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**IMPROVING A PLAYCENTRE SCIENCE
PROGRAMME
THROUGH ACTION RESEARCH**

**A Project Report Submitted in Partial Fulfilment of the
Degree of Master of Educational Administration
at
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ABSTRACT

This is a study of the process of improvement of a science programme provided in a playcentre. In a project using action research methodology with one third of the adults staffing the playcentre, during one term, the science programme in the centre was considerably improved, on measures of dialogues with the children, and of planning activities specifically for science. The staff members, mothers in the playcentre, reported increased confidence in talking with children about science topics, and a significant change in their interaction patterns both with their own families and with other children in the playcentre science programme. The action research methodology was found to be a particularly helpful one in supporting the group of parents in improving their centre's science programme.

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Chapter One

INTRODUCTION

The author's interest in the study of science in early childhood is a long-standing one. An involvement in early childhood over a period of more than twenty years, and in a variety of roles, has developed insights specifically into two aspects of any teacher education programme with adults working with this age group. Firstly, most women working in early childhood lack confidence in their provision of a suitable science programme for their children, and secondly, they are very quickly able to realise that they do know and utilise a lot of science in their daily lives. These adults, usually also the parents of the children in their sessions, also quickly understand the importance for their children that they explicitly incorporate science experiences into their programmes. This project is an investigation of whether changes are made in an early childhood science programme as the result of the staff members in the programme undertaking a short teacher education course with a focus on science, and to identify the nature of any such changes.

Science is an important curriculum area in early childhood because of its potential in helping children to make links between their observations and their ideas about the world; science activities encourage the use and exploration of language and of logical reasoning. Skills, knowledge and attitudes developed in the science programme can pervade all areas of living and learning. Children who do not engage in those experiences in particular areas of the early childhood curriculum which are likely to promote skills and thinking in science, may well already have their pathways to future interests and career choices in some way limited (Meade & Staden, 1985). An implication of the ideal that every child in an early childhood programme be given "equitable opportunities to participate" (Carr & May, 1992, p.8) is that opportunities should be equally available for every child in all curriculum areas, a situation which is no more likely to exist in early childhood centres than it does in society generally.

Curriculum goals for children are unlikely to be developed in areas in which the adults have no confidence, because of their own perceived lack of knowledge. Meade (1985) discusses the value to the programme of staff members in early childhood centres thinking through their curriculum goals. Where the goals of activities are clearly identified by the staff members, "essentially the same materials

and activities can be organised into a coherent programme for optimal learning and development" (Lazar, 1983, cited in Meade, 1985, p.133).

The two major areas addressed in this project are the provision of science as a curriculum area in early childhood, and the changing of teacher attitudes, especially concerning teachers' own knowledge about and confidence in sharing science with young children. Throughout, the emphasis has been on empowering women to conduct investigations concerning their current science programmes with their children, with the facilitator/researcher utilising action research as a tool in teacher change.

Chapter Two

THE SCIENCE CURRICULUM IN EARLY CHILDHOOD

This chapter examines some of the difficulties encountered in helping children to make better sense of their world, through a programme of science education, in early childhood. Where informal learning for children is emphasised, in a free play programme supervised by adults who generally lack confidence in themselves as scientists, the conditions for the "making of a good scientist" (Woolnough, 1989) in the early stages of their education are unlikely to exist. The chapter concludes with a description of the culture of playcentres in New Zealand, including aspects of the curriculum.

2.1 SOME PROBLEMS AND A SOLUTION

"The purpose of science education at any level is to help children make better sense of their world" (Biddulph and Osborne, 1984, p.3). According to Hodson (1985), a science education programme is incomplete if it neglects any of the following: "a concern for scientific knowledge (certain facts, principles and theories are worth knowing), a concern for the processes and methods of science (reasoning and investigating), direct experience of scientific activity, appreciation of the complex relationships between science and society and the fostering of positive attitudes towards science" (Hodson, 1985, p.26).

Woolnough (1989) considers that it is essential to develop and provide for children a holistic approach to science education, in the "making of a good scientist"; one which includes the "affective aspects of commitment and confidence, the personal insights which come both through formal and informal learning, and the tacit knowledge that comes through experience, both structured and in play. These four aspects must continually be interacting, in a flexible and individualistic way, throughout the scientific education of the student" (Woolnough, 1989, p.131).

As identified in the following sections, the adults in early childhood centres generally lack the qualities which both Hodson and Wollnough consider to be important for the development of an adequate science programme. For the majority of women working in early childhood, their life experiences, including

schooling and higher education, have not provided them with the confidence and understandings of science which may be developed through a science education.

2.1.1 The Current Staffing Situation in Early Childhood

The task of encouraging science in early childhood programmes is a daunting one, largely because of the the lack of science experiences in the personnel working with young children. Fensham (1991) identified some of the social influences on staff members which contribute to the lack of science in early childhood in Australia. Ninety one to one hundred percent of the staffing throughout Australian early childhood centres are female, and early childhood preservice teachers are less representative of the general multicultural society than even the primary preservice teachers. Ninety eight percent of the 1988 cohort were from homes where English is the first language, and 80% were from white Australian, third generation families, with parents with relatively lower educational achievement than other sectors of teacher education; the students themselves had higher Year 12 scores than their counterparts in other sectors (where high scores indicate lower achievement). "These characteristics of early childhood teachers are just those which go with exclusion from, and a sense of deficit about science" (Fensham, 1991, p.6).

The New Zealand early childhood staffing situation is similar to that of Australia, with 99% of staff members being female. In the playcentre movement the sessions are staffed almost exclusively by mothers, for many of whom their playcentre training is their only formal tertiary education. That women are both somewhat scarce in the field of science, and are generally lacking in confidence in their knowledge about any ability to either know or to "do" science, has been well documented (eg Fensham, 1991; Meade, 1985).

2.1.2 Science as a Masculine Subject

For many reasons, science is conceived by the public as a "masculine" subject (Birke, 1986). Certainly a gross inequality in the number of men and women involved in the pursuit of science exists. This matters because it implies that women are provided with fewer opportunities to engage in

science than are men, and also because science is being denied the benefits of the different skills which women would bring to science. Many factors have been identified as construing to maintain the dominance of men in science, including discrimination at all levels, and especially society's belief in the place of women in the home (Kahle, 1986).

The masculinity of science has its basis in its perceived objectivity and competitiveness, two traits which are associated with masculinity in our society. Pervading much research in biology and psychology is the assumption that gender differences, such as female "passivity, coyness, nurturance and facility at typing", and male "aggression, assertiveness and objectivity" are biologically determined and fixed. "Insofar as these stereotypes help to reinforce the oppression of women by implying that gender roles are forever fixed, then the science that perpetuates them can be said to act in male interests. In that sense, even its content becomes masculine" (Harding, 1986, p.191).

Birke (1986) suggests that as long as women are primarily responsible for childrearing, and children are exposed from an early age to almost exclusive female care, girls will continue to find their independence through identifying with their mother, maintaining close emotional links, while for boys, independence must be gained by breaking those close emotional links to identify with their fathers. Thus, while girls learn a greater sense of connectedness and relationships, boys learn autonomy and separation. If the roots of objectivity and abstract reasoning are indeed in autonomy, and if achievement in science is dependent on "objectivity and abstract reasoning", then boys are obviously more likely, than girls, to seek science knowledge in later life. "The problems facing women in relation to science, then, are not relatively trivial ones such as discrimination, but lie deep in the sexual divisions of society itself" (Birke, 1986, p.189). Certainly girls appear to feel alienated from the abstractedness of science, perceiving science as less relevant to their lives and needs as social beings. Thus, any attempt to remedy women's lack of confidence in science needs to acknowledge the very real depth of influences acting against this, for many women.

This project is an attempt to develop confidence in science for a group of women through encouraging them to experience science as relevant to them as much as to men. Whether or not girls identify with their mothers and

boys with their fathers, the issue addressed in this project is the possibility of changing attitudes towards science, so that science can be more available to a wider range of people.

2.1.3 Science as Knowledge of Worth

Fensham (1991) sees no evidence for science being considered as "knowledge of worth" in the field of early childhood teacher education programmes. In Australian early childhood preservice teacher education programmes, relatively few hours are devoted to science courses, and there is a lack of input to the important teaching experiences for these students from their science specialists. Fensham perceives the lack of a cognitive strand, of which science would be an important component, in the "overarching and explicit theme of the developing child in these programmes for early childhood teachers" (Fensham, 1991, p.6). Although mathematics is not seen by Fensham as a strong strand in early childhood teacher education programmes, it does have its recognised place in every early childhood programme, alongside those of social, motor, and language development. If one teacher who has specialised in mathematics leaves the programme, it is likely that the programme will nevertheless continue. Not so for the rare science programme, which is very much dependent on the enthusiasm of individual teachers. These teachers tend to take the programme with them when they leave, simply because there is no-one to replace them. In the author's experience, these trends identified for Australian early childhood science education for teachers are similar to those in New Zealand. It is indicative of the New Zealand situation that there is no recorded data available from which to make comparisons.

