two observers. The latter situation was chosen because it allowed data of a higher quality to be collected. Clearly, two observers could collect twice as much data, and by dividing some tasks, data from a wider range of variables could be collected. Further, the opportunity for discussion and comparison of recordings enables consistent interpretation of events.

Observation of one hour in each of a number of classrooms may be described as "thin" description (Brophy, 1979), but a number of variables necessitating longer periods of observation for stable measurement have been controlled in this research. Most importantly, context variables relating to subject matter, instructional objectives, and general variables relating to teacher background, attitudes and perceptions about teaching the topic have been incorporated into the research design.

Use of the Classroom Observation Schedules

Classroom data were recorded by two observers in a consistent format according to the lesson structure. During whole-class instruction two observation schedules were used. One observer used the Whole-Class Activity Schedule to record the activity of each boy and girl. Sweeps of the class were made every three minutes. The second observer used the Teacher-Student

Interaction Schedule to code teacher-student interactions. During group work both observers used the Group-Work Schedule which included a section for student activity, and a section for teacher-group interaction. The two observers each watched a different half of the class, recording the activities of each girl and boy within each group of students. Sweeps were made every ninety seconds, and teacher-group interactions were recorded when they occurred. This method of observation usually provided 20 to 30 observations of each student during group-work. In many cases, the teacher stopped by a group, observed for a moment, then moved on without verbal interaction. In instances where there was no clear non-verbal signal from the teacher, an interaction was simply recorded.

During whole-class instruction fewer observations were obtained because usually less time was spent in whole-class instruction and the time for each sweep was longer. In classrooms with a high degree of structure, teachers often called the class to attention to discuss a common problem, to provide a summary or reminder of work to be done, or to give directions for the next task. Such periods of whole-class instruction were frequently of less than two minutes duration, and it was not possible to complete a full class sweep for student activity. Consequently, the data from student activity during whole-class instruction are less stable because they are based on fewer observations.

In addition to using the classroom observation schedules, each observer completed a Lesson Abstract sheet. On this was recorded the lesson topic, and a summary of what occurred in the lesson, noting times of changes between whole-class instruction and group-work. These sheets also provided space for noting any classroom incidents, problems or other events. The observers were introduced at the beginning of each lesson, and then effectively ignored by class and teacher during the lesson.

Copies of all classroom schedules and coding notes appear in Appendix C.

CHAPTER 5

DESCRIPTION OF INSERVICE PROGRAMS

The Two-day Inservice Program

The inservice program for the experimental group was designed as two distinct one-day sessions separated from one another by a period of one week. The first day consisted of five segments. The first of these (75 minutes) comprised a speaker and a film (Hidden Curriculum) aimed at raising teachers' awareness of the nature of sexism and the typical contribution of schools and teachers to sex-role stereotyping. Following discussion of this information, another speaker focused, in the second segment (90 minutes), on the role of women in modern Australian society and the general inappropriateness of a sex-typed education as preparation for this role. Data on workforce participation and on changing patterns of family life were used to illustrate various points. This segment then concluded with a viewing of the slide set Jobs on the Slide and further discussion over lunch. In the next segment (60 minutes) a third speaker addressed the issue of subject choice patterns in secondary schools, with the intention of drawing teachers' attention to the poor retention rate of girls in the physical sciences, and the limiting effect of sex-stereotyped subject choice on career options. This was followed by a viewing of the film Women in Engineering and further discussion in which one of the issues raised was the possible relationship between students' primary school experiences and their secondary school subject choices. The focus shifted in the fourth segment (45 minutes) to the syllabus and curriculum materials provided by the Education Department of Western Australia for the teaching of Year 5 primary school science including Electricity. Teachers were given the opportunity to familiarise themselves with these materials.

Finally, in the fifth segment (30 minutes) it was pointed out to teachers that the following week was intended to be a time of reflection, observation and self-analysis. Some suggestions were made regarding activities teachers might try during this period. As part of these activities, the teachers were asked to observe the degree to which the language, roles and procedures adopted in their schools reinforced traditional sex stereotypes (eg allocation of tasks and duties to males and females, lining up of boys and girls before entry to a room, modes of discipline adopted for boys and girls). It was also suggested that they might analyse a tape of either their own or another teacher's lesson to obtain an estimate of any sex differentiation in active teaching attention, classroom interaction, modes of classroom discipline and verbal reinforcement. Worksheets and background information devised originally by Hurwitz and Shaffer (1980) were adapted for use by teachers for these activities. A sample worksheet is included in Appendix D.

Day Two of the inservice contained four segments. The first segment (60 minutes) consisted of a guided discussion, in which teachers presented the results of their activities of the previous two weeks. Most teachers had found the activities interesting and enlightening. Some had already, as a consequence of their raised awareness, made changes in the way their classrooms were organised, and in their behaviour towards girls and boys. A few remained skeptical about the need for change. The teachers' observations were discussed in terms of documented research on classroom interaction, with special reference to the work of Evans (1979, 1982) in Victorian primary schools and to ways in which teachers can inadvertently pass on attitudes to students - for example female teachers showing fear of spiders or incompetence with machines. Techniques for overcoming any tendencies towards sex bias were presented, along the lines of those outlined in the worksheet shown in Appendix D. The importance of competence and confidence, particularly for females teaching science, was emphasised. Particular reference was made to the need for both girls and boys to be confronted with competent female models in areas generally stereotyped as male domains.

In the second segment of Day Two (90 minutes) the results of the initial questionnaire to teachers were presented and discussed. (These results are reported in Chapter 6.) All teachers were keenly interested in the feedback and professed little surprise at the direction of the findings. The latter included lower levels of teacher interest, background knowledge, skill, and resources for teaching of Energy topics (of which Electricity is one), particularly among female teachers. The findings also included some tendency for teachers to stereotype Plants and Animals as girls' areas and Matter and Energy as boys' areas, a tendency which this inservice program was designed to overcome. Teachers were next presented with a short resume of research on the relationship between children's interests, attitudes and achievement in science. They then focussed on the syllabus and curriculum materials provided for Electricity and discussed assumptions and attitudes which could hinder learning (particularly by girls) in relation to this topic.

The third segment of Day Two (120 minutes) dealt specifically with the science content and teaching of Electricity. This segment of the inservice program (together with the discussion of syllabus and curriculum materials for primary science from Day One) was repeated later with the control group of teachers. It took the form of a hands-on workshop. The workshop assumed no background knowledge of Electricity since selected teachers had professed inadequate background knowledge and a low level of motivation and competence in teaching the Energy area. During the workshop, teachers

(i) discussed ideas about programming Electricity and other science topics and integrating science with other parts of the curriculum.

(ii) were given a program for Electricity with accompanying worksheets suitable for use in a Year 5 class.

(iii) proceeded to work, in pairs, through the series of worksheets, using electrical equipment.

(iv) were given individual help and explanation for problems encountered in working through the content of the topic.

The fourth and final segment of Day Two (30 minutes) consisted of a review session in which techniques for non-sexist science teaching were revised.

The Half-day Inservice Program

The inservice program for the control group of teachers was designed for one half-day. It was held in the afternoon at the same venue with the same personnel as the two-day inservice program. As indicated above this half-day inservice covered only the sections on skills and materials for teaching Electricity, and was completed in the same sequence as for the experimental group of teachers.

CHAPTER 6

ANALYSES OF TEACHERS' QUESTIONNAIRES

Teachers' Initial Questionnaire

The initial teachers' questionnaire was sent to those teachers in one metropolitan region who taught straight Year 5 classes. Responses were received from 34 males and 26 female teachers. Each section of the questionnaire was analysed separately for male and female teachers, and relevant differences are referred to in the discussion of results. A copy of the questionnaire is included as Appendix A of this report.

Teacher Background and Experience

All teachers had a three-year teaching qualification, or equivalent, and 44 teachers (23 males, 11 females) had further qualifications or some progress toward a higher qualification (usually a Bachelor of Education degree). One male and five female teachers had less than five years teaching experience, and more than half had nine or more years experience. Only two teachers mentioned science as a major area of study in their qualification.

Science Programming

In most of the schools in the project science was taught for an average of about one hour each week, although the time programmed for science ranged between 35 and 120 minutes per week. Science was taught in the afternoon by 90 per cent of these teachers. This time allocation to science matches that found by Rowe (1983) in independent research in Western Australia.

More than half of the teachers (19 males, 16 females) reported that they used the Primary Science Syllabus, and/or the teacher resource books <u>Doing</u>

Science (Education Department of Western Australia) as their main programming resources. Other teachers used a variety of resources, including the library and their own materials collected during their teaching careers.

In most cases, a balance of topics relating to Animals, Plants, Matter and Energy were programmed for 1983, but male teachers had programmed more Matter and Energy topics (about three-fifths of course) than female teachers (a bit less than half of course).

Science Teaching Preferences

Many teachers stated preferences for teaching or not teaching particular science topics. Preferences shown in Table 6.1 reveal that more than half of the female teachers, and a quarter of the male teachers preferred not to teach topics concerned with Matter and/or Energy, and most teachers responding in this way specifically mentioned Electricity. Stated teaching preferences indicate that more males than females prefer to teach about Matter and Energy, while females prefer to teach about Plants and Animals.

Table 6.1

Teacher Preferences for Teaching Different Areas of Science

Teaching Area	Prefer to Teach (%)		Prefer NOT to Teach (%)	
	male	female	male	female
Animals, Plants	24	62	12	11
Matter, Energy	38	15	26	54
No preference	38	23	62	35

Teachers' Perceptions about Teaching in the Different Areas of Science

Teachers were asked to select, for each of the four areas of science, a response describing their level of interest, background knowledge, skill in teaching, and teaching resources available.

Teacher interest in teaching about Animals, Plants, Matter and Energy was described as "highly motivated", "motivated" or "not motivated". Teacher background knowledge was described as "extensive", "adequate" or "extra preparation needed". For each item the responses were scored 3, 2 and 1, respectively, and mean scores are reported in Table 6.2. In general terms, male teachers report that they are motivated to teach, and consider their background knowledge to be adequate to teach, in all areas. The responses of female teachers differ according to the area of science. Females are more highly motivated to teach topics concerning Animals and Plants than Matter and Energy. On average, they rate their background knowledge as "adequate" to teach about Animals and Plants, but one half responded "extra preparation needed" for Matter, and nearly three quarters chose this response for the Energy area. With one exception all teachers rated themselves as "reasonable" or "competent" in teaching about Animals and Plants, but a few responded "I'm not sure of my ability" for teaching about Matter and Energy. Most of these teachers were female, with 40 per cent responding in this category for Energy.

Table 6.2

Mean Scores (Standard Deviations) for Teachers' Self-Perceptions About Teaching the Areas of Science

Self-Perception	Sex of Teacher	Animals	Plants	Matter	Energy
Interest	male	2.15(0.61)	2.12(0.55)	2.18(0.58)	2.21(0.81)
	female	2.32(0.63)	2.44(0.51)	2.09(0.67)	1.78(0.80)
Background Knowledge	male	1.97(0.52)	1.79(0.48)	1.95(0.55)*	1.91(0.67)*
	female	2.04(0.60)	2.04(0.60)	1.52(0.59)	1.36(0.49)
Skill in Teaching	male	2.32(0.47)	2.26(0.45)	2.35(0.60)	2.18(0.63)*
	female	2.42(0.58)	2.46(0.58)	2.04(0.68)	1.76(0.72)

*Differences between male and female teacher mean scores significant, $p < .05$.

Teachers were also asked to rate the adequacy of the teaching resources for each of the science areas. On average, the rating was adequate in each area, however the lowest ratings were given for the Energy area.

Teachers' Perceptions of the Relevance and Easiness of Science

The majority of teachers (between 70 and 90 per cent) responded that the Animals, Plants, Matter and Energy areas were useful and relevant to both boys and girls. There were differences in teachers' perceptions of the easiness of the different areas of science. Teachers were asked to indicate whether; in their experience, boys and girls found each of the areas of science "easy to understand" "presents occasional difficulties" or "hard to understand". These responses were coded 3, 2, and 1 respectively, and mean scores are recorded in Table 6.3.

Table 6.3

Mean Scores for Teachers' Perceptions of the Easiness of Science for Boys and Girls

	Animals		Plants		Matter		Energy	
Sex of Teacher	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
male	2.73	2.73	2.55	2.58	2.27	2.24	2.27	2.21
female	2.81	2.81	2.69	2.81	2.48	2.24	2.52	2.16

Teachers reported that Animals and Plants presented few difficulties for boys and girls, but the Matter and Energy areas were reported to present more difficulties. Male teachers reported that Matter and Energy presented more difficulties than either Animals or Plants for both boys and girls, and every one of these differences was statistically significant ($p < .01$). Female teachers had a similar pattern of responses, but the differences in ratings of easiness between the two groups of areas were statistically significant ($p < .01$) for girls, but not for boys. Unlike male teachers, who perceived Matter and Energy to be just as easy for girls as boys, female teachers perceived these two areas to present more difficulties for girls than for boys ($p < .01$).

Teachers' Perceptions of the Responses of Boys and Girls to Science

Teachers were presented with fifteen statements of behaviour, with five items reflecting children's interest, self-confidence, and performance levels in science. Teachers were asked how many children demonstrated the described behaviour in areas of biological and physical science. The response choices were: all or almost all, three-quarters, half, one-quarter, very few, and were scored 5, 4, 3, 2, 1, respectively.

Each of the items had eight sets of results - male and female teachers' perceptions of the behaviour of boys and of girls in biological (Animals and Plants) and Physical (Matter and Energy) science. A method was sought for collapsing the data for more parsimonious reporting. The a priori structure among the items representing children's interest, self-confidence and performance was generally supported by an examination of item response patterns and by a series of linkage analyses (McQuitty, 1957), except for three items (Items 3, 10 and 12) which had unusual response patterns. It was clear that children's interest, self-confidence and performance were each measured by four items with similar response patterns, so the results were summed over those four items and reported in Tables 6.4 and 6.5. The results for Items 3, 10 and 12 are reported separately.

It is notable that female teachers gave a higher mean response than male teachers in every item for both boys and girls and for both biological science and physical science, however the difference between responses was statistically significant ($p < .05$) only on Items 1, 3, 6 and 7. Items 1, 6 and 7 are part of the self-confidence measure, so the results for this measure (Table 6.4) and Item 3 (Table 6.6) are reported separately for male and female teachers. Other results are reported for male and female teachers combined.

<u>Children's self-confidence in science.</u> Teachers' perceptions of children's confidence in science lessons were measure by Items 1, 5, 6 and 7 which read respectively, "approach task with confidence"; "volunteer new information and own ideas"; "try to solve their own problems before seeking help"; "take an active, rather than a passive, role in the lesson". The responses to each item were combined and the results are presented in Table 6.4.

Table 6.4

Male and Female Teachers' Perceptions of the Self-confidence of Children in Science

	Male Teacher			Female Teacher		
Science	Boys	Girls	t	Boys	Girls	t
Biological	3.52	3.60	NS	4.07	3.96	NS
Physical	3.52	3.33	2.92**	4.11	3.79	3.71**
t	NS	2.49*		NS	3.29**	

* $p < .05$ ** $p < .01$ (for paired t-tests)

Male teachers perceived that, on average, between one half and three-quarters of boys and girls exhibited the described behaviours. Female teachers had higher average ratings, perceiving about three-quarters of their students to be self-confident. The mean ratings of female teachers were significantly higher than those of male teachers for each science for boys ($p < .01$) and for girls ($p < .05$).

Both male and female teachers perceived girls to be more confident in biological science than in physical science, and girls to be less confident than boys in physical science. These differences were statistically significant and the t-test results are included in Table 6.4.

Children's interest and performance in science. The responses to four items describing interest in science were combined and the results appear in Table 6.5. The items are 2, 4, 8 and 11, and state, respectively, "are easily interested"; "work enthusiastically"; "seem to enjoy their work"; "participate willingly in lesson". Table 6.5 also reports teachers' perceptions of children's performance in science. Performance was described in items 9, 13, 14, and 15, which read, respectively, "get good results'; "have no trouble keeping up"; "concentrate throughout lesson"; "find the work easy". There were no significant differences in the ratings of male and female teachers, so their ratings were combined.

Table 6.5

Teachers' Perceptions of Children's Interest and Performance in Science

	Interest			Performance		
Science	Boys	Girls	t	Boys	Girls	t
Biological	4.28	4.37	NS	3.76	4.02	6.18*
Physical	4.31	4.18	3.11*	3.72	3.81	NS
t	NS	2.78*		NS	3.42*	

* $p < .01$ (for paired t-tests)

Most children are interested in, and enthusiastic about, science, with teachers perceiving more than three-quarters of their class responding positively to the items about interest. In particular, teachers reported that nearly all children participate willingly in their science lessons. Most of them also cope easily with science as teachers rated, on average, close to three-quarters of their class as performing well. Boys were perceived to be interested equally in biological and physical science, and to perform equally well in both. Girls, however, were perceived to be more interested, and to perform better in biological science than physical science, and these differences were statistically significant ($p < .01$).

Teachers perceived girls to be more interested in, and to perform at a higher level, than boys in biological science. The performance difference was statistically significant ($p < .01$). Although boys were perceived to be more interested in physical science than were girls ($p < .01$), girls were perceived to perform a little better than boys in physical science, but this difference was not statistically significant.

Other behaviour in science. Three items had a pattern of results quite different to the other groups of items. Items 10 and 12 had very low mean ratings, with no differences in mean ratings between male and female teachers for boys and girls for either science. Item 10 was "prefer to work alone, rather than in a group". The mean rating for this item was 2.05 indicating that, on average, about one quarter of children preferred to work alone. The mean rating of Item 12 "do extra work at home" was 2.23. However, there was more variation in teachers' responses for these two items than for any other items.

Item 3 read "take pride in the appearance of their work", and this item elicited the largest differences in ratings between boys and girls. The results are in Table 6.6 and show that teachers rated children's pride in their work significantly higher for girls than for boys, in both the biological and physical sciences.

Table 6.6

Mean Responses of Male and Female Teachers for Behaviour of Boys and Girls in Biological and Physical Sciences for Item 3 : Take Pride in the Appearance of their Work.

	Biological Science			Physical Science		
Teacher	Boys	Girls	t^a	Boys	Girls	t^a
male	3.45	4.27	7.40**	3.52	4.10	4.31*
female	3.58	4.67	6.40**	3.81	4.62	4.56**
t^b	NS	2.80*		NS	2.72*	

a Paired t-test results
b Independent t test results

* $p < .01$
* $p < .001$

Although female teachers gave higher ratings than male teachers for boys and girls, the ratings were significantly higher only for girls. In each case more than three-quarters of girls were perceived to take pride in the appearance of their work, compared with between half and three-quarters of the boys.

Teaching Methods in Science Lessons

Teachers were asked to reflect on their lessons during the term, and to estimate how frequently each of nine kinds of teaching activity occurred in their science lessons. The nine activities are recorded in Table 6.7 and because the differences in mean responses between physical and biological sciences and between male and female teachers were not statistically significant, the data were averaged over teachers and over sciences to provide one set of results.

Table 6.7

Percentage of Lessons Over a Term in which Specific Teaching Activities Occur

	% Frequency of Occurrence					
Teaching Activity	90	70	50	30	10	0
1. Teacher tells/explains content	6	22	17	17	26	12
2. Teacher-led discussion	11	17	21	23	20	8
3. Teacher demonstration	4	14	19	18	34	11
4. Audio-visual presentation	0	5	5	18	63	9
5. Children do same teacher-directed activity or experiment	11	19	17	18	25	10
6. Children do own activity or experiment	13	11	22	27	22	5
7. Small group discussion	6	12	16	23	32	11
8. Directed written work	3	9	7	29	39	13
9. Children research own project	3	4	5	22	53	13

Examination of Table 6.7 suggests that a "typical science lesson" is likely to include some teacher explanation; some class, and perhaps some small group, discussion; children engaged in some activity or experiment, possibly accompanied by a demonstration from the teacher. The least frequent teaching activity is an audio-visual presentation. In about one third of classes children research their own project in at least one in five lessons.

In general terms, it appears that children work alone, or in small groups (activities 5, 6 and 7), about as often as whole-class instruction (activities 1, 2, 3) occurs. However, care must be taken in making such generalisations, because there are many different patterns of teaching, and inspection of individual teacher responses shows that while some teachers prefer expository methods, others prefer their class to spend much of the time working on small group activities.

Teachers were also asked how many science-related excursions their class would have during the term. Of the 60 teachers, 31 did not schedule any excursions, 15 teachers scheduled one excursion, 12 scheduled two excursions, and two teachers planned three excursions.

Reasons for Teaching Science

Teachers were asked to rate each of the eleven "possible reasons for teaching science" according to "how much importance does your science teaching and programming give to each of these considerations in teaching science to children at the Year 5 level?". A five point scale, with "5" labelled "high importance" and "1" labelled "low importance", was used as the response format. The means and response frequency distributions appear in Table 6.8. Although the reasons were placed in random order on the questionnaire, they are ranked in three groups in Table 6.8, according to their mean rating.

Inspection of Table 6.8 shows that the mean rating of each aim exceeds the midpoint of three, although except for the top three reasons, there is considerable variability in response. It is interesting to note that every reason was rated more highly by female teachers, although the difference in mean rating reached significance at the .05 level only on the fourth, sixth and eighth reasons. However, the reasons were ranked similarly by both male and female teachers so the combined means are reported in Table 6.8.

Table 6.8

Means and Response Frequency Distributions for the Importance of Reasons for Teaching Science

Rank	Reason	Mean	% Response Frequency: Low Importance 1	2	3	4	High Importance 5
1.	to interest children in science	4.52	0	0	10	28	62
2.	to give practice in problem solving skills	4.38	0	2	13	30	55
3.	to show how science is related to everyday life	4.15	0	2	21	37	40
4.	to develop self-discipline and independence	3.96	2	5	28	25	40
5.	to give practice in communication skills - verbal	3.93	2	7	20	39	32
6.	to develop social skills (such as cooperation)	3.92	2	5	25	37	31
7.	to give practice in communication skills - written	3.73	5	7	29	29	30
8.	to integrate science with other school subjects	3.53	2	12	38	28	20
9.	to provide scientific knowledge	3.47	3	8	42	32	15
10.	to give practice in manipulative skills	3.45	8	13	25	34	20
11.	to prepare students for science later on	3.40	8	10	34	30	18

The mean ratings show that teachers give greatest emphasis to children's interest, problem-solving skills and the relationship of science to everyday life. The second group of reasons includes the development of self-discipline and independence, and the acquisition of social and communication skills. These reasons are probably those least specific to science, and all must be relevant to other subjects in the curriculum. Even so, they are commonly espoused as aims in documents relating to science, and clearly teachers support them. Teachers give relatively low importance to the provision of scientific knowledge and its use in other areas, and for later science work. The issue of "why teach science?" is discussed more fully elsewhere (Rennie, 1983).

Teachers' Comments About Science

In a free-response section of the questionnaire teachers were asked if they wished to make comment about science teaching and learning for boys and girls in the different areas of science. Comments were made by 14 female and 16 male teachers. In summary, there were five main issues raised. Teachers were troubled by a lack of equipment, especially in the Energy/Electricity area; the time involved in preparing activity lessons which children enjoy; and a lack of background in the Energy area. Several teachers noted that they didn't notice much difference between boys and girls, and others asked for more inservice/help with their science teaching.

Analysis of Teachers' Final Questionnaire

The final questionnaire for teachers was designed to measure teachers' attitudes and perceptions about teaching Electricity and about children's responses to the Electricity topic. A copy is included in Appendix A. In addition, the questionnaire was used to gather teachers' opinions about the inservice course they attended. Completed questionnaires were received from the eight teachers (four male and four female) in the control group, and nine teachers (five male and four female) in the experimental group.

Teacher's Perceptions About Teaching Electricity

Teachers were asked to rate their interest in teaching Electricity as "highly motivated", "motivated" or "not motivated"; to describe their background knowledge as "extensive", "adequate" or "extra preparation needed"; and to rate their skill in teaching Electricity as "competent", "reasonable", "I'm not too sure of my ability". The responses for the three items were scored 3, 2 and 1, respectively, and mean ratings are reported in Table 6.9. The last column in this table is a comparison with the mean scores of this group of teachers on the same items answered for the Energy area in the initial questionnaire. It is of interest that the teachers, particularly the female teachers, were more positive in their perceptions about Electricity after teaching the topic than they were about the Energy area prior to their experience with the Electricity topic. However, although teachers felt more motivated about, and skilled in, teaching Electricity, some still felt a need for more background knowledge.

Table 6.9

Mean Scores (Standard Deviations) for Teachers' Self-Perceptions About Teaching Electricity

Self-Perception	Sex of Teacher	Experimental Group	Control Group	Comparison with Pre-test
Interest	male	2.20(0.45)	2.50(0.58)	+ .55
	female	2.75(0.50)	2.20(0.00)	+1.09
Background Knowledge	male	1.60(0.89)	2.25(0.50)	+ .11
	female	1.75(0.50)	1.50(0.58)	+ .25
Skill in Teaching	male	2.00(0.00)	2.50(0.58)	+ .33
	female	2.25(0.50)	2.25(0.50)	+ .87

Teachers' Perceptions of the Relevance and Easiness of Electricity

All teachers responded that the Electricity topic was useful and relevant to boys, and all but one teacher made the same response for girls. Teachers were asked whether, in their experience, boys generally found the Electricity topic "easy to understand" "presents occasional difficulties" or "hard to understand". The responses were scored 3, 2, 1 respectively. The same question was asked separately for girls. The means responses of teachers are reported in Table 6.10.

Table 6.10

Mean Scores (Standard Deviations) for Teachers' Perceptions of the Easiness of Electricity for Boys and Girls

Sex of Teacher	Experimental Group		Control Group	
	Boys	Girls	Boys	Girls
male	2.20(0.45)	2.20(0.45)	2.50(0.58)	2.25(0.50)
female	2.50(0.58)	2.00(0.00)	2.75(0.50)	2.00(0.00)

Male teachers perceived Electricity to be of similar difficulty for boys and girls. At least half of the female teachers in each group perceived Electricity to present more problems for girls than boys. Boys and girls own perceptions of the difficulty of Electricity are reported in Chapter 7: on average girls perceived the topic to be harder than did boys, and the differences were greater in classes taught by female teachers.

Teachers' Perceptions of the Responses of Boys and Girls to Electricity

Teachers were presented with nine statements of behaviour reflecting children's interest, self-confidence, and performance level in the Electricity topic. The response choices were: all or almost all, three-quarters, half, one quarter, very few, and were scored 5, 4, 3, 2, 1 respectively. Examination of the mean responses indicated no systematic differences between the responses of teachers in the experimental and control groups, so their data were combined.

Table 6.11

Teachers' Perceptions of Children's Behaviour in Electricity and in Matter and Energy Topics

		Electricity			Matter and Energy[a]		
		Mean	SD	t	Mean	SD	t
1. handled equipment with confidence	boys	4.41	.62	2.15*	4.13	.83	1.81
	girls	4.18	.64		3.93	.96	
2. were easily interested	boys	4.94	.24	1.80	4.60	.74	1.68
	girls	4.76	.44		4.33	.82	
3. worked enthusiastically throughout the science topic	boys	4.88	.33	1.80	4.25	.77	0.97
	girls	4.71	.47		4.19	.75	
4. volunteered new information and own ideas	boys	3.53	1.28	4.16**	3.63	1.20	2.53*
	girls	2.82	1.42		3.31	1.14	
5. tried to solve their own problems before seeking help	boys	4.12	.86	4.12**	3.27	1.03	0.97
	girls	3.59	.87		3.20	1.01	
6. took an active, rather than a passive, role in the lesson	boys	4.41	.71	3.25**	4.06	.93	3.06**
	girls	4.00	.94		3.56	1.09	
7. seemed to enjoy their work	boys	4.76	.44	1.42	4.44	.63	0.00
	girls	4.65	.49		4.44	.63	
8. did extra work outside of time allocated for science	boys	2.88	1.41	4.52**	1.94	1.24	0.00
	girls	2.00	1.27		1.94	1.12	
9. had no trouble achieving the objectives of the lesson	boys	4.41	.62	2.15*	3.62	1.02	0.00
	girls	4.18	.73		3.63	1.09	

[a] These statistics are for the research group of teachers for similar items on the Teachers' Initial Questionnaire (see Appendix A).

* $p < .05$ ** $p < .01$ (for paired t-tests).

Female teachers gave a higher mean rating than male teachers for every item (as they had done on the initial questionnaire) but because of the small differences, the responses of male and female teachers could be summed without loss of information. The mean ratings of teachers' perceptions of the behaviour to boys and girls for each statement of behaviour are reported in Table 6.11. Included in Table 6.11 for purposes of comparison are the statistics for the research group of teachers on those items which appeared in the initial questionnaire. Paired t-tests were used to detect statistically significant differences between teachers' ratings of boys and girls.

Table 6.11 shows that boys are given a higher mean rating than girls on every item. Items 1, 4, 5 and 6 refer to children's self-confidence and for these items, together with Item 9 which measures performance, the differences between ratings for boys and girls are statistically significant. Items 2, 3 and 7 refer to children's interest and enjoyment in Electricity. The means are high for both boys and girls, with teachers reporting that nearly all children enjoyed Electricity. Less than half of the boys, and about one quarter of the girls were reported to do extra work outside of science class (Item 8).