The current project, while not attempting to address the larger issue of science and women in society, does attempt to change the attitudes towards science, of a small group of women working in early childhood. If women can come to view science as relevant and useful to them, knowing that they use it in their daily lives, then this attitude will be likely to benefit the children with whom they live and work. In a sense, helping women to see that science is relevant for them, entails taking the masculinity out of it, or "changing science", one of the solutions to encouraging females into science suggested by many (eg Birke, 1986; Kelly, 1987; Burns, 1988).

2.2 LEARNING IN SCIENCE - The Constructivist Approach

Biddulph & Osborne, (1984, p.13), outline four possible delivery modes for the science curriculum. The preferred model, interactive learning, contains elements of the other three approaches; transmission, process, and discovery learning.

In interactive learning, children are provided with experiences for the purpose of generating their questions and eliciting their present ideas. Children are encouraged to work towards clarifying their ideas and resolving their questions with help and guidance. The approach is based, in part, on a view of science as an individual and collective activity to make better sense of the world, and also on a view of learning based on the idea that each learner must construct his/her own knowledge, based on current knowledge.

In this constructivist approach, learning is something for which the learner takes personal responsibility. The interactive model implies an interchange of talk among people who respect each others ideas. This begins with a "genuine desire to know what a child thinks (and why)" (Biddulph & Osborne, 1984, p.13).

Interactive learning includes four principles. The first is the identification of children's present ideas and questions, which requires listening to and watching children, asking them open-ended and challenging questions. Secondly, the provision of stimulating experiences which encourage children to confront, explore and develop their ideas is important. Certainly, the experiences should help children raise questions. Thirdly, helping children to develop, clarify, modify and extend their ideas through seeking answers to the questions they are interested in. This again requires dialogue between adults and children, and between children. Fourthly, communication with other children is as important as with adults. Stromquist, (1988) claims that there is no evidence that dialogues with teachers always develop children's language and ideas more than those with peers. It is also valuable to help children to realise that explanations of why things behave the way they do are often not right or wrong, but are rather consistent with the evidence or inconsistent, useful or less useful; plausible or not plausible, intelligible or not intelligible.

Children need to become accustomed to having their ideas challenged, and to challenging each others' ideas. Explanations should be tentative, exploratory, and always open to revision. The message should be conveyed to children that their

ideas are genuinely valued. This requires from the staff a forbearance in making decisions and in 'doing for' the child in all but the most mundane daily activities. Children who are encouraged to be physically independent and to make their own intellectual decisions will continually encounter incidental socio-cognitive conflicts, the solution of which will develop problem-solving strategies and other cognitive skills.

Throughout this interactive learning approach to helping children to engage in scientific activity, the emphasis is on listening to children's ideas and understandings, and supporting their thinking and experimentation.

2.3 LEARNING IN EARLY CHILDHOOD

Katz and McClellan (1991) support interactive learning as the most effective for most early childhood learning. Learning in early childhood is ideally of a holistic nature, in which both care and educational requirements of the child must be simultaneously addressed, in developmentally appropriate ways. Essential learning areas are not subject-based, as they generally are for example in primary school curricula; rather they foster cross-curricular skills and qualities (Katz and McClellan; 1991), especially communication, social, problem-solving, decision-making, and self-management skills. The early childhood curriculum features an emphasis on personally meaningful contexts and an interest in problem-solving and activity-based curriculum. "Well-being, Belonging, and Contribution,... have a high priority for young children" (Carr & May, 1992, p.107); in early childhood the social is a key area of experience and learning as well as a category of skills.

Similarly for later stages of "being good at science", Woolnough (1989, p.131) considers essentially a "holistic, problem-solving activity dependent on personal qualities such as commitment and personalised knowledge" (Woolnough, *ibid*) to be the most effective. The opportunity to engage in practice, play and exploration, advocated by Woolnough as the necessary elements of learning science, are just those conditions provided by a well-run and effective early childhood centre.

Assessment in early childhood is similarly holistic, and made "...in the same contexts of meaningful activities and relationships that have provided the focus for the curriculum" (Carr & May, 1992, p.103); while the programme can be evaluated for its capacity to provide for these activities and relationships, and records and

observations kept on individual children to ensure that they are being adequately provided for, the fact remains that early childhood is a non-compulsory area of education. As such, and in keeping with the age/stage of the children, there is normally a more relaxed attitude to specific academic outcomes for each child, and certainly no pass/fail system of promotion from early childhood to primary levels. Freedom from external assessment of individual children allows for the development of an individual/group specific programme at this stage of the child's education, a factor which allows adults working with young children a great deal of freedom in developing the most relevant programme in science for their specific children.

Fleer (1992) has investigated the relevance of interactive learning to early childhood. In her work in Australia with twelve teachers of children between the ages of three and seven years, she found that a number of modifications to the interactive learning approach for primary and secondary students were required for this younger age group. Teachers needed to select from the large numbers of ideas brought to the learning situation by the children, in order that some of these ideas could be pursued in greater depth than others. They also needed to suggest possible methods of investigations, on most occasions, and to provide the resources and demonstrate their use to the children. Finally, the teacher needed to participate in a lot of one to one interaction, and could record only some of the children's ideas, because of the time this takes with young children.

2.3.1 Child-Adult Interactions in Early Childhood

Unfortunately, research indicates that the potential of greater freedom to develop the most suitable programme for each group of children in early childhood programmes has not often resulted in this potential being realised, as indicated by Meade (1985).

Research in teacher-child interactions in early childhood centres indicates distinctive patterns in adult preferences for activities. Generally, adults spend relatively little time working in activities with children, and when they do their time is not evenly distributed across the various activities available. Meade (1985) highlighted the most common activities for adults as "tidying up, getting equipment, and general supervision " (Meade, 1985, p.39). Smith (1983), identified adult preference for children's activities to be in the order of: story, snacks/meals, collage and other art, quite high in puzzles,

with very little favour for trolleys, bikes, forts and car-cases, finger-paint, outdoor story, indoor large muscle play and puppets. While science is potentially available in every activity provided (Crabtree, 1988), it seems that it is just those least favoured by the adults in centres which are most likely to provide problem-solving experiences, especially in mechanical areas.

Adult-child interactions in early childhood programmes have been found to facilitate many aspects of children's development. Taylor, Exon & Holley (1972) found that children who receive more attention do better in their language development; Karnes et al (1970), compared the outcomes for children when adults are working well with them with those for children left to their own devices, and found that the latter fared less well; Murphy & Wilkinson (1982) found that 'graduates' from a Scottish Nursery school who did not display enhanced intellectual development, were those children who had spent more of their time unoccupied or in non-play activity or physical games, that is in those activities which are less likely to involve contact with adults. In order that all children have the opportunity to gain the maximum value from experiences available in the early childhood programme, adults need to share experiences with children wherever appropriate in all activity areas.

One of the "most notable results" (Meade, 1985, p.40) of the Meade findings was the generally high number of contacts between children and adults, per adult. The average of four per minute, or 120 per half hour, indicates a constant shifting of the adults' attention from child to child and from task to task. This is consistent with the findings of Clift, Cleave & Griffin (1980), that early childhood educators' changes in tasks were frequent, and that the interactions were short, the majority being only 30 seconds in duration, and related to management and organisation. To facilitate staff members "working well with children" (Karnes et al 1970) they need to be involved with the children's activities, which results in fewer changes and fewer interruptions.

2.3.2 Dialogues in Early Childhood

Sylva, Roy & Painter (1980) have contributed to the process through which adults share ideas with young children, in their work with dialogues. They defined a dialogue as a sustained conversation of three or more exchanges, with the minimal structure of A-B, B-A, A-B, (A an adult and B a child) where the topic of conversation is similar throughout, and each contribution expands on the previous one (Meade, 1985 based on Sylva et al, 1980). By the very definition of interactive learning, little can occur until a number of dialogues, of several exchanges each, take place between children, and between adults and children, in any one session.

2.3.3 Social Interactions and Learning in Early Childhood

Solomon (1987) discusses the value of social interaction in children's learning, ".. the social scene makes an essential difference to the learning task, to how the task is perceived, and even to the tools for thought that will be used" (Solomon, 1987, p.64). Although personal reflection and thought-construction are required in the process of gaining knowledge, it is through feedback from friends and others in the social networks that an individual's ideas are clarified and legitimised.

Schutz & Luckman (1973) refer to knowledge gained in social interactions as "life world knowing", such social notions being very resistant to change, simply because they are constantly reaffirmed in daily social interactions. This knowledge has a totally different foundation from the scientist's logically derived world of meaning, with a different language, and even being stored in memory separately from the symbolic "school knowledge", (Schutz & Luckman, 1973, p.114). It is simply "not an option" to teach science as a topic insulated/isolated from everyday contexts (Solomon, 1987, p.79). The importance of working with young children in a social relationship, using their language and basing scientific discussions on their current levels of understanding, in dialogues, is obvious. Through interactions with others, supported by the interactive learning methodology described by Osborne and others, as described above, children construct their own knowledge.