The research group of teachers had reported a similar pattern of behaviour for science to do with Matter and Energy in the initial teacher questionnaire, except that no differences in performance were reported between boys and girls. However, except for Item 4 (volunteering information and own ideas), teachers rated more children exhibiting the described behaviour in Electricity, compared to Matter and Energy.

Problems Experienced in the Electricity Topic

A list of eight potential problems was compiled from discussions with teachers during the inservice course and observational visits. Teachers were asked to respond for each possible problem: "did not occur", "occurred but caused no concern", "a problem but easily overcome", "a problem overcome with effort", "a continuing problem". The most common problems were "obtaining sufficient equipment", and "too much equipment consumed" and both were rated "a problem easily overcome". Storing equipment was rated typically as "occurred but caused no concern". The amount of time required for lesson preparation was rated half-way between these two categories.

The other four listed problems referred to possible sex differences. They were rated similarly by male and female teachers from both groups. "Boys used equipment more than girls", and "I had to spend extra time with girls explaining how to use the equipment" were both rated "did not occur" by half the teachers and rated "occurred but caused no concern" by the other half. The last two problems were "boys (girls) couldn't see the point of doing Electricity" and were rated "did not occur" by nearly all teachers.

Teachers were asked to volunteer any other problems experienced. The actual wording of the five problems specified are given in Appendix E. Two referred to children wishing to go overtime, or pursue their own ideas with equipment. Three were rated "a continuing problem" and these referred to recording individual skills, poor manipulative skills hindering children, and girls not wishing to voice answers when working with boys. The last problem was mentioned by a male teacher from the experimental group.

The Usefulness of the Inservice Courses

Teachers were asked which parts of their inservice course they found particularly useful, and which parts were not useful. The unedited comments of each teacher were included in the feedback sent to teachers, and are reproduced here as Appendix E. The control group experienced only the inservice work relating to teaching the Electricity topic and their comments on the usefulness of the course related to this. All teachers found the inservice useful, but particularly appreciated were the opportunities to try out the activities and the help given with lesson plans and programming. No teacher found any part not useful to them.

When asked to suggest ways such inservice work could be made more useful, suggestions included more time for inservice, including more than one science topic, and increased emphasis on the practical involvement of teachers in programming.

The experimental group of teachers received the equivalent half-day inservice on the teaching of the Electricity topic, and one and one-half days on raising teacher awareness of problems girls may face in physical sciences, and the acquisition of skills in implementing a non-sexist approach in science teaching. Possibly because of the longer inservice, the experimental group of teachers made longer and more detailed responses. These are reported in full in Appendix E.

In response to the question asking what parts of the inservice programme were particularly useful to them, three of the experimental group of teachers (one male and two female) mentioned the inservice work on Electricity. Two male teachers found the parts about a non-sexist approach in the classroom were useful, and one of these teachers noted that he had researched sex segregation in his own time quite apart from this inservice. The remaining teachers (two male and two female) responded that both parts of the inservice were useful to them.

Several of the experimental group of teachers made a response when asked what parts they found not useful to them. One male teacher and one female teacher found the sessions on sexism too long, and two other male teachers felt these points were a bit "overdone". Two teachers (one male and one female) made complimentary comments. One wrote

> I found it all most beneficial - wish it had gone on longer and covered more topics plus ways to alter teaching patterns so that girls are not so disadvantaged.

Some teachers' suggestions for improving the segments on sexism included provision of opportunities to analyse videotapes of science classes, arrangement of visits to schools to observe the nature and extent of sex stereotyping and more specific instruction on teaching strategies for eliminating sexism.

Effect of Inservice on Teachers' Approach to the Electricity Topic

Teachers were asked what difference (if any) the inservice made in their approach to the Electricity topic in relation to content, to teaching strategies, and to the ways they deal with boys and girls. In terms of content, the responses of teachers in the control and experimental groups were similar. Teachers reported that the inservice had made them more knowledgeable and given them the confidence to try the topic with a "hands on" approach.

Three teachers in the control group made a response to the question relating to teaching strategies. All referred to help given in lesson preparation. Six teachers in the experimental group made comments. Five referred to their willingness to tackle activity-based lessons with increased involvement of children in group work. The sixth teacher mentioned basic teaching strategies. She wrote

> Made me aware of the importance of questioning strategies, review previous lessons and importance to make sure children really follow instructions.

The final question asked teachers what difference the inservice made to the ways they dealt with boys and girls. It was expected that this question would provoke a different type of response from the control group compared with the experimental group. Three teachers in the control group made no response. Two made comments to the effect that boys and girls coped equally well and both were given assistance when required. Two male teachers in the control group reported that they became more conscious of the girls, and found single sex groupings more successful than boy/girl groups. One female teacher wrote, without further explanation

> Reinforced my own desire to do something about stereotypes and role identification by gender.

The response of teachers in the experimental group generally expressed a sensitivity to the problems girls might face in their class (although one male teacher made no response to this question). Most of the responses referred to conscious attempts "to be fair to both sexes", giving equal amounts of time and attention to boys and girls, and to encourage them to participate equally in the lessons. The longest response came from a female teacher, who wrote

> Quite significantly. I altered arrangement of seats, became more conscious of the types of responses made to sexes re level of thinking or level of questions posed. I've tried to devote time more evenly. (I fear however that with time this level of consciousness has probably reduced.)

This same teacher wrote additional comments elsewhere on her questionnaire, noting that, initially, girls obviously lacked confidence and familiarity with the materials compared with the boys. However, by half-way through the topic, girls had settled in and become more confident in working with the equipment and in solving their own problems - in fact became more like the boys. Many teachers voiced similar comments to the researchers during class visits. As girls became more confident, it is not surprising that teachers' levels of consciousness reduced. It was expected that the awareness-raising effects of the inservice naturally would dim as time passes, but teachers' comments, and the continuing contact with the researchers during classroom observation and the completion of the questionnaires, suggest that teacher-awareness was raised, with positive effects, for some time. Further, three of the eight teachers in the control group became aware of problems girls experienced in their classrooms, an awareness which was an unexpected bonus from their involvement in this research.

CHAPTER 7

ANALYSIS OF CHILDREN'S QUESTIONNAIRES

Children's Initial Questionnaire

The Children's Initial Questionnaire was administered to the classes of the twenty teachers involved in the inservice program, and to the classes of five other teachers who expressed interest in the questionnaire. Responses were received from 394 boys and 373 girls in Year 5. The first sixteen items of the initial questionnaire formed a general science interest scale, and were scored using a four point response format. The next five items asked about children's interest in Electricity, and the last two concerned children's opinion of whether, and why, they thought they could be a scientist when they grew up.

General Science Interest Scale

Comparative results for boys' and girls' scores on the first sixteen items of the questionnaire appear in Table 7.1. These items were selected to represent science-related activities which were diverse in content and in the type of activity. Results are thus reported for each item as well as an overall total score.

The results in Table 7.1 reveal two important points. First, as shown by the total score in the last row of the table, boys and girls have a similar overall interest in the science activities described in the questionnaire. Second, the results for the individual items show that boys and girls have quite different patterns of interests, a point concealed by the total scores. Specifically, in relation to sex-differentiated directions of

Table 7.1

Boys' and Girls' Responses to the Science Interest Scale

	Boys		Girls		t
	Mean	SD	Mean	SD	
HOW MUCH WOULD YOU LIKE TO FIND OUT					
1. how iron ore is made into steel	2.87	1.02	2.45	0.99	5.77**
2. how electricity makes the television work	3.45	0.80	3.13	0.90	5.15**
3. how compost helps plants to grow better	2.33	1.08	2.64	1.00	-4.13**
4. how germs can make you sick	2.95	1.10	3.25	0.98	-3.96**
HOW MUCH DO YOU LIKE TO DO					
5. experiments with earthworms	2.70	1.08	2.44	1.12	3.36**
6. experiments with shadows	2.40	1.04	2.55	1.04	-2.10*
7. experiments with seeds	2.53	1.08	2.98	0.94	-6.20**
8. experiments with water	3.19	0.96	3.25	0.89	-0.88
HOW MUCH DO YOU LIKE TO DO SCIENCE WORK					
9. about the weather	2.55	1.06	2.47	0.94	1.11
10. about moths, butterflies and caterpillars	2.60	1.11	3.06	0.97	-6.07**
11. about wheels and motors	3.55	0.81	1.91	1.01	24.83**
12. about mushrooms and toadstools	2.19	1.11	2.65	1.08	-5.77**
HOW MUCH WOULD YOU LIKE TO					
13. collect rocks and minerals	3.07	1.02	2.85	1.07	2.94**
14. make working models from Lego or other kits	3.74	0.64	3.03	1.03	11.63**
15. grow your own vegetable or flower garden	2.73	1.07	3.52	0.74	-11.81**
16. look after mice or goldfish as pets	3.38	0.90	3.64	0.70	-4.48**
Total Score	46.31	7.79	45.83	7.26	0.87

* $p < .05$ ** $p < .01$

interest, these data reveal that the boys, on average, seem to be more interested than the girls in science about Matter and Energy (Items 1, 2, 11, 13, 14) while the girls on average seem to be more interested than the boys in science about Plants and Animals (Items 3, 4, 7, 10, 12, 15, 16). Exceptions to these generalisations are the greater interest of the boys in earthworms (Item 5), the greater interest of the girls in shadows (Item 6), and the similar interest of boys and girls in water (Item 8), and weather (Item 9).

Thus, although it seems reasonable to say that boys and girls may have different science interests, the differences are not as clear-cut as suggested by some reports which imply a labelling of physical and biological sciences as boys' and girls' sciences respectively (Ormerod, 1979). Rather, boys' and girls' levels of interest appear to be related quite closely to their likely out-of-school experience. Where the experience is one which is likely to be universal (earthworms, shadows, rocks, germs, water and weather) little differentiation of interest is shown between the sexes. In other areas, such as wheels and motors and growing a vegetable or flower garden, where boys' and girls' out-of-school experiences are likely to be quite different, sex-stereotyping is apparent.

The different pattern of interests of boys and girls in science justifies the decision to analyse items separately. Collapsing the data to obtain a total score clearly results in a loss of information. This point and others relating to the dimensionality of the instrument are elaborated in Rennie and Parker (1984). The total mean scores indicate that boys and girls have a similarly high level of interest overall in these science-related activities, whereas the item mean scores reveal that the boys and girls have different preferences.

Electricity Items

Five items on the Children's Initial Questionnaire described activities relating to Electricity. These items provided baseline data for children's interest in the kind of activities which were to be part of the Electricity topic taught by the research group of teachers to their classes. The results for these items appear in Table 7.2. For every activity boys have expressed a greater interest than girls. This supports the suggestion that boys, rather than girls, are likely to be oriented towards this type of activity, perhaps because their out-of-school experiences are more likely to have included similar activities (Kahle and Lakes, 1983; Lie and Bryhni, 1983).

Table 7.2

Boys' and Girls' Liking for Science Activities Relating to Electricity

	Boys		Girls		t
	Mean	SD	Mean	SD	
HOW MUCH WOULD YOU LIKE TO					
work out ways to make a torch globe light up	3.28	0.92	2.74	0.94	8.03*
test things to see if electricity passes through them	3.38	0.90	2.90	1.00	7.01*
cut up a battery or a torch globe to see what's in it	3.46	0.86	3.12	1.03	4.94*
make your own switch to turn a light on and off	3.58	0.79	3.25	0.94	5.21*
do an experiment to see how brightly a torch can shine	2.85	1.02	2.58	0.98	3.82*

* $p < .01$

Becoming a Scientist

The final item of the Children's Initial Questionnaire asked "If you wanted to, could you be a scientist when you grow up?", and requested a reason for the response. There was little difference in the response to the first of these questions, with 54.8 per cent of boys and 48.2 per cent of girls responding yes. Children gave a wide variety of reasons for their answer. These were categorised and the results are shown in Table 7.3. In general terms, the pattern of reasons given were rather similar for boys and girls. The noticeable differences were that boys were more likely to say they were good or clever at science (Yes-Reason 1) while girls were more likely not to

Table 7.3

Reasons Offered by Boys and Girls for "Why I Could or Could Not Be a Scientist"

Reason	Boys (%)	Girls (%)
WHY I COULD BE A SCIENTIST		
0. No reason given.	1.0	1.1
1. I am good/clever at science.	12.5	8.3
2. I enjoy/like science.	13.3	12.9
3. Can do experiments/invent things.	7.7	7.3
4. If I tried hard I could/you can be anything you want.	6.6	8.6
5. Would like to learn a lot/do more study.	6.6	4.9
6. Be famous/get lots of money.	2.3	0.8
7. Help people/animals.	0.3	1.1
8. Interested in a specific area (usually something to do with animals).	4.8	3.2
WHY I COULD NOT BE A SCIENTIST		
0. No reason given or just don't want to be.	2.8	2.9
1. I'm not clever/brainy/it's too hard for me.	11.9	12.4
2. Science is boring/don't like it.	9.9	14.3
3. Don't like experiments/too dangerous	2.0	1.0
4. Don't know much about it/I wouldn't be good at it.	3.8	8.3
5. Too much study/hard work.	4.6	3.3
6. It's not for girls.	0.0	0.8
7. Science hurts animals.	0.2	0.3
8. Have other plans (usually nurse, teacher, vet for girls, wide variety for boys).	9.7	8.3

know much about science or assume they would not be good at it (No-Reason 4). Some children volunteered an occupation they had already chosen. Of the 23 girls mentioning an occupation, five said they would be a teacher, eight wanted to be a nurse, one a doctor, and four wanted to become a 'vet'. Twenty three boys also mentioned an occupation - three planned to be a sportsman, two a pilot, two a butcher, one a (woodwork) teacher, and the others mentioned occupations in a wide range.

Effects Associated with Class Membership and Sex of Teacher

The analyses reported above used the individual child as the unit of analysis. This is appropriate because a composite description of children's attitudes is required, and children are mixed in groups in the sample as they are in the population. However, in the analysis of the final questionnaire, comparisons needed to be made between a smaller number of classes taught by teachers in the experimental and control groups, comparisons for which the class would be a more appropriate unit of analysis. The data from the Science Interest Scale were thus subjected to a rigorous analysis to detect variance which might be attributable to class membership or to the sex of the class teacher.

The design of the research is a nested and crossed design, where classes are nested with the sex of the teacher and both of these factors are crossed with the sex of the student. Class is a random factor, but the sex of the teacher and of the student are fixed factors. The data for each item were analysed separately in an analysis of variance following Winer (1971, p. 362), and in no instance was there a statistically significant interaction between sex of student and sex of teacher, nor was there a statistically significant effect attributable to the sex of the teacher. There were statistically significant effects associated with the sex of the student which follow the pattern reported in Table 7.1, except that a more conservative test has resulted.

Because there are no significant effects associated with the sex of the teacher, classes were pooled across teachers and simple two-way analyses of variance were used to test for effects associated with class membership. The results of these analyses are reported in Table 7.4. There is little evidence

Table 7.4

Sex X Class Analysis of Variance on Science Interest Scale

Item	Sex		Class		Interaction		Residual
	SS	F(1,24)	SS	F(24,685)	SS	F(24,685)	SS
1	27.92	26.14**	79.81	3.57**	25.62	1.15	638.24
2	17.87	13.45**	36.27	2.22**	31.89	1.95**	466.73
3	22.05	16.97**	45.36	1.82**	31.19	1.25	711.05
4	13.57	17.83**	71.10	2.88**	18.27	.74	705.16
5	13.46	8.79**	83.97	3.16**	36.73	1.38	759.19
6	5.82	3.89	58.01	2.41**	35.87	1.49	687.75
7	42.41	26.39**	37.75	1.57*	38.56	1.62*	678.91
8	.35	.28	33.01	1.68*	29.64	1.51	560.43
9	1.23	1.15	48.21	2.12**	24.63	1.08	646.59
10	44.32	48.44**	53.52	2.21**	21.03	.87	689.29
11	454.08	626.18**	45.22	2.44**	16.64	.90	526.89
12	35.07	31.91**	70.68	2.73**	25.27	.98	737.03
13	7.09	6.50**	82.70	3.46**	26.20	1.09	687.94
14	97.52	97.03**	46.21	2.84**	24.12	1.48	467.21
15	116.11	100.18**	27.79	1.39	27.81	1.39	573.96
16	15.63	16.35**	29.53	1.98**	22.95	1.54*	429.57

*$p<.05$ **$p<.01$

of sex X class interaction - the interaction is statistically significant for only three items. The main effects associated with sex of child are as before, but with the more conservative tests, there are no statistically significant effects on Items 6, 8 and 9, and the effect for Item 13 is significant at the .05 level. All other effects are significant at the .01 level. There are substantial main effects associated with class membership, with only Item 15 having no statistically significant effect. This item refers to growing a garden, and is possibly the item least oriented towards the classroom. These results are not surprising, because each class has had its own unique sequence of science experiences during the school year, and in previous years. The results are important, however, and it is clear that class-membership is a variable of which account must be taken when analysing the data from the final questionnaire.

Children's Final Questionnaire

The Children's Final Questionnaire was used to measure children's enjoyment of, and perceptions about, the Electricity topic. A copy of it is included in Appendix B. The Final Questionnaire was administered by the classroom teacher at the conclusion of the series of lessons on Electricity. It comprised eleven items, three of which were also included in the initial questionnaire. Children's final questionnaires were matched with their initial questionnaires; nineteen children who did not complete the latter were deleted from the sample. Unfortunately, one class of final questionnaires was returned without any identification of the respondents and could not be used. This left a research sample of 498 children, 254 boys and 244 girls, from ten classes of the teachers in the experimental group and seven classes of three male and four female teachers in the control group. The composition of the research sample is set out in Table 7.5

Table 7.5

Composition of the Research Sample

by Research Group and Sex of Teacher

Sex of Teacher	Sex of Student	Experimental Group	Control Group	Total
Male	boy	75	38	113
	girl	71	38	109
Female	boy	81	60	141
	girl	76	59	135
	Total	303	195	498

The analysis of the Children's Final Questionnaire is reported in two sections. Tables 7.6 and 7.8 report the mean scores on each item of boys and girls in the experimental and control groups taught by male and female teachers. All analyses used the class as the unit of analysis because of class-related differences found during analysis of the initial questionnaire. The number of classes in each category is small, but the means are associated with small standard errors because they are calculated from aggregated data. Although the research groups were formed initially by random assignment, the loss of three classes from the control group invalidates the assumption of equivalence. Consequently an analysis of differences between boys and girls within classes is preferred to an analysis comparing raw scores between groups.

The data from the Final Questionnaire provide the basis for making comparisons between boys and girls in terms of their attitudes and perceptions about the Electricity topic. Because the groups are not necessarily equivalent, the item mean scores may not be a valid means of making comparisons between groups. However, if differences between the scores of boys and girls are smaller in the experimental group than in the control group then this would suggest that teachers in the experimental group have been more able than the control group of teachers to promote a non-sexist classroom environment.

The differences in scores between boys and girls were analysed by subtracting the girls' mean score from the boys' mean score for each class and using this difference score as the criterion measure. A two-way fixed effects analysis of variance was then used to test for effects associated with group and sex of the teacher. If there are no significant main or interaction effects, then the test of the grand mean (that is whether the overall mean difference score differs from zero) can be used as a test for a significant difference between boys' and girls' scores. If there are significant effects, then tests for differences between boys and girls can be carried out on subgroups separately.

Children's Enjoyment of the Electricity Topic

The first four items of the Final Questionnaire asked students how much they enjoyed particular activities experienced during the Electricity topic. The response choices to the items were: "not at all", "a little bit", "a fair bit", "a lot". These items were scored 1 through 4 respectively and can be summed to form a short scale measuring enjoyment of electrical activities. Means for the items and the scale are reported in Table 7.6. Also included in Table 7.6 are the mean scores for Item 8, which asked whether children enjoyed working with the electrical equipment less, as much, or more than they thought they would. This item was scored 1 through 3.

Whether or not the children enjoyed the Electricity topic can be judged from two sources of data. First, the means in Table 7.6 reveal that, on average, children scored between 'a fair bit' and 'a lot' for Items 1 - 4, and

Table 7.6

Mean Scores for Children's Enjoyment of Activities during the Electricity Topic

	Experimental Group				Control Group			
	Male Teacher		Female Teacher		Male Teacher		Female Teacher	
Item	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
1. Torch globe	3.35	3.24	3.28	3.43	3.73	3.08	3.45	3.02
2. Conductors	3.12	3.04	3.16	3.33	3.09	2.92	3.18	2.91
3. Circuits	3.31	3.22	3.43	3.43	3.59	3.19	3.41	3.26
4. Switch	3.54	3.37	3.65	3.67	3.69	3.42	3.40	3.26
Scale (Items 1 - 4)	13.33	12.88	13.53	13.85	14.10	12.65	13.44	12.45
8. Enjoy	2.45	2.49	2.44	2.53	2.55	2.41	2.62	2.31

for Item 8 scored well over the midpoint. Clearly the topic was enjoyed, and there is an overall tendency for boys to have scored higher than girls, particularly in the control group. The second source of data comes from comparison with results from the Initial Questionnaire. Three of the items in the Final Questionnaire (Items 1, 2 and 4) were also included in the Initial Questionnaire where they were presented as "How much would you like to"...? rather than "How much did you enjoy"...? The results from the Initial Questionnaire revealed significant differences in favour of boys, but these differences are not as clear cut for the Final Questionnaire. Girls enjoyed the described activities more than they had anticipated at the time of the initial questionnaire. In contrast, boys' enjoyment was about the same or even less than anticipated. As a result, the mean scores of girls were much closer to those of boys. Table 7.7 presents the mean differences between boys' and girls' scores on the three common items for the Initial and the Final Questionnaires.

Table 7.7

Mean Differences between Boys' and Girls' Responses to

Items Common between the Initial and Final Childrens' Questionnaires

	Experimental Group				Control Group			
	Male Teacher		Female Teacher		Male Teacher		Female Teacher	
Item	Initial	Final	Initial	Final	Initial	Final	Initial	Final
1. Torch globe	.69	.11	.42	-.15	.84	.65	.39	.43
2. Conductors	.62	.08	.37	-.17	.90	.17	.57	.27
4. Switch	.44	.17	.26	-.02	.66	.27	.37	.14
Total	1.75	.36	1.05	-.34	2.40	1.09	1.23	.84

The data in Table 7.7 show that the experience of doing the Electricity topic brought the scores of boys and girls much closer together in each group, in fact the girls enjoyed the work more than boys in the experimental classes taught by female teachers resulting in a negative difference. Clearly, the actual experience of working with the equipment is an enjoyable one, particularly as girls did not expect to enjoy it so much.

Analysis of differences between the control and experimental groups on the Final Questionnaire were carried out using the sum of Items 1 to 4 to form an Electrical Activities Scale. The mean differences between boys' and girls' scores were analysed in a two-way analysis of variance. The analysis revealed a statistically significant group effect ($F = 9.88$, $p < .01$), but the effect associated with the sex of the teacher did not reach statistical significance ($F = 3.01$, $p = .11$). The mean difference scores for the four groups are graphed in Figure 7.1.

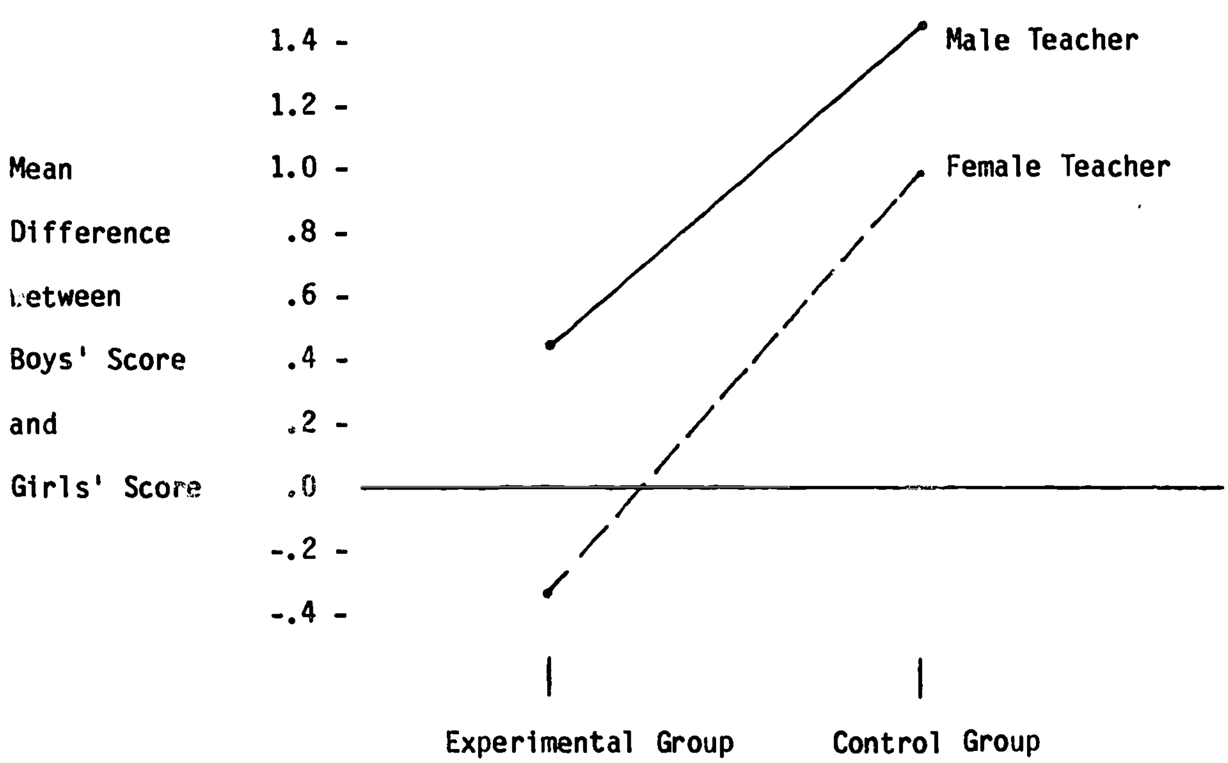


Figure 7.1: Mean Difference Scores between Boys and Girls on the Electrical Activities Scale.

Figure 7.1 shows that the mean scores of boys and girls are much closer in the experimental group - in fact girls scored higher than boys on the electrical activities scale in classes taught by female teachers in this group. The significantly larger differences in the control group mean that girls did not enjoy the topic as much as did boys in these classes even though their scores had increased from the Initial Questionnaire. The difference score was significantly greater than zero only in the control group ($F = 14.37$, $p < .01$) so the difference between boys and girls is significant for this group, but not for the experimental group.

Somewhat similar results are obtained for Item 8, which asked about anticipated enjoyment of the topic. The analysis resulted in a significant group effect ($F = 4.23$, $p < .10$) but no teacher effect ($F < 1.0$). The mean difference scores for Item 8 are graphed in Figure 7.2. The interaction term is not significant ($F < 1.0$).

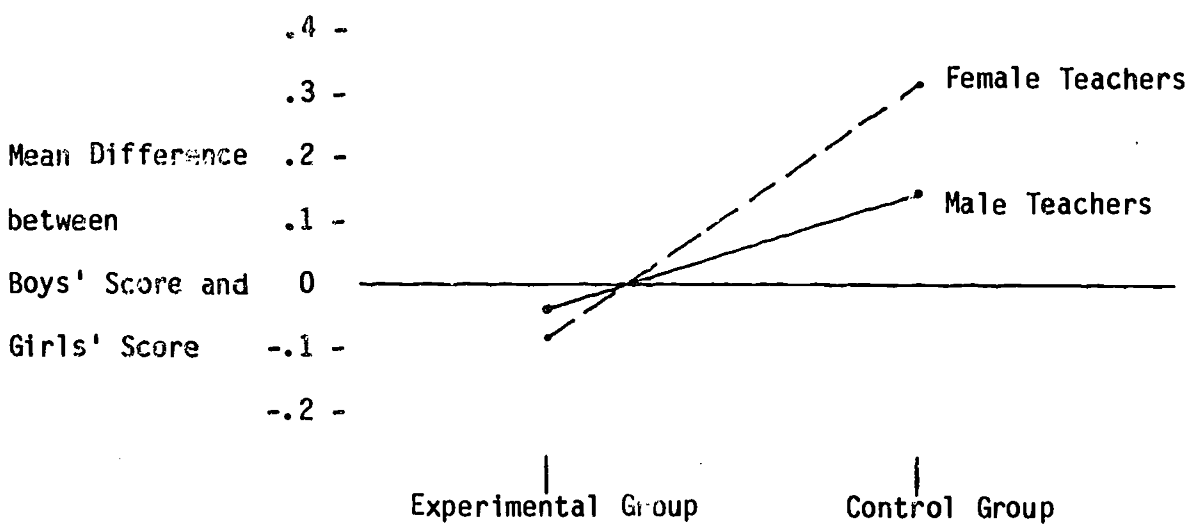


Figure 7.2: Mean Difference Scores between Boys and Girls on Item 8 - Enjoyment of Topic.

The graph in Figure 7.2 again shows little difference between boys and girls for the experimental group, but a greater difference in the control group, particularly in classes taught by female teachers. However, the difference between boys and girls did not reach statistical significance.

Taken together, the results for these items suggest that more teachers from the experimental group than the control group have been able to teach the Electricity topic in a manner which appeals more equally to girls and boys.