2.3.4 Scaffolding Children's Learning

Fleer (1991) agrees that science learning in early childhood is "better placed within a paradigm in which learning is socially constructed" (Fleer, 1991, p.17). Fleer's work is based on Vygotsky's arguments that children are "entrenched in social experiences, many of which they participate in and make sense of, but which they do not always understand" (Fleer, 1991, p.17). Vygotsky called the gap between the child's current performance and her potential performance if given the support of someone with a higher level of skill, the "zone of proximal development" (Scroufe & Cooper, 1988, p.352). The role of more knowledgeable people, both adults and children, in building on a child's current knowledge, is a vital one. Bruner (1965) has described one means of fostering the advancement of children within their zone of proximal development using "scaffolding" techniques. In scaffolding, the more experienced person supports the learner through observing behaviours to note current understanding, and providing guidance, hints, or advice, and offering feedback about the performance, as well as correction when needed" (Scroufe & Cooper, 1988, p.436). The teacher progressively alters expectations of understanding, with the learner's advances, as "initial approaches are replaced gradually with ones that enhance the mastery of more complex understandings (Scroufe & Cooper, 1988, p.436). This is exactly the role of interactive dialogue between adults and children in early childhood, especially in the current context, when it extends children's learning in science.

Pramling (1990) was able to show clear differences in outcome for children depending on their teachers' outlook and ways of working with children. The focus of Pramling's research was on the effects of teachers encouraging children to reflect on their experiences of situations created by the teacher for this purpose. During long-term projects, children's attention is drawn to the metacognitive skills of how they learn, and how they come to think about their problems. "Helping children to learn is a question of getting them to understand certain aspects of reality by thinking" (Pramling, 1990, p.110). In Pramling's experimental group, the children showed significant progress, not only becoming aware of how they think and learn, but they also became better at learning new content, than children in the control groups (Pramling, 1990, p.111).

Pramling's (1990) studies were based on the viewpoint, emanating from the phenomenological movement, that the child and the world form a unit; the child lives in a world that is comprehended and experienced as a thought about the world. In this "constitutionalist" approach to the structure of knowledge, the world has both a subjective and an objective reality in the child's mind, in contrast to the constructivist (Piagetian) approach, in which the child is thought to create her own world, a subjective world that is separate from the concrete reality.

2.3.5 Te Whariki

Te Whariki, the National Early Childhood Curriculum Guidelines in New Zealand, (Carr & May, 1992) sets the framework on which a science programme for children could be developed.. Holistic from the outset, this set of curriculum guidelines seldom mentions the word "science", yet it itemises very clear connections with the "Science in the National Curriculum" draft for primary schools (Carr & May, 1992, p.128-130) .Te Whariki headings of "exploration and communication" link well with the New Zealand School Curriculum Science (1992) level 1 headings, which include making sense of the living, physical, material worlds and making sense of planet earth and beyond.

Given adequate resourcing for the introduction of the early childhood curriculum initiative, early childhood personnel could learn to provide good science programmes without being daunted by the word "science". However, even this curriculum document does not address the potential demonstrated for children by Pramling (1990), to learn specific metacognitive skills in their very early years.

2.4 PLAYCENTRE

2.4.1 The Culture of New Zealand Playcentres

Playcentre is a nationally recognised and government funded early childhood organisation in New Zealand, with a very clear philosophy of families learning together (see Appendix 1). Initiated during World War II, as mutual support for women with absent husbands and young families to care

for and educate, playcentre is very much a women's growth movement. Participant parents of the children on the rolls are responsible for the administration and maintenance of all sessions, buildings, and grounds, as well as for the education of all "staff" members, the majority of whom are parents of children in the sessions. Mutual support, a hallmark of playcentre and central to its philosophy, extends beyond the grounds of the centre, as families often become lifelong friends.

Decision-making in such a group is normally by consensus. All members have the opportunity, if not the expectation, to become playcentre officers, fulfilling both administrative and educational functions in the centre, at some stage of their career in the organisation. To ensure that long-standing members do not stifle oncoming ones, there are time restrictions for the holding of any one position. Specifically, decisions concerning the programme are made by the whole group of parents involved. Many playcentres offer group supervision, in which no one person is appointed as the supervisor, and all parents working with the children are required to gain a minimal level of education, completing a certain number of specified modules in the local association's supervisor training courses. To meet supervision requirements of both the Ministry of Education and of the local playcentre association, the combined level of teacher education in the group must also be at a certain level, and include all the modules of the national core curriculum for early childhood teacher education.

The playcentre teacher education programme has a clear structure at both the regional and national levels. The core curriculum, studied to the National Playcentre Supervisors Certificate level, currently meets the standards of the New Zealand National Qualifications Authority (NZQA) (see Appendix 2), at the level of the three year Diploma of Teaching. The contents are offered locally, through group and individual work, and by attendance at lectures and/or the completion of correspondence courses. Generally, equivalence to diploma level will require about five years of part-time concurrent study and practical experience, during immersion in the playcentre philosophy. While relatively few parents at any one time in one playcentre would reach diploma level, the accumulation of the constituent learning units within the group can qualify the group to be engaged in group supervision, which will be described in this report with reference to the Terrace End Playcentre (see section 4.2.1).

There is no rigid hierarchy of roles and responsibilities in playcentre, as there are in many other educational institutions. The voice of the new parent, usually the mother, is as valid as is that of a more experienced playcentre member.

2.4.2 The Playcentre Curriculum

As in any group of early childhood staff, parent and management teams in New Zealand, whether kindergarten, playcentre, or childcare, the specific structure of the sessions is unique to the group. Often there is more similarity between, for example, a playcentre and a kindergarten, than there is between two centres within one organisation. One example of such variation is that of morning tea being either at a set time for all the children together, or available throughout the session. Each arrangement encourages the children's learning of different skills and understandings. Decisions such as this are made at every level of structure in the early childhood programme.

Playcentre adheres to generally accepted philosophies of mainstream early childhood programmes in New Zealand, including the provision of developmentally - appropriate practices, catering for individual needs of children. "In New Zealand, the free play philosophy is very widely accepted by early childhood educators" (Meade, 1985, p.35).

Generally, equipment in playcentres is specifically designed for children to work at the level of their choice. Children have ready access to tools and materials, which they are usually encouraged to replace after use, and adults challenge and encourage children's ideas as supporters and facilitators. Children are taught basic skills required for activities, and the 'rules' for maintaining their environment.

A wide variety of activities is provided, both indoors and outdoors. Space and equipment are available for stimulating experiences; how the adults organise the time for children and their own contribution depends on many variables, with the amount of structure in a programme having different outcomes for different children.

Chapter Three

TEACHER CHANGE THROUGH EMPOWERMENT OF TEACHERS

Having examined a selection of the teacher change literature, this chapter focuses on action research, specifically the Kemmis & McTaggart (1988) model, as one method of effecting change.

3.1 TEACHER CHANGE

The thesis of this study is that teachers are very ready to consider potential methods of improvement in their teaching practice, when they are themselves in control of investigating the rationale for the change, and in any implementation and evaluation which ensues.

Richardson (1990) addressed the issues of significant and worthwhile change in teaching practices, and the place of research in supporting this change, from two perspectives, that of the teacher change literature, and that of the learning to teach literature. In the teacher change literature teachers' reluctance to change is described as the result of either organisational problems within the institution, or as the inability of the programme to change teachers' personal knowledge, attitudes and beliefs concerning practicalities, usefulness to their situation, and cost. In each case of teacher change research reported by Richardson in which reluctance to change was an issue, the change proposed was instigated from an external source and the teachers were accorded little, if any, autonomy in decisions concerning rationale and methodology of the proposed changes.

In the learning to teach literature, on the other hand, the focus has been either on the development of the teacher's thinking and actions, throughout their careers from preservice to experienced teachers, or on their "ways of knowing" (Richardson, 1990, p.12). What teachers do in their classroom is the result of a combination of many factors, including personality, subject matter knowledge, pedagogical teacher education, and experience. Schon (1982) conceived the practitioner as interacting with the "particular situation (to bring) forth knowledge in action, gained from experience in similar circumstances" (Richardson, 1990, p.12). The classroom is, in fact, an "extremely potent teacher" (Richardson, 1990, p.12),

some would say the only real teacher, and others (eg Schon, 1982; Schulman, 1986; Anning, 1988) have cautioned that "experience is educative only with reflection" (Richardson, 1990, p.12). In this paradigm, improvement in the teacher-learning process can only be effective when the teacher's current knowledge and experiences are acknowledged and extended, through reflection by the teacher herself.

Several researchers have identified the influence of the teachers' beliefs about themselves as learners, often originating in their own experiences as learners in their formative years, on their current knowledge and teaching practices. For example, Hollingsworth (1989) concluded that the patterns of intellectual change in teachers in their fifth year of a teacher education programme were strongly influenced by their prior beliefs about teaching and learning. The learning-to-teach literature provides evidence that teachers do change, and elucidates the "powerful and inevitable relationship between experience and personal biography, and what and how one learns to teach" (Richardson, 1990, p.13). Bell (1990) found explicit links between teachers' statements of their beliefs and their life experiences beyond the early childhood centre, which influenced their practice in the centre. This is not promising news for the provision of a science programme in early childhood, when women's life experiences of science are often subjectively judged as minimal (Crabtree, 1988). Fensham's (1991) study of early childhood student teacher preparation for teaching science describes some of the origins of early childhood staff members' lack of experience in science.

Richardson (1990) suggests several issues and their inter-relationships which provide a framework which is required for bringing about "significant and worthwhile change" (Richardson, 1990, p.13). These include control of the change, the focus, and the determination of what is and is not significant and worthwhile change. Fenstermacher & Amarel (1983), Kemmis & McTaggart (1982; 1988) and Parlett & Hamilton (1972) have all argued that teachers should be in control of decisions concerning what changes they should make, and how they should be effected, because of the situational nature of teaching. The more recent research shifts the focus from that of the teacher's behaviour, to change in practical knowledge and understandings. Richardson (1990) suggests that it seems that what actually happens in the classroom is of less importance when focusing on the encouragement of changes, than is the "practical knowledge which drives or is a part of those classroom actions" (Richardson, 1990, p.13). In any classroom situation, the teacher quickly judges the situation or context and decides on what

action to take, based on knowledge gained from previous similar situations. The teacher's practical knowledge base will be refined and increased through reflection on the effects of the action. In a change project, the focus should be strongly on the teacher's own understandings and practical knowledge, which should be considered in relation to what is happening, or what could happen in that teacher's classroom.

Teachers are changing all the time. The problem, then, is not one of change or non-change, but of ensuring that the changes made are both educationally "significant", change that educationally makes a difference for the students, and "worthwhile", or in a direction considered by both researchers and practitioners in the education community to be valuable.

Further factors which facilitate teacher change, according to the Waikato Learning in Science project team, include the need for understanding the area of change, the time-line for encouraging such change, the support available, and the models of professional development being utilised (Silvester, 1989). In summary, both the content and the process of change, each distinctly different, need to be addressed. Traditional, one-day workshops or seminars, while successful in producing positive attitudes, have been found to be ineffective in changing behaviour. Time for "practice, reflection and collaboration" are necessary, as is ".. ongoing, interactive, cumulative learning.." (Gilbert & Osborne, 1981, p.12), if teachers are to change their beliefs about teaching and learning, and develop new skills and behaviours to support those beliefs (Fullan, 1987).

One process designed specifically to encourage change which is significant and worthwhile to the change agents, in their control, and, ideally, supported by the institution in which it is proposed, is action research, the subject of the next section.

3.2 ACTION RESEARCH

"Action research is any systematic inquiry, large or small, conducted by professionals and focusing on some aspects of their practice in order to find out more about it, and eventually to act in ways they see as better or more effective" (Oberg & McCutcheon, 1987, p.117).

The purpose of action research, as implied in the title, is to link action with research, in "trying out ideas in practice as a means of improvement and as a means of increasing knowledge about the curriculum, teaching, and learning" (Kemmis & McTaggart, 1982, p.5). In action research, the teaching community is itself responsible for every phase of the research; in conducting their own research, teachers, parents, administrators and others have the opportunity to both improve and to gain greater understanding of what they do.

Action research has its origins in Lewin's (1946) work, developed and applied over a number of years, in situations in America as diverse as integrated housing, equality of opportunity in employment, causes and cures of prejudice in children, the socialisation of street gangs, and the training of youth leaders. The underlying strength of each of these projects was the commitment to improvement through group decision-making. In action research, it is always the members of the group who will be most affected by any changes, who have the primary responsibility for deciding on courses of action which may lead to improvement, and on the evaluation of the results of any strategies put into practice.

Action research may be carried out from a variety of perspectives and methodologies. Teachers' planning and actions are likely to be guided by their past experiences, and through a series of experiments which have worked for them (Oberg & McCutcheon, 1987). They may also have adopted an official educational theory, such as Piaget's, which is useful for their explanations of learning and teaching events, between children and adults. Another base of theory may be the choice of a paradigm, be it from a positivist, an interpretivist, or a critical science perspective. McCutcheon & Jung (1990) have indicated that action research is sufficiently broad and flexible a method to be equally applicable from each of these perspectives. Regardless of the informal or formal philosophies guiding the researcher, the method has several features common to each project. These essential features have been identified by Goswami & Stillman (1987), Hustler, Cassidy & Cuff (1986), and by Kemmis & McTaggart (1988). "Action research is characterised as systematic enquiry that is collective, collaborative, self-reflective, critical, and undertaken by the participants of the inquiry. The goals of such research are the understanding of practice and the articulation of a rationale or philosophy of practice in order to improve practice" (McCutcheon & Jung, 1990, p.148).

Action research has been an important part of Australia's school improvement and educational research for more than a decade, and it has been utilised in various models in many nations in supporting teachers in the development of their enquiries in their own classrooms (Kemmis & McTaggart, 1988). Baird & Mitchell (1986) conducted an action research project in a Victorian secondary school for two years, in which a prime objective was for teachers to adopt constructive perspectives in their teaching. The results of this PEEL project suggest that significant change in the quality of teaching and learning can be produced when outside consultants collaborate with teachers in action research in their situation. Inservice courses have been found to be particularly effective when the teachers have themselves been involved in designing the course (Lombard, Konick & Schultz, 1985).

Kemmis & McTaggart's (1988) *Action Research Planner* provides a useful structure for the examination of curriculum in action. The planner is designed for educational communities to utilise for themselves, in systematically examining what happens in their settings, in the implementation of planned changes, and in the critical monitoring and evaluation of such changes.

Tripp (1990, based on Habermas, 1974) distinguishes between three forms of action research: the technical, the practical, and the emancipatory, each informed by a different human interest. The technical base asks questions such as "What can I do and how can I best do it?", treating the social world as though it were a part of the natural world; the practical also asks "What should I do and how ought I do it?", recognising the difference between the natural and the social world, but accepting the status quo of the social world; the emancipatory base questions the social assumptions on which the social life is based, seeking always a more egalitarian world. In keeping with both current and historical philosophies of early childhood, the author's basic philosophical position is an emancipatory one. "Interest in praxis is the hallmark of the critical theorist, and is fundamental to an interest in knowledge as emancipatory" (McCutcheon & Jung, 1990, p.147). This critical science perspective involves the researcher in examining taken-for-granted institutionalised practices and outcomes of education, such as inequities of gender and of culture. Such inequities have throughout the literature examined in this project, been shown to be operating against the provision of adequate science programmes in early childhood centres.

3.2.1 Cycles in One Model of Action Research

The Kemmis & McTaggart (1982; 1988) model of action research proceeds through a spiral of steps, each step of which consists of stages of planning, action, and the evaluation of the result of the action. This cyclic nature of the research acknowledges the need for action plans to be flexible. Because of the nature of research in complex social situations, it is not possible to anticipate everything which might require attention during the research, or to plan each step precisely. Lewin's (1946) overlapping of the action with the reflection stages was a deliberate strategy to allow for changes in plans as people learned from their own experiences, and communicated this learning to others. The four stages in each step are carried out collaboratively, with others affected by the programme being involved in the process at all stages.

3.2.2 Stages

The four stages of each step in the Kemmis & McTaggart (1988) plan are: (see Figure 1).

Stage One - The Plan

The purpose of the plan is to "allow the practitioner to act more effectively over a greater range of circumstances, more wisely and more prudently" (Kemmis & McTaggart, 1982, p.8). The result should be greater empowerment to act more effectively as an educator, going beyond current constraints, at least to some degree, realising new potential in educational action.

The general plan must be sufficiently flexible that it can accommodate previously unrecognised constraints, and take into account the risks involved in social change, recognising material and political constraints in the situations.