Perceptions About the Electricity Topic

Six items tapped children's self-confidence in doing the work in Electricity, their perceptions of its difficulty, and about the career of electrician. Items 5, 6 and 7 asked children how good they thought "most boys", "most girls", and "you", were at working with globes, wires and batteries. The response choices were: "hopeless", "not much good", "pretty good", "really good". These three items were scored 1 through 4 respectively, and the mean scores are reported in Table 7.8.

Table 7.8

Mean Scores for Children's Perceptions about the Electricity Topic

	Experimental Group				Control Group			
	Male Teacher		Female Teacher		Male Teacher		Female Teacher	
Item	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
5. Most boys	3.45	3.17	3.35	3.30	3.44	3.23	3.69	3.28
6. Most girls	2.75	3.29	2.68	3.12	2.67	3.26	2.50	3.00
7. You	3.29	2.89	3.18	2.92	3.27	3.05	3.30	2.73
9. How easy	3.65	3.58	3.70	3.40	3.46	3.15	3.86	3.44
10. Women electricians	76.78	90.17	77.78	98.18	91.19	95.83	78.37	91.43
11. You an electrician	88.32	82.12	93.12	89.27	87.00	70.54	88.15	69.40

Item 9 asked how hard children found the Electricity work and the item was scored 1 through 5 on a scale from "always hard" to "always easy". The last two items referred to electricians. Item 10 asked children whether they thought women could learn to become electricians, and Item 11 asked whether they themselves could learn to become an electrician if they wanted to. The results for these last two items are recorded in Table 7.8 as the percentage responding "yes" to each item.

The mean scores for Items 5 and 6 reported in Table 7.8 show that boys perceive "most boys" to be good at working with the equipment, but perceive "most girls" not to be as good as "most boys". In contrast, girls thought "most girls" were about as good as "most boys" at working with the equipment. The results for Item 7 suggest a lack of self-confidence in girls. Boys perceived themselves to be nearly as good as most boys at working with the equipment but girls saw themselves as less able than most girls.

There are no significant differences associated with group membership or sex of teacher for Item 5. The test of the grand mean (which is 0.23) resulted in $F = 7.00$, $p < .05$, that is, significantly more boys than girls think boys are really good at working with globes, wires and batteries. The opposite is true for Item 6. Girls have a much higher estimation of the ability of girls to work with the equipment ($F = 36.33$, $p < .001$). Differences between boys' and girls' mean scores are similar (around -0.5) in each teacher-group, and there are no group effects nor effects associated with the sex of the teacher.

The results for Item 7 (how good are <u>you</u>?) show a different pattern. The mean differences are graphed in Figure 7.3. Analysis of the mean differences between boys' and girls' scores on this item reveal a significant interaction between group and sex of teacher ($F = 5.07$, $p < .05$). The interaction is caused by the large difference between boys' and girls' scores in the control group classes taught by female teachers, and the relatively low difference in classes taught by male teachers in this group. In the experimental group, the difference is smaller in classes taught by female teachers. In every category, the difference score is positive, and the overall mean of 0.37 is significantly different from zero ($F = 38.39$, $p < .001$). Boys are more confident of their ability to handle the electrical equipment.

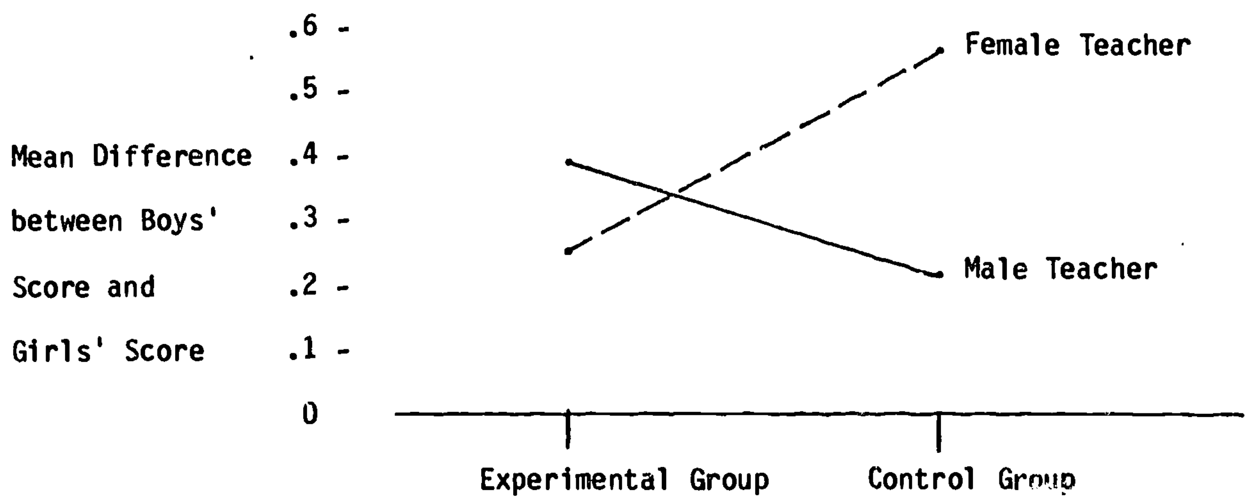


Figure 7.3: Mean Difference Scores between Boys and Girls on Item 7 - "How good are you...?"

Inspection of the means in Table 7.8 reveals that boys in the female teacher control group had the highest mean for Item 5 (most boys) and the lowest mean for Item 6 (most girls). Girls in these classes have the lowest means for Items 6 and 7. It is clear that simply having a female teacher as a role model does not ensure that girls will have high confidence in handling the equipment. However, the female teachers in the experimental group, who were sensitised to girls' problems and to the need to act as competent role models, have succeeded in having smaller differences between boys and girls on all three items.

Item 9 asked children how easy or hard they found the work in Electricity. The mean scores in Table 7.8 show that, on average, boys' means are higher than girls' means, but all are between the "sometimes easy" and "mostly easy" response choices. The mean difference scores between boys and girls are graphed in Figure 7.4, and show that the differences between boys and girls tend to be larger in classes taught by female teachers within each group. However there is no statistically significant effect attributable to either the sex of teacher or group membership. There is a significant result associated with the test of the grand mean ($F = 14.16$, $p < .01$) indicating that the average scores of boys are significantly higher than those of girls.

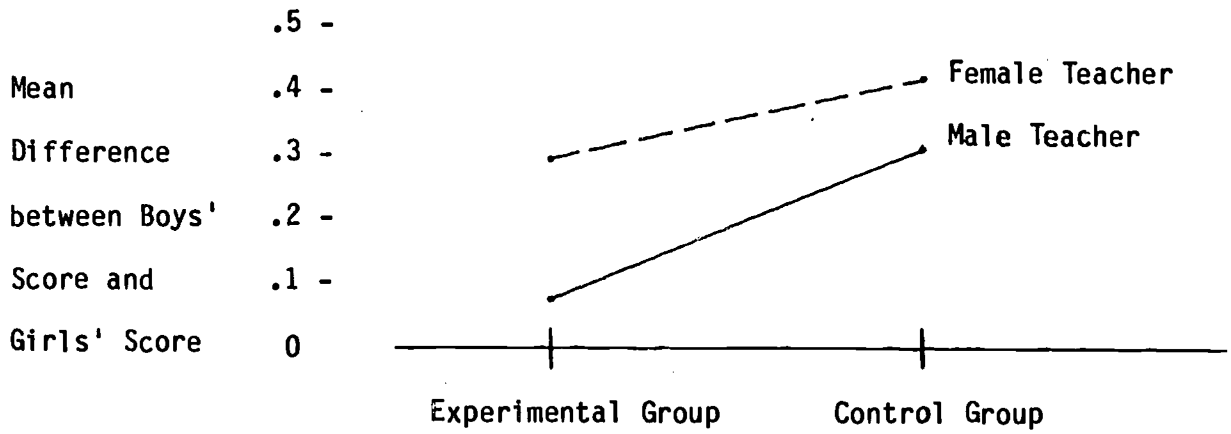


Figure 7.4: Mean Difference Scores between Boys and Girls on Item 9 - "How easy...?"

The last two items of the Final Questionnaire concern the career of electrician. Item 10, asking whether women could learn to become electricians, had very large between class differences. The mean percentages of "yes" responses are reported in Table 7.8. There was no group effect, nor was there an effect associated with sex of teacher. Overall, fewer boys than girls thought that women could become electricians - the mean difference between boys and girls was 13.8 per cent and this was significant ($F = 13.49$, $p < .01$). However, the interesting feature is the high percentage of boys in classes taught by the male control group teachers who thought that women could learn to become electricians. Item 11 asked children whether they thought they could learn to become electricians if they wanted to. The mean difference scores are graphed in Figure 7.5. There is a group effect present ($F = 3.90$) which reaches significance at the .10 level.

The difference between the percentage of boys and girls responding "yes" to this question is smaller for the experimental group than the control group. In fact, the difference between boys' and girls' responses is significant only for the control group ($F = 7.24$, $p < .05$). The results in Table 7.8 show that in all classes around 90 per cent of boys thought they could become electricians. An average of 85 per cent of girls in the experimental group said yes to this question, but only 70 per cent of girls in the control group responded "yes". In the experimental group 8 per cent fewer girls said yes to Item 11 than said "yes" to Item 10. In the control group, this difference was more than 20 per cent. Thus, many girls who thought women could be electricians, did not think they themselves could become electricians, an indication of a low level of self-confidence, particularly among girls in the control group.

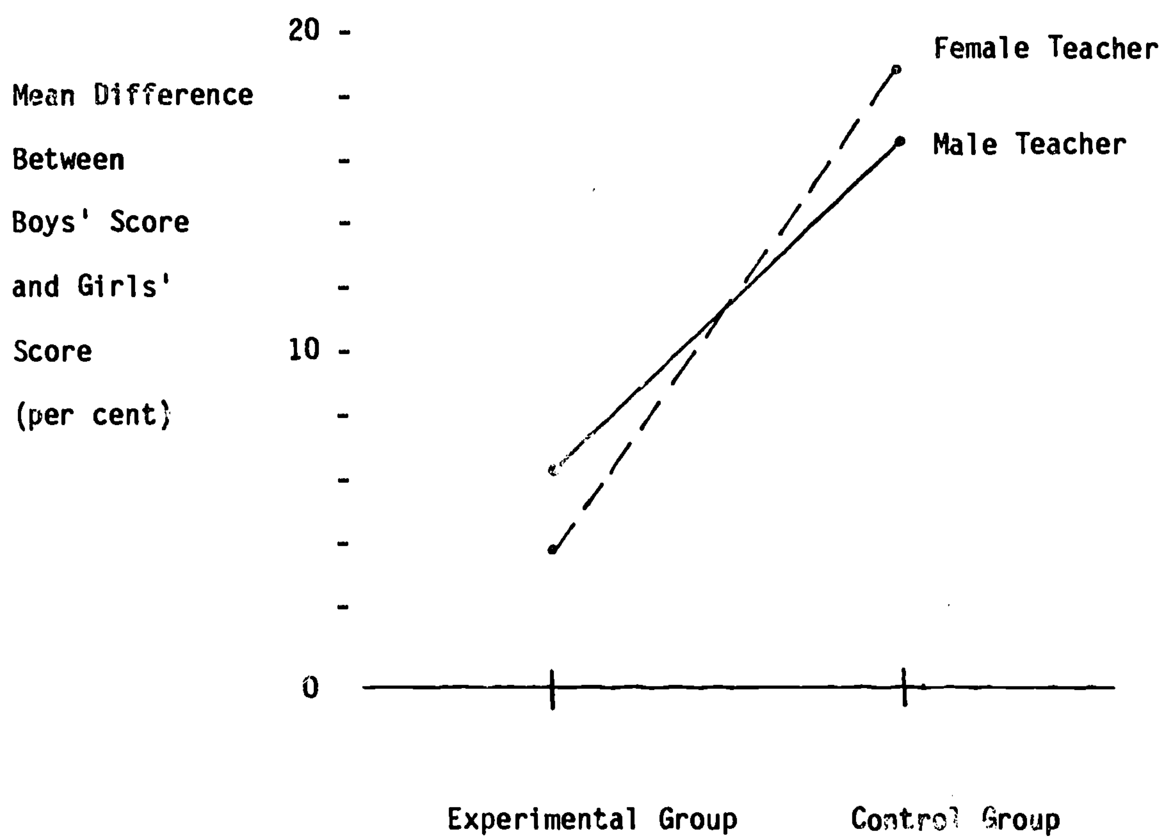


Figure 7.5: Percentage Mean Difference Scores between Bo[illegible] on Item 11 - "Could you be an electrician?"

CHAPTER 8

ANALYSIS OF OBSERVATIONAL DATA

Each of the eighteen classrooms in the research study was observed for one science lesson of about one hour in length. Classes averaged 31 children present at the time of observation. The focus of the lesson in most cases was on making a switch. There was some variation in instructional methods used by teachers. Often the lesson consisted of an introduction by the teacher to the whole class, some group work using the electrical equipment, a concluding discussion and packing up. Some teachers gave more structure to the lesson by alternating group work with short (one or two minutes) whole-class discussion of a problem, new instructions or progress check. Both of these methods were used successfully, and children were on-task an average of 95 per cent of lesson time.

The percentage of time spent in whole-class instruction by individual teachers ranged from 12 per cent to 52 per cent, with an average of 36 per cent or about twenty one minutes of a one hour lesson. Of this, an average of ten minutes were spent in question/answer discussion and between four and five minutes were used to give directions, instructions or explanations. The remaining time was used to distribute, check and pack up equipment, have children display and explain their results, check their progress and other routine matters. Many teachers had the equipment ready before class which saved considerable time. These classes all ran very smoothly, without disruptive "equipment-chasing" by children at the beginning of the lesson and during group work.

Children's Activities during Whole-class Instruction

During whole-class instruction, children's activities were recorded by sweeping the class and noting each child's activity. However, in eight classrooms, the whole-class instruction time was in several very short periods and less than four sweeps were completed during the lesson. These classes were not included in an analysis of children's activities or time-on-task. In the other ten classes, boys were on-task 93 per cent of the time, and girls 96 per cent of the time. Usually, the activities were listening to, and participating in, discussion, listening to directions, reading or writing. Some children, particularly boys, tended to handle the equipment and this was considered as time-on-task unless it was clear that the child was not attending to the lesson.

Teacher-student Interaction during Whole-class Instruction

The interactions between the teacher and children were categorised in three ways: the initiator of the interaction, the nature of the interaction, and the teacher's feedback/evaluation to the child.

Teacher-initiated Interactions

Teacher-initiated interactions were classified as either asking questions or making an evaluative statement about children's work or behaviour. There were so few evaluative statements that these were not analysed. The teacher's questions were coded as knowledge, requiring a factual or recall answer; understanding, requiring a higher cognitive level than recall; and procedural, relating to matters of procedure. The very few procedural questions were not analysed. The sex of the child responding to each question was recorded, and the teacher's feedback or evaluative reaction to the child's response was categorised as praise, affirmation, ambiguous or no response, negation, criticism. There were no critical evaluations recorded and very few praise statements. Consequently the five categories were collapsed to three for analysis: positive response for praise or affirmation of child's answer, neutral responses when there was no response or ambiguous, negative response when teacher indicates child's response was incorrect.

The number of teacher-initiated interactions recorded in each class varied between zero and 41 interactions. Female teachers tended to have more question/answer discussion than male teachers and averaged 18 interactions compared to an average of 12 for male teachers. Five male teachers recorded two or less interactions which were judged too few to analyse. Other teachers had at least nine interactions, and the analysis of these interactions is reported in Table 8.1.

Table 8.1

Analysis of Teacher Questioning and Feedback

Research Group	No. of Classes	Questions Asked (%)		Feedback (%)		
		Knowledge	Understanding	Positive	Neutral	Negative
Experimental	8	40	60			
Boys		45	43	80	18	2
Girls		55	57	69	22	9
Control	5	34	66			
Boys		39	51	83	13	4
Girls		61	49	72	28	0

Note: 1. These results are averaged using the class as unit-of-analysis.

2. The percentages of questions received by boys and girls are weighted to take account of different numbers of boys and girls in each class.

Examination of the data in Table 8.1 prompts three comments. First, teachers in both research groups asked more questions requiring at least the cognitive level of understanding to respond than simple knowledge questions.

This ratio is considerably higher than that reported in most other research (see, for example, Sirotnik, 1983, p. 20). Second, girls were more likely to be asked questions than boys. In the experimental groups, teachers asked girls about 55 per cent of both the knowledge and understanding questions. In the control group, boys and girls each received about half of the understanding questions, but the girls received 60 per cent of the knowledge questions. Third, teachers respond positively to the answers given to about three-quarters of their questions. As teachers praised very little, this simply means that children get about this many questions right, with boys getting about 10 per cent more right than girls. However, if children gave the wrong answer, teachers were more likely to ignore the response or make an ambiguous comment (such as "perhaps"), than to say that the answer was wrong. This meant that these children received no clear feedback for their response. During their observations, the researchers noticed that children receiving a neutral response appeared to lose interest in the discussion. They seemed more likely to continue listening if they were told they were wrong.

Child-initiated Interaction

Students rarely initiated interactions during whole-class instruction. Of the 284 interactions coded, only 26 were initiated by children. In five of the 18 classrooms none was recorded. In the other classrooms, a total of 19 boys initiated an interaction by volunteering some information, two asked a question and one sought an evaluation of his work. One girl volunteered information, one asked a question, and two asked for their work to be checked. Teachers gave a positive response in nearly all of these interactions.

Children's Activities during Group Work

Children worked in pairs or threes using the electrical materials for an average of 64 per cent of class time. One class had groups of four, but as there was sufficient equipment, the children worked in pairs. Children's activities during group work were coded in six categories: watching or listening to other group members; reading or writing; manipulating equipment, planning/discussing their work; other-on-task behaviour, such as finding equipment, borrowing a pencil, talking with the teacher; off-task behaviour.

The activities of each boy and girl were recorded within their group, so that patterns of activity could be examined for children in same sex and mixed groups. The data were collected by two observers each observing half of the class. These data were combined to give average results in each class for boys and girls in same sex or mixed groups. The process of data combination took account of different numbers of sweeps by the two observers, different numbers of children in groups, and different combinations of the type of group coded by each observer. The results are presented in Table 8.2 separately for the experimental and control groups. Average results for male and female teachers within each group were always less than one standard deviation apart.

During group work children were on-task for an average of 94 per cent of the time, and most of this time was spent actually working with and manipulating the electrical equipment.

Analysis of time spent by boys and girls on the various activities reveals some interesting comparisons. Table 8.2 shows first, that there is little difference between the pattern of time spent on each activity by boys whether in same sex or mixed groups, and this pattern is similar between the experimental and control groups of teachers. Second, the pattern of time spent on activities by girls in same-sex groups matches the pattern for boys in same-sex groups, and these patterns are similar between the two teacher groups. Third, in mixed groups taught by the experimental group of teachers, boys and girls spent about the same amount of time on each activity, except that girls spent a bit more time watching/listening. Compared to girls in all-girl groups, girls in mixed groups spent less time reading/writing and more time watching/listening. Almost the same amount of time was spent manipulating equipment. Fourth, in mixed groups taught by teachers in the control group, girls spent nearly 25 per cent less of their time manipulating equipment than did boys. The corresponding comparison for the experimental group is 3 per cent. Girls spent nearly one quarter of their time watching/listening, while boys spent only 6 per cent of their time in this passive involvement.

Table 8.2

Percentage of Time Spent on Activities by Children in Same-sex and Mixed Groups.

Composition of Group	Activities					
	Watching listening	Reading writing	Manipulating equipment	Planning discussing	Other on-task	Off task
			Experimental Group			
Boys						
same sex	10.0	15.5	58.6	3.9	7.1	4.9
mixed	10.8	10.7	58.8	7.0	7.4	5.3
Girls						
same sex	9.4	20.7	54.4	3.8	6.1	5.6
mixed	18.3	11.6	55.8	6.0	4.6	3.7
			Control Group			
Boys						
same sex	6.9	17.9	57.4	4.1	6.8	6.9
mixed	5.9	15.0	62.1	4.3	6.0	6.7
Girls						
same sex	10.1	22.0	49.5	5.1	7.5	5.8
mixed	24.0	22.4	37.6	4.9	3.9	7.2

Note Results are averaged using groups within classes as the unit of analysis

Participation by the experimental group of teachers in the inservice course is associated here with more active involvement of girls in the activities of group work. In classes taught by control group teachers girls were more likely than boys to watch or listen in mixed groups while the boys spent more of their time manipulating equipment. Compared to girls in all-girl groups; girls in mixed groups spent 14 per cent more time watching/listening, about the same time reading/writing and 12 per cent less time experimenting. The corresponding comparisons in the experimental group show that girls in mixed groups spent 9 per cent more time watching/listening than girls in all-girl groups, 9 per cent less time reading/writing and one per cent more time experimenting.

During the collection of group work data, the observers took note of how the groups were formed. In most cases children worked with their usual seating partner, in other cases children selected their own partner, usually of the same sex. Other times the teacher moved children into groups which were sometimes same-sex, and sometimes mixed groups. The observers noticed that children in teacher-made groups did not work as well together as did children-choice groups or usual-partner groups. As the time spent manipulating equipment is the activity requiring the most sharing and working together, an ex post facto analysis of this data was made using the group as the unit of analysis. The results appear in Table 8.3. Teacher-made groups occurred less often in the experimental classes than in the control classes, so it was important to show that the method of group formation is not confounding the results reported in Table 8.2.

The figures in Table 8.3 suggest that all children spend more time with the equipment when they are working with their friends or their usual seating partner, than when in groups selected for that lesson by the teacher. A possible explanation, based on this analysis and classroom observation, is that children more readily share tasks in a cooperative way when they are working with someone they know well. This results in higher average time manipulating the equipment than if there is indecision about who does what. If this serendipitous finding is supported in other classroom observation, then it is a factor of which teachers should take cognisance when planning group interactions.

Table 8.3

Mean Time Spent Manipulating Equipment by Children in Different Groups

Group	Usual or Child-selected Partner		Teacher-selected Partner	
	n	Time (%)	n	Time (%)
Boys				
same sex	94	60.6	18	52.8
mixed	36	61.4	23	53.7
Girls				
same sex	76	54.1	15	46.3
mixed	36	60.3	23	36.0

Teacher-student Interaction during Group Work

Teacher-student interactions during group work took place as a result of the group calling for the teacher's assistance, or the teacher observing the group in a supervisory role. If the group was progressing satisfactorily, the teacher often moved past without comment. Other times, the teacher offered help and/or gave an evaluation of work or progress. Such evaluation was coded as positive or negative. Negative evaluation was usually corrective rather than critical. Only two or three critical evaluations of behaviour were noted and these are not analysed.

Teacher interactions with groups were described without reference to sex because the interaction involved the whole group, but the observations are analysed separately for same sex and mixed groups. Analysis was based on a class analysis which took account of the different numbers of groups of each composition in the class to arrive at a per group figure which was comparable between classes. Class results were then averaged over the research groups of teachers, and are reported in Table 8.4.

Table 8.4

Mean Teacher-student Interactions per Group during Group Work

Research Group	Groups interacted with (%)	Number of interactions initiated by: Teacher	Number of interactions initiated by: Student	Teacher uses equipment (%)	Teacher evaluates: Positive (%)	Teacher evaluates: Negative (%)
All-Boy Groups						
Experimental						
male	81	1.05	.59	27	13	4
female	95	1.51	.82	21	19	2
Control						
male	87	1.36	1.00	35	9	6
female	79	1.09	1.10	23	15	0
Mixed-Sex Groups						
Experimental						
male	86	1.32	.75	16	8	2
female	100	2.30	.70	6	20	0
Control						
male	86	.77	.58	7	4	12
female	100	.87	1.37	15	22	0
All-Girl Groups						
Experimental						
male	84	.82	1.35	32	6	0
female	90	1.44	1.31	39	7	0
Control						
male	72	1.30	1.31	34	23	3
female	93	.54	1.21	50	12	0

The first column in Table 8.4 is a measure of the degree of supervision of groups in each class. The figure gives the percentage probability that each group was observed by, or interacted with, the teacher at least once during the lesson. For example, in classes taught by male teachers in the research group, 81 per cent of all boy groups could be expected to be involved in at least one interaction with the teacher. Female teachers interacted with all of the mixed groups in their classes. In general, female teachers were more likely than male teachers to interact with all groups in their classes.

The number of interactions varied within each class, and the second and third columns of Table 8.4 report the average number of interactions per group which occurred during the lessons. Of course, there are likely to be more interactions when more lesson time is spent on group work, and when teachers move quickly between groups rather than stay for long interactions with a few groups. Nevertheless, the results show that teachers tended to initiate the interactions with all-boy groups, and girls tended to initiate the interactions with all-girl groups. Teachers in the experimental group supervised the mixed-sex groups closely, initiating the highest number of interactions with these groups.

During some interactions, teachers handled the electrical equipment either by helping children "get it right", or by actually completing the work for them. The percentage of interactions where this occurred is recorded in the fourth column of Table 8.4. In general, teachers seem more likely to help all-girl groups in this way, and least likely to help mixed groups. Female teachers, particularly those in the control group, were less likely to help the boys' groups than the girls' groups.

The last two columns in Table 8.4 report the nature of evaluation teachers made for progress or work completed. These evaluations occurred in less than one quarter of the interactions and were usually positive. Contrary to evaluation given for answers to teacher questions in whole-class discussion, most positive evaluations were praise, rather than a simple affirmation that work was correctly done. In a number of cases, children were asked to display completed work to the class, or to show "how they did it". Teachers usually chose equal numbers of boys and girls when calling on individuals for this purpose.

Informal Observations

During classroom visits, the researchers had the opportunity to talk informally with teachers, and generally the teachers' ideas were reflected in their responses to the Final Questionnaire which were discussed in Chapter 6. The researchers also were able to listen to discussions between teacher and students, and among students. Much of the content related to how the students were progressing in the planning and execution of the task in hand, but some of the comments relevant to the research were not easily coded. One example involved a teacher from the control group who several times instructed girls with equipment problems to "go and ask the boys". Given that the teacher was busy with another group, it is reasonable to ask students to seek help from their peers, but it may have been better to avoid this particular phrase and name specific students who were coping well - many of whom were girls.

Two other examples of children's interactions are worth recording here. Each occurred in a class taught by a control group teacher. In the first example, a boy and girl seated directly in front of one observer were given the task of making up a switch. The boy took the equipment and began work. The girl alternated between watching and looking about the room. On two separate occasions the teacher instructed the boy to share the equipment and work together. After the second visit by the teacher the boy turned to other boys behind and said "This is men's work. You can't let girls do this - they'll only mess it up". In the second example, two boys were working on a task watched by the girl who was the third member of their group. Seeing that a piece of masking tape was required, the girl picked up tape and scissors to cut a piece. One boy said "I'll do that", grabbed the tape and cut it. Then, with the scissors still in his hand, said to the girl "You've gone and made it too short!".

Both of these anecdotes point to a lack of belief by boys in girls' ability to perform the required tasks, and an unwillingness to allow them active involvement. The observations are consistent with the objective data from the coding sheets which show girls in mixed groups are likely to miss out on hands-on activities. Boys were seen to snatch equipment from girls and to ridicule their attempts to contribute. Interestingly, the reverse was not observed. It may have been coincidence that these observations occurred in control group classes rather than experimental group classes, but the objective observational data suggest that girls did get a better deal in the latter. In any case, it is clear girls need help to become actively involved when boys are paternalistic in their actions.

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APPENDIX A

TEACHERS' INITIAL QUESTIONNAIRE (page 1)

TEACHER QUESTIONNAIRE

NOTE: The number in the top right corner is the code for this questionnaire. Your name is not required. Your responses will contribute to our overall picture for Year 5 science, but will be anonymous.

TEACHER BACKGROUND

Present School ______________________ Sex __________

Please give details of your training for teaching

Teaching Qualification(s) ______________________ Year Completed __________

Institution ______________________ Major Area __________

Units taken concerned with science ______________________

Other qualifications relevant to teaching ______________________

Please indicate the Year levels you have taught recently (and/or specialist subjects or duties)

1982 ______________________

1981 ______________________

1980 ______________________

1979 ______________________

Please name any hobbies or interests outside of school which are related to science

____

SCIENCE PROGRAMMING

On average, how many minutes each week are programmed for science? __________ minutes per week

What time of day is science usually taught? am or pm (circle one)

What science topics are programmed for this year, and were programmed for last year?

1983 ______________________

____

1982 ______________________

____

What resources do you usually use in planning your science programmes? (For example, the Primary Science Syllabus, the Doing Science books, Science Skills Box)

____

Please name any science topics you prefer to teach ______________________

____

Please name any science topics you prefer not to teach ______________________

____

YOUR PRESENT CLASS (Please tick one box for each question)

Do you consider your class to be .... fairly uniform in terms of ability ☐

mixed in terms of ability ☐

In general terms, do you consider the ability of your class to be .... above average ☐

about average ☐

below average ☐

TEACHERS' INITIAL QUESTIONNAIRE (page 2)

HOW DO YOU FEEL ABOUT TEACHING IN THE DIFFERENT AREAS OF SCIENCE?

The following statements refer to the four areas described in the Primary Science Syllabus

ANIMALS - example topics are spiders and reptiles
PLANTS - example topics are fungi and plant propagation
MATTER - example topics are air, mixing and changing matter, structures
ENERGY - example topics are shadows, electricity, wheels.