Stage Two - Action

Practice is seen as "ideas-in-action" (Kemmis & McTaggart, 1982, p.8). The action is deliberate and controlled, and is used as a platform for further development and subsequent action, guided by the prior planning though not controlled by it. The three gains expected of the

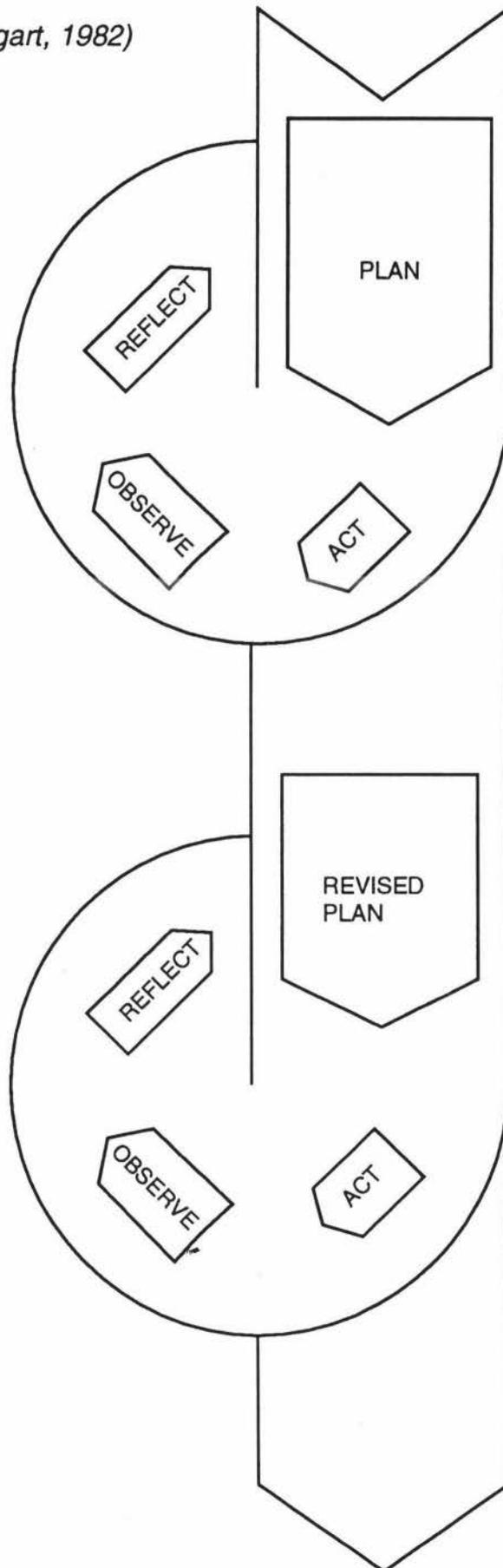
action are the improvement of practice, the improvement of understanding, and the improvement of the situation in which the action takes place (Kemmis & McTaggart, 1982, p.9).

Stage Three - Observation

Observation serves to document action, and to allow reflection both in the short-term and at a later date. It is necessarily carefully planned, but also remains flexible, to allow the unexpected or unconsidered to be documented for reflection. It will aim to document the action, the effects of the action, and the context of the situation in which the action occurs.

FIGURE ONE : ACTION RESEARCH CYCLE - FOUR STAGES IN EACH OF TWO CYCLES

(Kemmis & McTaggart, 1982)



Stage Four - Reflection

This phase is both retrospective and reconstructive; it uses the observations which were planned "to make sense of processes, problems, issues and constraints made manifest in strategic action" (Kemmis & McTaggart, 1982, p.9). Usually discussion and discourse is the mode through which the various possible perspectives are addressed, and the reflection results in a "reconstruction of the social situation" (p.9) as the basis of a revised plan. The reflection is evaluative, in that judgements are made concerning the desirability of effects of the intervention; reflection is also descriptive, in that it builds a more complete picture of what life and work in the situation is like, what the constraints are, and what can be done about them.

3.2.3 Thematic Concerns in Action Research

The four stages of the action research cycle are each utilised in the examination of a "thematic concern", a broad educational issue or question, (Kemmis & McTaggart, 1988, p.9). Since action research is a collaborative, participatory exercise, it is the group which necessarily identifies its own thematic concern, the area in which it decides to focus its improvement strategies. The role of an "outsider" in supporting the group's investigations, must be clearly established as that of a facilitator only. While such a facilitator will have been invited to share the group's project because of specific expertise, her major function will necessarily remain as supporting the empowerment of group members in developing their own expertise.

3.2.4 Consideration of All Registers in Action Research

"Changing education is a matter of engaging in a struggle towards better educational ideas, better educational practices, and better social relationships and forms of organisation for education" (Kemmis & McTaggart, 1988, p.34). Improving education involves much more than individual improvement; it encompasses cultural action at the level of the group of which the individual is a member. For any change to occur in the

knowledge and skills, attitudes and practice of the adults working in science in early childhood, changes must be made in three interdependent areas of education:

- the language, which describes, explains, and justifies education
- the activities, including curriculum and administrative aspects of education as social and historical formation, and
- the patterns of social relationships which constitute education.

The activities of educational institutions are not sacrosanct: they have developed historically to encompass a hierarchy of power, which maintains the role structures and divisions of labour inherent in today's formal educational organisations for schooling. In the daily reconstructions of these roles and practices, "contestation and institutionalisation go hand in hand" (Kemmis & McTaggart, 1988, p.40). In social life generally, as well as in education, forms of language, of activity, and of social relationships, become institutionalised through contestation. Language, activity, and social relationships, the three domains of individual and cultural action, are of fundamental importance in the understanding of and contribution to educational and social reform, and are thus relevant in any teacher change project.

Language becomes institutionalised when it takes on specific, orderly forms for specific, well-known purposes in specific contexts. Thus an informal language gradually becomes what can be termed discourse, through the open-ended exploration of ideas.

Locally varying activities become institutionalised when they take specific, orderly forms for specific purposes in specific contexts; such practices include established routines, methods, or curriculum packages, based on intrinsic values.

Social relationships become institutionalised when they take on specific orderly forms for specific purposes in specific contexts, such that a group shares an understanding of its special language. Such organised structures determine role and status relationships between people.

In describing the relationships between language/discourse, activities/practice, and social relationships/forms of organisation,

inconsistencies between theory, beliefs and practice may emerge. Kemmis & McTaggart (1988) describe language/discourse, activities/practice and social relationships/organisation, as registers of improvement. By monitoring the change in each register, they suggest that the "nature and consequences of our efforts towards improvement" can be monitored (Kemmis & McTaggart, 1988, p.44). For example, is language becoming more coherent and forming more orderly discourse? are activities becoming established as better informed and more justifiable practices? are social relationships becoming organised in structures which better meet our educational aspirations? are discourse and practice consistent? are discourse and organisation consistent? etc.

Given the disparities between the language of everyday conversation and that of science, the call to change methods of teaching from largely a transmission approach to more interactive styles, in order to encourage children to learn science with understanding (Biddulph & Osborne, 1984) is particularly relevant in this study.

Chapter Four

METHOD

This chapter describes the Playcentre involved in the project, its culture, and its procedure through the early stages of the first cycle of Kemmis & McTaggart's (1988) model of action research. Acting in the role of invited facilitator, the author supported initiatives suggested by the group, adding suggestions as relevant. In addition, with the permission of the group, methods of evaluation to measure some areas of potential change in the programme during the course of the project were devised; these measuring procedures, also described in this chapter, were supplied as feedback to the group as appropriate.

4.1 FORMATION OF THE PROJECT TEAM

The Terrace End Playcentre group of parents collectively considered that very little science was being shared with the children in their sessions, and approached the researcher for assistance. The first meeting to which the researcher was invited was a full centre business meeting, of all the parents, at which discussion of the centre's science curriculum was only one item on a long agenda. Possible methods which would facilitate development of their science programme were discussed briefly. It was made clear that participants contributing to the development of their science programme would be doing the investigation themselves, and that any decisions and efforts towards improvement would be theirs. It was decided at this first meeting that members interested in being committed to working on the improvement of the science programme, would meet on a set date, and that this group would probably decide to meet regularly for up to 4 or 6 weeks. The first meeting would consist of discussing the current science programme, what the perceived gaps were, and the consideration of methods for remedying these. Members from other centres would be invited to join the group, which was to become the project team.

It was agreed at this general meeting that if a sub group of parents were committed to undertaking intensive learning in the area of science, the whole group would fully support their initiatives, which would benefit all. Reporting procedures

between the project team and the main body of parents would be important to consider, and these were addressed throughout the project.

The Terrace End Playcentre is a group of approximately 25-30 families, with children of ages between 2.5 and 6 years officially attending sessions, though in practice, younger siblings frequently, and older siblings on occasion, also attend sessions. Except for one playgroup session each week, which met without a supervisor, and the extension session, which operated with an appointed supervisor, group supervision was the norm in this playcentre. In group supervision, the majority of families are represented on the roster for session duty, usually by the mothers of the children attending the sessions. For the four sessions each week conducted by group supervision, four adult members were on duty.

The document guiding programme development in an early childhood centre in New Zealand is the centre's charter, which is a signed agreement between the centre and the Ministry of Education. Statements from the Central Districts Playcentre Association charter, which is also the charter for Terrace End Playcentre, state the "Guiding Principles" of the centre as "meeting the overall needs for education and care of each child attending shall be the first and major consideration... Care and education should be integrated in the curriculum and the development of self esteem, confidence, independence and interest in learning for young children and infants should be facilitated at all times. A set of national curriculum guidelines for developmentally appropriate programmes and practice should, when developed, provide the basis for the early childhood curriculum" (Central Districts Playcentre Association, 1991, p.4).

No statements are made in the playcentre charters concerning requirements to provide activities in the area of science. The closest entry to any science activity is in the objectives and practices list, which includes "... both active and quiet, planned and spontaneous, small group and individual activities, both indoors and out of doors, with children able to make choices about the degree, type and manner of their participation" (Central Districts Playcentre Association, 1991, p.7).

4.2 INITIAL REFLECTIONS

The format and issues addressed in this section are those raised through attention to the Kemmis & McTaggart (1988) Planner .

4.2.1 Terrace End Playcentre Practices

All the mothers attending the Terrace End Playcentre commence studies towards the Central Districts Playcentre Association training modules. A few members in each group will be likely to complete this training to the level of equivalence to the Diploma of Teaching. However, due to changing family circumstances, and the frequent gain in enthusiasm of individuals once training commences, it is not possible at any point in time to identify which individuals will do so

Several specific practices exist in the Terrace End Playcentre, to ensure that the stated "desirable practices" are adhered to under group supervision, during which no one person had the responsibility of knowing all the children's stages and requirements. At the conclusion of each session, those on duty for the day meet to share immediate responses to the effectiveness of the session, and to record their major activities and interests of the session. A session evaluation form (sample, Appendix 3 (ii)) is completed, recording several aspects of participation in the session, especially the names of children with whom they held extended activities or dialogues, and the topics of conversation and activity. These records are the basis of regular evening discussion groups, involving all the parents of the children in the sessions, to assess each child's progress in all areas. In this way, children who require assistance are quickly identified, and outside expertise sought as considered necessary.

The records described above were to become a rich source of data for the researcher; they contained a written record, for every session conducted throughout 1991, of planning for the sessions, and of the children with whom dialogues were shared and the topics of conversation.

The overall programme was constantly being assessed, not only through meetings held specifically for that purpose, but more particularly because of

the ethos of this environment in which teacher education, which in the playcentre system includes ongoing observation and analysis of programmes, is continually being undertaken by the participants in the group. It was usual to see formal observations being completed during any session, by mothers trained in observation skills. It is also usual to note that the majority of adults present are working with children, encouraging indepth dialogue, since developing dialogues is one aspect of the first training module, which all mothers are encouraged to complete.

In this centre, several members are currently continuing their early childhood education to a high level, equivalent to the Diploma of Teaching. Children are offered both regular activities every session, and specific activities provided by the those on duty with special interests to share with children, which have developed either from their own skills and interests, or from following up children's interests and ideas.

The general educational level of the adults in this centre varies from those with professional education, including degrees and nursing qualifications, to those who left school at 15, though the latter would be a minority.

The major constraints for playcentre parents undertaking their educational activities are time and energy. All parents who join are required to attend a specified set of introductory sessions, and regular meetings, and they are all encouraged to continue with the Supervision modules, at their own rate and often in supporting groups. These commitments, combined with those of regular duty sessions, which are frequent because of the number required for group supervision rosters, and those of being parents of young families, mean that all the parents involved in this programme are very busy people. On some occasions their other education commitments clashed with the organised science sessions, which required the rescheduling of the latter; in some instances work completed in one area was useful for another, such as for a group member who requested permission to view videos made for the science programme within the workshop she was conducting, for another centre, on observation skills.

Thus activities are coordinated for individuals and for the group, at times competing at others reinforcing time and energy spent. The participants in this group all agreed to combine their efforts in improving their jointly-

defined programme to include science for their children. For many of the participants, membership of this group contributed credits towards some aspect of their ongoing Playcentre Teacher Education programme.

4.2.2 Characteristics of the Project team

The project team consisted of twelve mothers from the Terrace End Playcentre, and two from a neighbouring centre, and the author, as the invited facilitator working with the group on their project. All members of this project team were committed to implementing a programme which more than adequately meets the specifications of their charter.

Project team members are identified in this report by a capital letter (A - N), for identification purposes only; by a lower case letter (a,b,c) to indicate no science studied at school (a), science to School Certificate level (b) or science to 6th form level or higher (c); and a number (1,2,3) to indicate level of playcentre training at the time of the commencement of the project: commencing training (1), working at Assistant Supervisor level (2), or qualified to National Supervisors Certificate (3). One member, (Lb3), was qualified to National Supervisors Certificate level, with a background of science to School Certificate level. Six members (Kb2; Ja2; Ha2; Eb2; Da2; and Cb2) were working at Assistant Supervisor level, with science backgrounds of no more than School Certificate level. Five members were at the beginning of their playcentre training, with various levels of science backgrounds (Ab1; Ba1; Fa1; Gc1; Ia1).

For one mother the first meeting of the project team was also her first playcentre meeting, during her first week in playcentre. Two members, each qualified with the Equivalent Diploma of Teaching, Early Childhood Education, were in their final year at Terrace End Playcentre. The remaining ten members were at various stages of their playcentre careers. One of these ten was Maori.

Occupations prior to involvement in playcentre included one secondary school science teacher ((Mc3), a nurse aide ((Kb2); two registered nurses (Cb2; Gc1); a factory worker (Ja2)., clerical workers (Da2; Ha2); hair dressers (Ia1; Fa1), and one librarian(Lb3).

4.3 FIRST AND SECOND SESSIONS WITH THE PROJECT TEAM

The first two meetings with the interested and available group of parents, in fact fulfilled the stage of reconnaissance in the cycle of action research.

Session One

Possible learning outcomes were planned as far as compatible with the philosophy of action research, see Table One.

TABLE ONE
POSSIBLE LEARNING OUTCOMES, SESSION ONE

<p><i>FOR THE RESEARCHER-FACILITATOR</i></p> <ol style="list-style-type: none">1. Knowledge of the group's current understandings and practices in the provision of a science programme.2. The identification of the requirements of the group in learning to provide an adequate science programme in their centre.3. The development of a programme outline to satisfy the requirements of the group, including number, times and dates of group meetings, and requirements of participants.4. The sharing of requirements of this project, as study towards the author's M Ed Admin; especially the utilisation of the action research method. <p><i>FOR THE PARTICIPANTS</i></p> <ol style="list-style-type: none">1. A group definition of science, and its place in the programme.2. identification of requirements of individuals in the group, in learning some science, and/or in learning how to provide for it in the centre.3. An introductory understanding of interactive learning methods.4. Shared understanding of research findings on verbal interactions between staff and children in early childhood centres, and on the value of specific planning for science based on clear philosophies.
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Contents of the first session with the project team

- a) Introductions - 15 participants and facilitator.
- b) Data collection - individuals responded, in writing, to the following:

What is science?

Where is science found in the centre, at present?

These data formed part of the evaluation, and results the are reported in Chapter 5.

c) Group Discussion

Following completion of the questionnaire, the group discussed their views of science. They defined science as making sense of the world, the investigation of nature, of physics, chemistry, geology, astronomy, earth sciences; and of gaining confidence to explore, experiment, to classify, to notice patterns, to relate ideas to each other logically, and to predict and explain.

d) Activity

Topic: Identifying potential science experiences in equipment and areas set out in the Playcentre.

The group dispersed in two's and three's to different activity areas of the playcentre, with the task of identifying the potential science experiences in that area. Books, collage, blocks, painting, carpentry, music, outdoor play, cooking, puzzles, and dramatic play were all analyzed, and the lists thus generated were shared with the whole group. The general consensus was (a) surprise that science is so readily available, and, (b) concern that it was not currently being utilised.

e) Viewing of Video-recording

During the week prior to the first meeting of the project team, video recordings of mothers and children interacting during Terrace End Playcentre sessions had been made on several occasions. The purpose of making these recordings was to provide the project team with visual and auditory material from their own playcentre sessions which they could analyse as required. At this first meeting one sequence was viewed, and critiqued for interactive and dialogue techniques used by the adult subject (a member of the group, a very new parent, and with her permission).

Session Two

Three of the fifteen who attended the first night did not return. One of these was a fully qualified supervisor, who had intended to attend the first session only, with an interest in knowing the procedure; one was a visitor from Auckland; the third, on discovering her pregnancy with twins, declared fatigue as the reason for unsuitability for evening meetings. The remaining thirteen members attended regularly wherever possible for the next five sessions.

Possible learning outcomes were planned as far as compatible with the philosophy of action research. See Table Two.

**TABLE TWO:
POSSIBLE LEARNING OUTCOMES, SESSION TWO**

- | |
|--|
| <ol style="list-style-type: none">1. the development of specific guidelines for future meetings of the project team; experience in, and defining of a workshop, and organisation of partnerships and dates of presentations for each.2. a definition of "dialogues", and practice of the techniques of listening to children's ideas.3. an introductory understanding of interactive learning methods; shared understanding of research findings on verbal interactions between staff and children in early childhood centres, and on the value of specific planning for science based on clear philosophies.4. development of a chart specifying the overall area of "thematic concern".5. experience of a sample workshop conducted by the facilitator. on the topic of "batteries, bulbs, and circuits in early childhood centres" (appendix 5).6. clarification of the action plan, and each member's part in this. |
|--|

Contents of the second session with the project team

a) Practice

Topic: teaching methods for the sharing of science experiences and knowledge with the children.

The use of transmission, discovery, process, and interactive learning approaches were demonstrated, and their places in teaching children and supporting their learning, discussed. Particular emphasis was stressed on listening to children's ideas, accepting these, and considering how best to support investigations which may challenge current conceptions. Practice of the use of open-ended dialogues occurred in threes, and was discussed in the whole group, in detail. This topic was to become central to the viewing of videos made of the participants talking with the children during sessions.

b) Brainstorm

Topic: area of "thematic concern" (Kemmis & McTaggart, 1988, p.93).