Although you may not use this syllabus, the science you are teaching can probably be divided into these four areas. Please respond to these statements by ticking the appropriate box in each of the four areas of science.

	ANIMALS	PLANTS	MATTER	ENERGY
My own interest in teaching this area is best described as				
highly motivated	☐	☐	☐	☐
motivated	☐	☐	☐	☐
not motivated	☐	☐	☐	☐
My own background knowledge for teaching this area is best described as				
extensive	☐	☐	☐	☐
adequate	☐	☐	☐	☐
extra preparation needed	☐	☐	☐	☐
The teaching resources (equipment, A-V aids, specimens, etc.) available for this area are				
more than adequate	☐	☐	☐	☐
just adequate	☐	☐	☐	☐
less than adequate	☐	☐	☐	☐
My skill in teaching this subject area is best described as				
competent	☐	☐	☐	☐
reasonable	☐	☐	☐	☐
I'm not too sure of my ability	☐	☐	☐	☐
For boys, and looking to the future, this area is generally				
useful and relevant	☐	☐	☐	☐
barely useful and relevant	☐	☐	☐	☐
useless and irrelevant	☐	☐	☐	☐
For girls, and looking to the future, this area is generally				
useful and relevant	☐	☐	☐	☐
barely useful and relevant	☐	☐	☐	☐
useless and irrelevant	☐	☐	☐	☐
In my experience, boys generally find this area				
easy to understand	☐	☐	☐	☐
presents occasional difficulties	☐	☐	☐	☐
hard to understand	☐	☐	☐	☐
In my experience, girls generally find this area				
easy to understand	☐	☐	☐	☐
presents occasional difficulties	☐	☐	☐	☐
hard to understand	☐	☐	☐	☐

TEACHERS' INITIAL QUESTIONNAIRE (page 3)

DO BOYS AND GIRLS RESPOND DIFFERENTLY TO SCIENCE?

How many of your boys and girls respond as described in science lessons?

Please tick one box for boys and one box for girls in each column, for each of the described behaviours. Try to think specifically of science, rather than for lessons as a whole.

Behaviour		BIOLOGICAL SCIENCE (ANIMALS and PLANTS) all or almost all	3/4	1/2	1/4	very few	PHYSICAL SCIENCE (MATTER and ENERGY) all or almost all	3/4	1/2	1/4	very few
1. approach task with confidence	boys	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	girls	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2. are easily interested	boys	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	girls	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
3. take pride in the appearance of their work	boys	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	girls	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4. work enthusiastically	boys	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	girls	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5. volunteer new information and own ideas	boys	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	girls	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6. try to solve their own problems before seeking help	boys	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	girls	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
7. take an active, rather than a passive, role in the lesson	boys	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	girls	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8. seem to enjoy their work	boys	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	girls	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
9. get good results	boys	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	girls	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
10. prefer to work alone, rather than in a group	boys	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	girls	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
11. participate willingly in lesson	boys	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	girls	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
12. do extra work at home	boys	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	girls	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
13. have no trouble keeping up	boys	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	girls	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
14. concentrate throughout lesson	boys	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	girls	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
15. find the work easy	boys	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	girls	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

TEACHERS' INITIAL QUESTIONNAIRE (page 4)

WHAT HAPPENS IN YOUR SCIENCE LESSONS?

Think back over your lessons in science during this term. Probably you use a variety of different techniques or activities in your teaching, possibly some more than others.

Please estimate how frequently each of the following kinds of activities occurs in your science lessons.

Please tick the box which most closely estimates the percentage of science lessons in which the activity occurs.

	Percentage of lessons over a term in which the activity occurs									
	BIOLOGICAL SCIENCE (ANIMALS and PLANTS)					PHYSICAL SCIENCE (MATTER and ENERGY)				
Activities	90% or more	about 70%	about 50%	about 30%	10% or less	90% or more	about 70%	about 50%	about 30%	10% or less
teacher tells or explains science content	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
question and answer, teacher-led class discussion	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
teacher demonstration	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
film/slide/tape/TV/radio presentation	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
children do the same teacher-directed experiment or activity	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
children do own experiment or activity (possibly using activity cards)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
children discuss topics in small groups	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
children work alone on directed written work	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
children research own assignment or project	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
other activity—please describe ____________	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

How many science-related excursions will your class have this term? ______ excursions.

APPENDIX A (continued)

TEACHERS' INITIAL QUESTIONNAIRE (page 5)

WHY TEACH SCIENCE?

Listed below are some possible reasons for teaching science.

How much importance does your science teaching and programming give to each of these considerations in teaching science to children at the Year 5 level?

For each statement, please circle the level of importance you consider appropriate for your Year 5 class.

Possible reasons for teaching science to Year 5	high importance				low importance
to interest children in science	5	4	3	2	1
to provide scientific knowledge	5	4	3	2	1
to give practice in manipulative skills	5	4	3	2	1
to give practice in communication skills - verbal	5	4	3	2	1
to give practice in communication skills - written	5	4	3	2	1
to give practice in problem-solving skills	5	4	3	2	1
to develop social skills (such as cooperation)	5	4	3	2	1
to prepare students for science later on	5	4	3	2	1
to show how science is related to everyday life	5	4	3	2	1
to integrate science with other school subjects	5	4	3	2	1
to develop self-discipline and independence	5	4	3	2	1
any other reasons? please state					
______________________________	5	4	3	2	1
______________________________	5	4	3	2	1
______________________________	5	4	3	2	1

Please make any other comments you wish about science teaching and learning for boys and girls and the different areas of science.

____

____

____

____

____

____

____

THANK YOU

WE ARE VERY GRATEFUL YOU COULD SPARE THE TIME TO HELP US.

TEACHERS' FINAL QUESTIONNAIRE (page 1)

TEACHER POST-QUESTIONNAIRE - PART A

Please indicate your sex ☐

Now you have been teaching the electricity topic would you please respond to these questions specifically for electricity.

ELECTRICITY

My own interest in teaching electricity is best described as

- highly motivated ☐
- motivated ☐
- not motivated ☐

My own background knowledge for teaching electricity is best described as

- extensive ☐
- adequate ☐
- extra preparation needed ☐

My skill in teaching electricity is best described as

- competent ☐
- reasonable ☐
- I'm not too sure of my ability ☐

For boys, and looking to the future, the electricity topic is generally

- useful and relevant ☐
- barely useful and relevant ☐
- useless and irrelevant ☐

For girls, and looking to the future, the electricity topic is generally

- useful and relevant ☐
- barely useful and relevant ☐
- useless and irrelevant ☐

In my experience, boys generally find the electricity topic

- easy to understand ☐
- presents occasional difficulties ☐
- hard to understand ☐

In my experience, girls generally find the electricity topic

- easy to understand ☐
- presents occasional difficulties ☐
- hard to understand ☐

TEACHERS' FINAL QUESTIONNAIRE (page 2)

DID BOYS AND GIRLS RESPOND DIFFERENTLY TO THE ELECTRICITY TOPIC?

How many of your boys and girls responded as described in the topic of electricity?

Please tick one box for boys and one box for girls in each column, for each of the described behaviours. Think specifically of electricity rather than science as a whole.

Behaviour		ELECTRICITY all or almost all	3/4	1/2	1/4	very few
1. handled equipment with confidence	boys	☐	☐	☐	☐	☐
	girls	☐	☐	☐	☐	☐
2. were easily interested	boys	☐	☐	☐	☐	☐
	girls	☐	☐	☐	☐	☐
3. worked enthusiastically throughout the science topic	boys	☐	☐	☐	☐	☐
	girls	☐	☐	☐	☐	☐
4. volunteered new information and own ideas	boys	☐	☐	☐	☐	☐
	girls	☐	☐	☐	☐	☐
5. tried to solve their own problems before seeking help	boys	☐	☐	☐	☐	☐
	girls	☐	☐	☐	☐	☐
6. took an active, rather than a passive, role in the lesson	boys	☐	☐	☐	☐	☐
	girls	☐	☐	☐	☐	☐
7. seemed to enjoy their work	boys	☐	☐	☐	☐	☐
	girls	☐	☐	☐	☐	☐
8. did extra work outside of time allocated for science	boys	☐	☐	☐	☐	☐
	girls	☐	☐	☐	☐	☐
9. had no trouble achieving the objectives of the lesson	boys	☐	☐	☐	☐	☐
	girls	☐	☐	☐	☐	☐

T B PROBLEMS EXPERIENCED IN THE ELECTRICITY TOPIC

ing our visits and talks with teachers, a number of problems, or potential problems, were mentioned.

much of a problem for you, were the follow things?

SIBLE PROBLEM	Did not occur	Occurred but caused no concern	A problem but easily over come	A problem overcome with effort	A continuing problem
Obtaining sufficient equipment	☐	☐	☐	☐	☐
Storing the equipment	☐	☐	☐	☐	☐
More than reasonable time required to prepare for the lessons	☐	☐	☐	☐	☐
Too much equipment consumed (eg blown globes, flat batteries etc.)	☐	☐	☐	☐	☐
Boys used equipment more than girls	☐	☐	☐	☐	☐
Boys couldn't see the point of doing electricity	☐	☐	☐	☐	☐
Girls couldn't see the point of doing electricity	☐	☐	☐	☐	☐
I had to spend extra time with girls explaining how to use equipment	☐	☐	☐	☐	☐
Any other problems? Please specify.					
______________	☐	☐	☐	☐	☐
______________	☐	☐	☐	☐	☐

TEACHERS' FINAL QUESTIONNAIRE (page 4)

FEEDBACK ON THE INSERVICE WORK

Now that you have taught the electricity topic, please reflect back on the inservice programme you attended.

Would you please indicate

1. any parts of the inservice programme you found particularly useful to you

2. any parts you found not useful to you

3. ways such inservice work could be made more useful

4. How did the inservice make a difference (if any) to your approach to the electricity topic?

a) in relation to the content?

b) in relation to the teaching strategies?

c) in relation to the ways you dealt with boys and girls?

APPENDIX B

CHILDREN'S INITIAL QUESTIONNAIRE (page 1)

Here are some questions about science.

First, here is a practice question. Put a tick on the circle which is right for your answer

	Not at all	A little bit	A fair bit	A lot
How much would you like to meet a dinosaur?	o	○	◯	◯

(If you aren't sure how to answer, ask your teacher.)

Now here are the questions for you.

HOW MUCH WOULD YOU LIKE TO FIND OUT	Not at all	A little bit	A fair bit	A lot
how iron ore is made into steel	o	○	◯	◯
how electricity makes the television work	o	○	◯	◯
how compost helps plants to grow better	o	○	◯	◯
how germs can make you sick	o	○	◯	◯

HOW MUCH DO YOU LIKE TO DO	Not at all	A little bit	A fair bit	A lot
experiments with earthworms	o	○	◯	◯
experiments with shadows	o	○	◯	◯
experiments with seeds	o	○	◯	◯
experiments with water	o	○	◯	◯

HOW MUCH DO YOU LIKE TO DO SCIENCE WORK	Not at all	A little bit	A fair bit	A lot
about the weather	o	○	◯	◯
about moths, butterflies and caterpillars	o	○	◯	◯
about wheels and motors	o	○	◯	◯
about mushrooms and toadstools	o	○	◯	◯

HOW MUCH WOULD YOU LIKE TO	Not at all	A little bit	A fair bit	A lot
collect rocks and minerals	o	○	◯	◯
make working models from Lego or other kits	o	○	◯	◯
grow your own vegetable or flower garden	o	○	◯	◯
look after mice or goldfish as pets	o	○	◯	◯

CHILDREN'S INITIAL QUESTIONNAIRE (page 2)

HOW MUCH WOULD YOU LIKE TO	Not at all	A little bit	A fair bit	A lot
work out ways to make a torch globe light up	o	○	◯	◯
test things to see if electricity passes through them	o	○	◯	◯
cut up a battery or a torch globe to see what's in it	o	○	◯	◯
make your own switch to turn a light on and off	o	○	◯	◯
do an experiment to see how brightly a torch can shine	o	○	◯	◯

If you wanted to, could *you* be a scientist when you grow up? (say yes or no) ________

Please write why yes or no ____

____

____

APPENDIX B (continued)

CHILDRENS FINAL QUESTIONNAIRE

Here are some questions about the science work in electricity you have been doing, using globes, wires and batteries.

PLEASE ANSWER THESE QUESTIONS WITH A TICK IN THE CIRCLE WHICH IS RIGHT FOR YOU.

HOW MUCH DID YOU ENJOY	Not at all	A little bit	A fair bit	A lot
working out ways to make a torch globe light up	o	○	◯	◯
testing things to see if electricity passed through them	o	○	◯	◯
using globes, wires and batteries to make different circuits	o	○	◯	◯
making your own switch to turn a light on and off	o	○	◯	◯

THINK ABOUT YOUR CLASS MATES WORKING IN SCIENCE	Hopeless	Not much good	Pretty good	Really good
How good are MOST <u>BOYS</u> at working with globes, wires and batteries	o	○	◯	◯
How good are MOST <u>GIRLS</u> at working with globes, wires and batteries	o	○	◯	◯
How good are <u>YOU</u> at working with globes, wires and batteries	o	○	◯	◯

FOR EACH OF THESE QUESTIONS, PLEASE TICK THE <u>ONE</u> BOX WHICH IS THE RIGHT ANSWER FOR YOU

How much did you enjoy working with globes, wires and batteries?

- LESS than I thought I would ☐
- AS MUCH as I thought I would ☐
- MORE than I thought I would ☐

How hard did you find the electricity work with globes, wires and batteries?

- always hard ☐
- mostly hard ☐
- sometimes hard, sometimes easy ☐
- mostly easy ☐
- always easy ☐

Most electricians are men. Do you think women could learn to become electricians?

(say yes or no) __________

Could <u>you</u> learn to be an electrician if you wanted to?