Issues related to providing science in early childhood were discussed, as summarised in Table 1. This "Aristotelian Table of Invention", utilising Schwab's four "commonplaces of education" (Kemmis and McTaggart, 1988, p.93) was found to be a useful method of identifying the "preoccupations or puzzlements" of a topic. Group responses were recorded in the cells identified by each of the four areas of education, the adults working in the programme, the children, the subject area, in this case, science, and the overall milieu. This exercise prevented the direction of the study from being decided too early, and ideas recorded were returned to for further attention as appropriate in the study.

c) Experience of a Sample Workshop

"Workshop Information" (see Appendix 5) notes were distributed and discussed briefly. The facilitator led the group through a workshop on "batteries, bulbs and circuits in Early Childhood centres". This consisted of brainstorming participants' current knowledge in the area, followed by experience in small groups with the equipment set up (see Appendix 6). Participants were provided a copy of this appendix as a handout. The workshop concluded with discussion on issues of storage, and of setting limits with children on the use of equipment which is often easily damaged.

TABLE THREE: DEVELOPING THE THEMATIC CONCERN

An Aristotelian Table of Invention, utilising Schwab's four "commonplaces of education" - a method of identifying the "preoccupations or puzzlements" of a topic.

(Kemmis & McTaggart, 1988, p.94).

in relation to ...	what can be said about			
	(A) TEACHERS	(B) CHILDREN	(C) SUBJECT MATTER	(D) MILIEUX
(1) TEACHERS	Teachers are nearly all women, usually with little education in science; nurturing; pragmatic; fulfilling at least two full-time occupations.	Different children. approach teachers with different frequencies, and for different purposes. Some require positive approval prior to attempting experiments or explanation.	Science is [perceived as] male, difficult, irrelevant to daily lives.	Teachers are very familiar with and (are supposed to) emphasise good language and maths programmes - not so for science.
(2) CHILDREN	Talk more to the girls in language extension activities than to boys; hold different expectations for boys and girls and encourage them in different areas. Generally talk little to children. Often "talk past" chn., using language for which chn. have very different meanings. No metacognitive skills developed in chn.	Are curious about everything, some very cautious, other eager to try and to suggest solutions for problems. Are ego - centric, trusting, industrious, autonomous, capable of metacognition. Learn through play.	Consists of exploring, experimenting and thinking. Can encourage children to explore, consider reasons, propose relationships and reasons.	Provides ample opportunity for 'doing' science.
(3) SUBJECT MATTER	Lacking in confidence in science. Very few provide adequate science programmes. They know a lot of science but don't know that they do.	Don't distinguish curriculum areas. Explore and experiment with every area. Are gaining prejudices and expressing personality differences in where, how, what and who they play with.	A redefinition of science for adults can make it readily available.	Contains science at all levels, meaning different things in different cultures (and genders); eg Maori science is often dismissed as 'myth' .. not science. Society will continue to miss out on valuable scientific input until more girls and "gentle" boys become interested and confident in making their contributions.
(4) MILIEUX	Spend their time in particular areas at the centre (Collage, stories) and not others (carpentry, blocks, sand, outdoors).	Have developed their friendships, with chn. of similar though dissonant levels of cognitive ability. Are very susceptible to philosophies operating ie. are capable of being autonomous in choice, and of thinking and experimenting, with support.	Is everywhere in the Early Childhood centre.	Surprise is often expressed by non -EC people that young children can do science (be it electrical circuits, or growing plants).

4.4 DEVELOPMENT OF THE FIRST ACTION RESEARCH CYCLE

By the end of the second session the participants were in a position to formalise their action cycle (see Figure 2).

4.4.1 First Plan - Thematic Concern Clarified

The two major areas on which the group chose to concentrate their first change efforts were a combination of the contents of several of the "cells" from Table 1 (see previous page) 1a; 1c; 1d; 2a:

- to practice listening to children in order to hear what they express of their thinking and understandings, in order to extend these, and
- to develop confidence in sharing science topics with children.

4.4.2 First "Act" Stage

In the first action stage project team members, both individually and as a group, put their first plan into action, as it related specifically to their identified areas of thematic concern.

Confidence in sharing science topics with children

The group decided that the most effective way for them to learn about science, and to gain some confidence in exploring with children topics about which they (the adults) themselves knew very little, was to conduct their own workshops for each other. In pairs, they agreed to research a particular subject, collect the relevant materials, and to share them with children, prior to sharing them with the project team, as a workshop. Descriptions of the workshop topics and organisation are included in section 4.4.

Listening to children

Practice in listening to children would occur during the process of preparing for the shared workshops. In addition, whenever possible, the sessions of sharing the workshop materials with children would be recorded on video,

and (with the express approval of the subjects) critiqued with the project group.

4.4.3 First "Observe" Stage

This stage of the first action research cycle occurred at two levels. Firstly, as participants worked in pairs to share the materials for their forthcoming workshops with the children they observed and provided feedback for each other. Secondly, during subsequent sessions with the project team, they viewed with the group the video recordings of these interactions with the children.

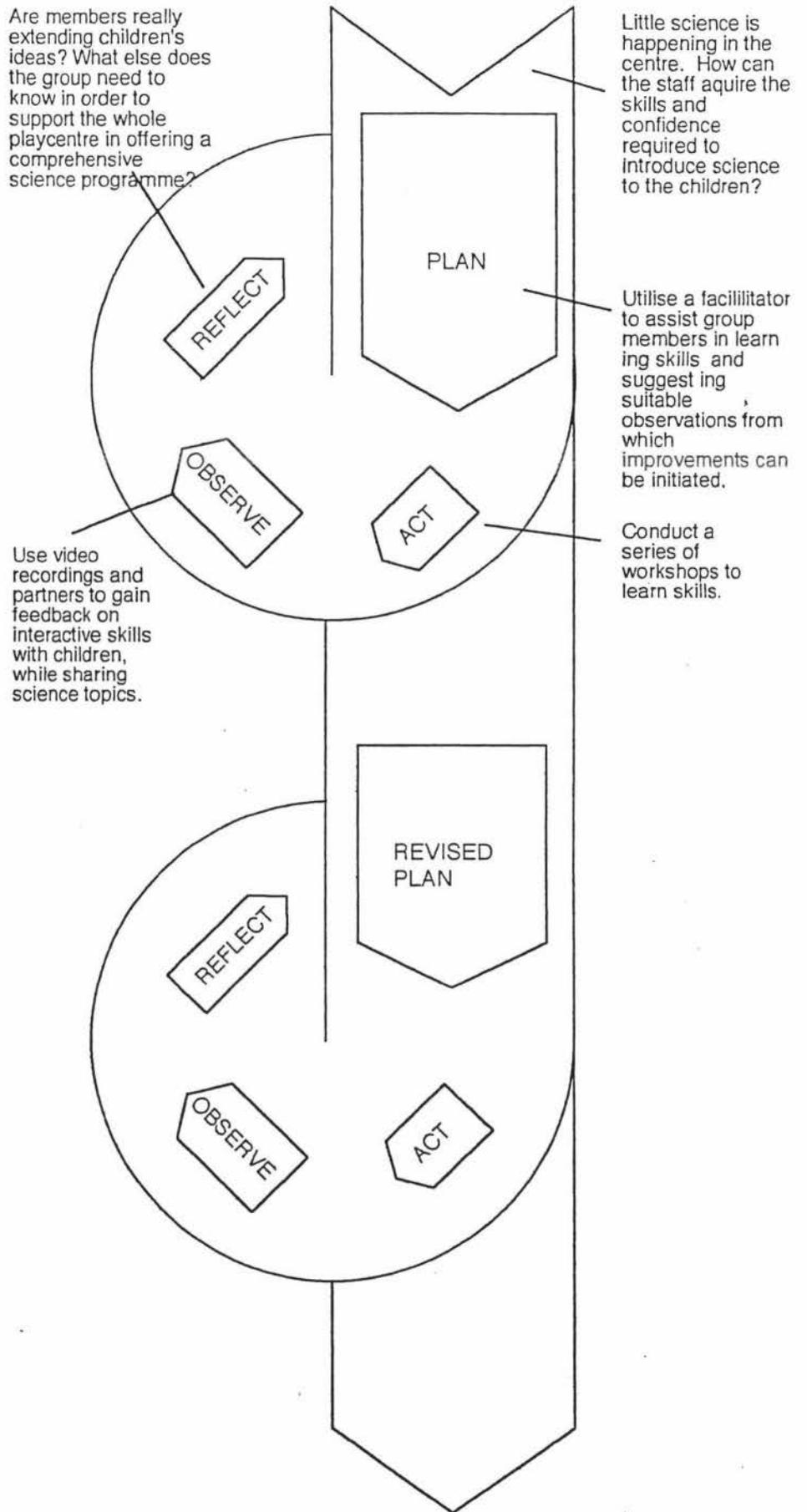
Observations included aspects of introducing new equipment and ideas to children, and the skills of dialogue, such as listening to the children's ideas, introducing ideas to children, and extending children's thinking and language.