(say yes or no) __________

WHOLE-CLASS ACTIVITY SCHEDULE

1 ________ Teacher ________ Room ___ Date ________ Sheet No. ______

of p	STUDENT ACTIVITIES						No. in Class	NOTES
	Watching Listening	Reading Writing	Manipulating Equipment	Planning Discussing	Other on Task	Off Task		
B								
G								
B								
G								
B								
G								
B								
G								
B								
G								
B								
G								
B								
G								
B								
G								
B								
G								

GROUP WORK SCHEDULE

(Groups formed by teacher/children/usual seating)

______________ Teacher ______________ Room ______ Date ______________ Sheet No. ______

No. in Gp.	STUDENT ACTIVITIES						TEACHER-STUDENT INTERACTION					NOTES
	Watching Listening	Reading Writing	Manipulating Equipment	Planning Discussing	Other On Task	Off Task	Initiator S or T	Tell or Discuss	Uses Equipment	Evaluates work +/o/-	Evaluates Behaviour +/o/-	

TEACHER-STUDENT INTERACTION SCHEDULE

______________ Teacher ______________ Room ______ Date ______________ Sheet No. ______

TEACHER-INITIATED					STUDENT-INITIATED					NOTES
Teacher Asks Question			Teacher Evaluates			Question				
n	Sex	Feedback to student response	Work	Behaviour	Sex	Type of Question	Teacher Response	Volunteer Information	Seeks Evaluation	
	B G	++ Praises answer + Affirms ± Ambiguous/perhaps o No response - Negate -- Criticise	++ Praise + Affirms o No response or returns to task - Negate -- Criticise		B G	K U P	++ Praise + Answer/acknowledge o Ignore - Negate -- Criticise			

APPENDIX C (continued)

LESSON ABSTRACT SHEET

LESSON ABSTRACT

School ______________________ Date ______________

Lesson Topic: ______________________

Time	Class Organisation*	Activity taking place

* WCI = Whole-class instruction

GW = Group work

CLASSROOM OBSERVATION - OVERVIEW OF PROCEDURE AND PURPOSE

CLASSROOM OBSERVATION - OVERVIEW OF PROCEDURE AND PURPOSE

Lesson Abstract Sheet (Observers A and B)

1. Filled in throughout lesson
2. Notes times and activities in progress
3. Gives overview of lesson content

Teacher-Student Interaction Schedule (Observer A)

1. Filled in during whole-class instruction
2. All interactions with identifiable individuals are coded
3. Gives student involvement in lesson through response to teacher questions, or initiating question or comment

Whole-Class Activity Schedule (Observer B)

1. Filled in during whole-class instruction
2. Sweep class every three minutes and record type of student involvement in lesson

Group Work Schedule for Children's Activities (Observers A & B)

1. Filled in during group or individual work
2. Sweep groups at regular intervals of one and a half minutes and record type of student in lesson and teacher-group interactions
3. Each observer records half of the class.

Note

Do not code when class is not working, i.e. before lesson begins, distributing/collecting equipment, during interruptions (e.g. Public address announcements).

APPENDIX D

SAMPLE WORK SHEET USED FOR INSERVICE

WORKSHEET FOR USE BY TEACHERS

Overcoming Sex Bias in Active Teaching Attention

- Ask a colleague to observe your classes, using the assessment sheet for the Active Teaching Attention Pattern. Better yet, have your classes video or audio taped. Then, using the assessment sheet, replay the tapes and evaluate your own teaching behavior.
- Circulate around the room, positioning yourself in different areas, to influence the degree of involvement of both girls and boys in learning.
- Make a conscious effort to encourage equal participation of all students. Hold both boys and girls accountable to the same standards for participation in classroom discussion.
- Distribute both *lower order* and *higher order questions* to girls and boys on an equitable basis.
- Measure your wait time to insure an equal distribution for girls and boys.
- Distribute reinforcement to both girls and boys, including verbal and non-verbal reinforcers.
- Give extended directions to boys and girls on an equitable basis; provide extensive directions so girls and boys can complete tasks independently; and, avoid doing or completing tasks for students.

Overcoming Sex Segregation in Classroom Interaction*

- Ask a colleague to observe your classes, using the assessment sheet for the Sex Segregation Pattern. Better yet, have your classes video or audio taped. Then, using the assessment sheet, replay the tapes and evaluate your own teaching behavior.
- When seating and lining up pupils, use categories other than gender to divide the class.
- At the elementary level, avoid sex-segregated play areas.
- When students self-segregate in their own activities, it may be necessary to form a new organizational pattern to achieve classroom integration.
- Encourage both sexes to participate in traditional and nontraditional activities.
- If students are uncomfortable with nonstereotyped assignments, discuss the issue of sex stereotyping and today's changing roles for women and men.
- Examine textbooks and other instructional materials for sex role stereotyping and sexist language.
- Make a conscious effort to assign boys and girls leadership and support roles on an equitable basis both within and outside the classroom (e.g., field trips).
- Encourage and reinforce girls and boys who are working and playing cooperatively.

Overcoming Sex Bias in Classroom Discipline

- Ask a colleague to observe your classes, using the assessment sheet for the Classroom Discipline Pattern. Better yet, have your classes video or audio taped. Then, using the assessment sheet, replay the tapes and evaluate your own teaching behavior.
- Avoid stereotyping girls as obedient and complacent and boys as aggressive and disruptive.
- The manner in which reprimands are given should be related to the misbehavior and not applied on the basis of sex.
- Harsh and public discipline is likely to be an ineffective approach for both female and male students.
- If penalties are given for inappropriate behavior, they should be related to the infraction and not applied on the basis of sex.

Overcoming Sex Bias in Verbal Evaluation

- Ask a colleague to observe your classes, using the assessment sheet for the Verbal Evaluation Pattern. Better yet, have your classes video or audio taped. Then, using the assessment sheet replay the tapes and evaluate your own teaching behavior.
- Avoid stereotyping girls as excelling in neatness and boys as excelling at intellectual accomplishment.
- Distribute praise for academic work to boys and girls on a fair and equitable basis:
  - . *Verbal reinforcement*--When students hand in good papers or make good comments about subject matter, offer such responses as: 'fine', 'very good', or 'excellent point'.
  - . *Nonverbal reinforcement*--Your can respond positively to students' academic work without saying anything: maintain eye contact with the students who are talking, lean toward them, move closer, nod affirmatively, smile, make physical contact, e.g., a touch, a hug, or a handshake.
  - . *Delayed reinforcement*--If a boy or girl makes a good comment at the beginning of a lesson, refer to or build upon that idea during the lesson or even during another lesson conducted at a later time.
- Identify both boys and girls whose academic work reflects neatness and conforms to rules of form.
- Identify both girls and boys whose academic work meets the standards of intellectual competence.
- When a student's verbal comment or written work is incorrect or doesn't meet standards of form and intellectual quality, go beyond criticizing and offer remediation comments to both girls and boys. Make sure the boy or girl clearly understands the nature of the inadequacy as well as how to correct it. Remember, it is extremely important to encourage both girls and boys to try harder

FEEDBACK

PART B PROBLEMS EXPERIENCED IN THE ELECTRICITY TOPIC

During our visits and talks with teachers, a number of problems, or potential problems, were mentioned.

How much of a problem for you, were the follow things?

POSSIBLE PROBLEM	Did not occur	Occurred but caused no concern	A problem but easily over come	A problem overcome with effort	A continuing problem
1. Obtaining sufficient equipment			X		
2. Storing the equipment		X			
3. More than reasonable time required to prepare for the lessons		X			
4. Too much equipment consumed (eg blown globes, flat batteries etc.)			X		
5. Boys used equipment more than girls	X				
6. Boys couldn't see the point of doing electricity	X				
7. Girls couldn't see the point of doing electricity	X				
8. I had to spend extra time with girls explaining how to use equipment		X			

9. Any other problems? Please specify.

① Children wanting to go overtime with equipment → (A problem but easily over come)

② Children going off track, wanting to follow own ideas and interests. Disappoints myself and them if I stop them → (A problem overcome with effort)

③ Recording individual skills → (A continuing problem)

④ Problems in manipulation of equipment which hindered development of objectives for some children → (A continuing problem)

⑤ Girls having the correct "solution", but not voicing them with boys around or as their partners → (A continuing problem)

FEEDBACK ON INSERVICE - CONTROL GROUP (page 1)

4

FEEDBACK (4)

½ day inservice

FEEDBACK ON THE INSERVICE WORK

Now that you have taught the electricity topic, please reflect back on the inservice programme you attended.

Would you please indicate

1. any parts of the inservice programme you found particularly useful to you

    1. 1. Practical aotivities and work cards
       2. Programme given to us.
    2. Programmes - ways of programming
       Cards - presentation of and activitiss involved
       Activity - being actively involved (experimenting)
    3. Practical involvement and the programmes provided - more please.
    4. The actual working experience in doing the experiments before the kids did it helped me as I found other avenues to guide the quicker children along.
    5. Examples of lessons.
    6. Hands on activities, lesson outlines
    7. Useful as a motivating force. Programme most helpful.
    8. Tsachers participating and completing activities which in turn, were attempted by the children in the classroom

2. any parts you found not useful to you

    No comments.

3. ways such inservice work could be made more useful

    1. Discuss more than one topic in science.
    2. Emphasis the practical involvement of the teachers. Include segment on programming/card making - if time allows.
    3. More time for it.
    4. Places or names where chsap equipment could be obtained relevant to the topic.
    5. I found this in service course very adequate.
    6. More of them.

4. How did the inservice make a difference (if any) to your approach to the electricity topic?

    a) in relation to the content?

    1. It gave me a starting point and a sequence of activities which were harder as you went on.
    2. Made me more aware of the greater interest I could generate to the kids thus making the whole topic interesting and productive.

APPENDIX E (continued)

FEEDBACK ON INSERVICE - CONTROL GROUP (page 2)

(5)

3. I found out what problems children might come across when they work through the experiments.

4. More specific.

5. More confident as I had worked through the activities beforehand which isn't always possible in other lessons.

6. The inservice acted as an incentive to attempt, with greater confidence, the teaching of the content.

b) in relation to the teaching strategies?

1. Lesson notes given out were helpful

2. More concise and definite ideas/pts to arrive at.

3. Materials used during, and kept after inservice were particularly helpful in programming andpreparing for lessons in 'electricity'.

c) in relation to the ways you dealt with boys and girls?

1. None

2. Possibly more conscious of the girls and went out of my way to help them to the detriment of the boys, at times. Grouped girls with girls as I found this to be the most affective means of making the lesson successful.

3. Became more conscious of the girls and had them in groups boy/girl which was not good.

5. Boys and girls seemed to cope equally as well.

6. Reinforced my own desire to do something about stereotypes and role identification by gender.

7. Nil

8. Self-confidence was raised, knowing one had the ability to explain some problems the children posed. Assistance was given to both sexes when it was sought.

APPENDIX E (continued)

FEEDBACK ON INSERVICE - EXPERIMENTAL GROUP (page 1)

FEED BACK ⑥

2 day inservice

FEEDBACK ON THE INSERVICE WORK

Now that you have taught the electricity topic, please reflect back on the inservice programme you attended.

Would you please indicate

1. any parts of the inservice programme you found particularly useful to you

1. Actually being able to do the activitiss and see some of the problems children encounter was excellent. The whole insrvice was great! Thanks.

2. The main thrust of all the people toward equal opportunity for girle in primary classrooms.

3. The session spent on electricity.

4. Information concerning sexism and eleotricity. Very useful actually doing activities - making circuits, switch.

5. 'Homework' - made aware of traps of sexism I'm falling into because of my socialization. (I researched Sex Segregation).

6. 1. The 'hands on' experimental sessions. These improved my confidence.
   2. The activity worksheets used later in class.
   3. The discuseione on 'sexism' increased my awareness of the problems at hand.
   4. The opportunity to discuss educational issues at leisure.

7. 1. 'Hands on' work with advisory staff to asist with electricity topic.
   2. Lectures on the diff. conditioning of girle and boys from birth and the different teaching strategies for girls and boys and the effect this has on self-esteem.

8. 1. The prepared prediction sheets and programme outline handed out.
   2. Seeing and handling materials connected to topic.

9. Sessione where we actually worked with equipment and looked at programming.

2. any parts you found not useful to you

1. The organization was very good and the programme ran in logical sequence , i.e. it made sense.

2. No.

3. The long discussions on sexism.

4. Surprised at how much time was devoted to sexism. Had expected to be doing more work on electricity.

5. Not really—all sections aimed at awareness and this was achieved. Some sections may have hammered the point a bit long.

6. The flick thru the revised syllabus. I can read!

7. I found it all most beneficial - wish it had gone on longer and covered more topics plus ways to alter teaching patterns so that girls are not so disadvantaged.

8. No comments.

9. Sessions on sexism were too drawn out.

FEEDBACK ON INSERVICE - EXPERIMENTAL GROUP (page 2)

7

3. ways such inservice work could be made more useful

1. Only by actually using a small group of children at the inservice to see if any hidden or real problems might surface. Could be interesting trying this?
2. Visits to schools to record what was happening followed by group inter-action of its significance in stereotyping sex roles.
3. No comments made.
4. Perhaps an extra activity session - develops more confidence in using equipment with own class.
5. More time on 'doing' science. Perhaps being taught as a class-videod. Analysis of lesson could be done by the inservice group in terms of how males and females interacted.- apply to classrooms of our own.
6. It should be held more often and with the same practical help.
7. I found it all most beneficial - wish it had gone on longer and covered more topics plus ways to alter teaching patterns so that girls are not so disadvantaged.
8. No comments made.
9. A lot more practical advice on conducting science lessons in large classes, group work etc. programming.

4. How did the inservice make a difference (if any) to your approach to the electricity topic?

a) in relation to the content?

1. Content would have been basically the same though I doubt if I'd have thought of all the areas covered such as varying the light intensity using resistance or making switches.
2. Previously I had not taken 'electricity' with Year 5 as most schools do not have this type of equipment to hand.
3. More confident.
4. Improved knowledge of the topic.
5. Gave ideas/confidence/resources.
6. My knowledge of the 'basics' improved. I didn't know what a short circuit or fuse were really about. I'd never seen one.
7. Confidence and increased knowledge.
8. Provided sufficient background knowledge to enable me to at least treat the area along the 'hands on' approach.
9. Made me a lot more confident in teaching the subject and a lot more knowledgeable.

FEEDBACK ON INSERVICE - EXPERIMENTAL GROUP (page 3)

(8)

b) in relation to the teaching strategies?

1. More willing to let children experiment with an open question and find out for themselves a little more.
2. In future I would have small groups doing different activities.
3. Prepared to tackle group work.
4. Revealed to me a series of lessons that I would have been hesitant to tackle before the inservice.

6. Nil.
7. Willingness to try 'hands-on' approach with every child rather than using a few children only.
8. No comments.
9. Made me aware of the importance of questioning strategies, review previous lessons and importance to make sure children really follow instructions.

c) in relation to the ways you dealt with boys and girls?

1. Only in that I was trying consciously to be fair to both sexes whereas I might have been less aware otherwise.
2. Itended to try to give the same amount of time and attention to both sexes.
3. No comments.
4. More conscioue effort to observe the girls.
5. Made aware of importance of teacher questioning, unknowingly helping girls more than boys etc.
6. Quite significantly. I altered arrangement of seats, became more conscious of the types of responees made to sexes re level of thinking or level of questions posed. I've tried to devote time more evenly. (I fear however that with time this level of conscioueness has probably reduced.)
7. Increased awareness of girls' feelings of inadequacy and attempts, subsequently, to overcome this.
8. Confirmed my realisation that these subject areas are equally important to boys and girls but because ofprevious role patterning girls may need more encouragement to become involved.
9. Made me a lot more aware of keeping the girls actively in discussions and not allowing boys to take over.