4.4.4 First "Reflect" Stage

Individual participants and their partners reflected on their experiences of sharing new science materials and ideas with children during playcentre sessions. Many participants shared their resources in this manner on 3 or 4 occasions prior to their workshop presentations with the project team.

Another level of reflection occurred during the workshop evenings, when participants agreed to the group'd viewing of the video recordings made of them sharing their resources with children during playcentre sessions. In this manner positive and constructive feedback was given by the group, all of whom would gain from the opportunity to reflect on practice, their own and others'.

FIGURE TWO :FIRST ACTION RESEARCH CYCLE AT TERRACE END PLAYCENTRE



4.5 THIRD, FOURTH AND FIFTH SESSIONS WITH PROJECT TEAM

During the third, fourth, and fifth sessions, project team participants worked in pairs to present workshops, each on a different topic in science, to the group. Topics chosen for presentation between 17th July and 7th August, 1991, were: water; forces; magnets; heat; colour/light; condensation; chemistry; and sound.

Session three, four and five

Each evening consisted of:

- a) Discussions on the science which had occurred during the week, either at home or during the playcentre programme. Often a participant would request feedback on "what else could I have said? How could we have extended the child's ideas, without my taking over?"
- b) Viewing of any video recordings made, where the subjects granted their approval for this. Due to technical difficulties and time constraints, there were fewer videos viewed than there were subjects prepared to share their experiences.
- c) Two workshops topics were conducted on each of these three evenings. Following the pattern of the demonstration workshop, the general area of the workshop topic was discussed (basic ideas), followed by "hands - on" experiences for all to attempt, usually including a handout prepared by the presenters. The evaluation included discussions on the outcomes when this equipment/material had been shared with the children, and sometimes there was a video clipping of this to be viewed and discussed.

4.6 DEVELOPMENT OF SECOND ACTION RESEARCH CYCLE

As a result of their progress through the first full cycle of planning, acting and observing, and reflecting on the outcomes, by the conclusion of the fifth evening, participants were prepared to enter their second action cycle.

Their second plan consisted of two aspects, or sets of goals; one short-term, the other long-term, for themselves as individuals, and for their centre's science programme.

4.6.1 Setting of Short and Long-Term Goals

Short-term, group goals

Each participant developed short-term goals related to the construction of kits for the Playcentre. Each kit was to contain the equipment and suggestions, for any parent in the centre to be able to work with the children on one of the workshop topics. Cardboard file boxes were purchased to contain each set of equipment.

To ensure both that these kits were produced, and that they were shared with the remainder of the Playcentre parents, a common group goal was set: to hold an open evening of workshops at which the kits would be launched. All centres in the local Playcentre Association to be invited.

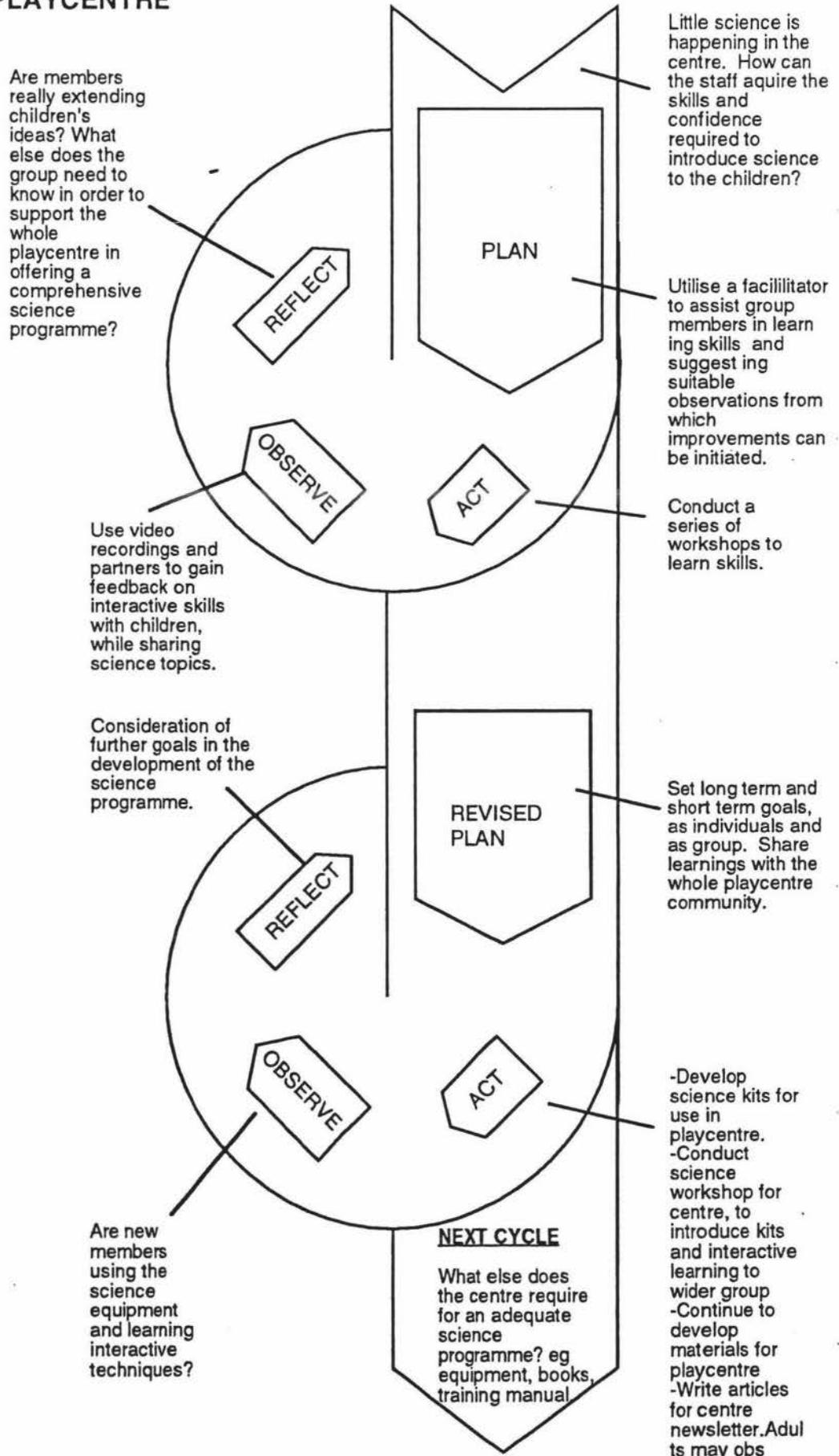
Long term individual goals

Goals which individuals set themselves included:

- to incorporate science in all areas of play
- to buy a crystal for the window, for 2 year olds
- to do volcanoes in the sandpit
- to make my own children more aware of the science around us *3
- making sure that new people know about the kits and what they can do with them.

Specifically, participants decided to provide less of the equipment at the commencement of the investigation, reserving materials for further extension as this seemed appropriate. They discussed their intentions of observing the children and listening to their own ideas, in order to ascertain their level of understanding, doing less of the talking themselves, to give the children the opportunity to express themselves. In doing so, they realised that they would need to be prepared to accept children's very different (from their own) explanations about how and why things happened, and remembering these in order to challenge the children at an appropriate stage, perhaps on another day or another week. Further learning in which they decided to engage was in becoming more aware of the equipment, books, and other resources which were available, and to which a child could be directed as her readiness to explore further seemed to be indicate

FIGURE THREE : TWO CYCLES OF ACTION RESEARCH AT TERRACE END PLAYCENTRE



4.7 EVALUATION PROCEDURES

Semi-independently of the group's project, the researcher was interested in recording some of the changes which may have been occurring as the result of the work of the group.

4.7.1 Course Records

- a) "What is Science?" questionnaire, completed by participants on the first night of the course, and repeated on the last night (appendix 4). These questions were designed to ascertain members' stated perceptions of science, before, and after the completion of, the project.

Questions included:

What is science?

Where does science happen in your Playcentre sessions at the moment?

- b) Video Recordings and Case Study of One Participant's Dialogues:
Video recordings were made of each of the participants working with children. One participant's dialogues have been transcribed from the video-recording, to note any improvement, this time at the level of the individual. These transcriptions have been recorded for a week during each of the following periods: prior to the commencement of the course; during the course; and a month subsequent to the completion of the course.
- c) Document search of the centre's daily records, completed by parents on duty each session (appendix 3). One week was chosen during each of three periods in relation to the project: one prior to the commencement of the project (period 1); one during its progress (period 2); and the third subsequent to its completion (period 3). Specifically, those aspects of the record which were of interest to the project were:

Dialogues with children:

"Which children were listened and responded to (8 minimum exchanges)?" In this section, people on duty recorded the topics of dialogue, as well as the children's names and activities.

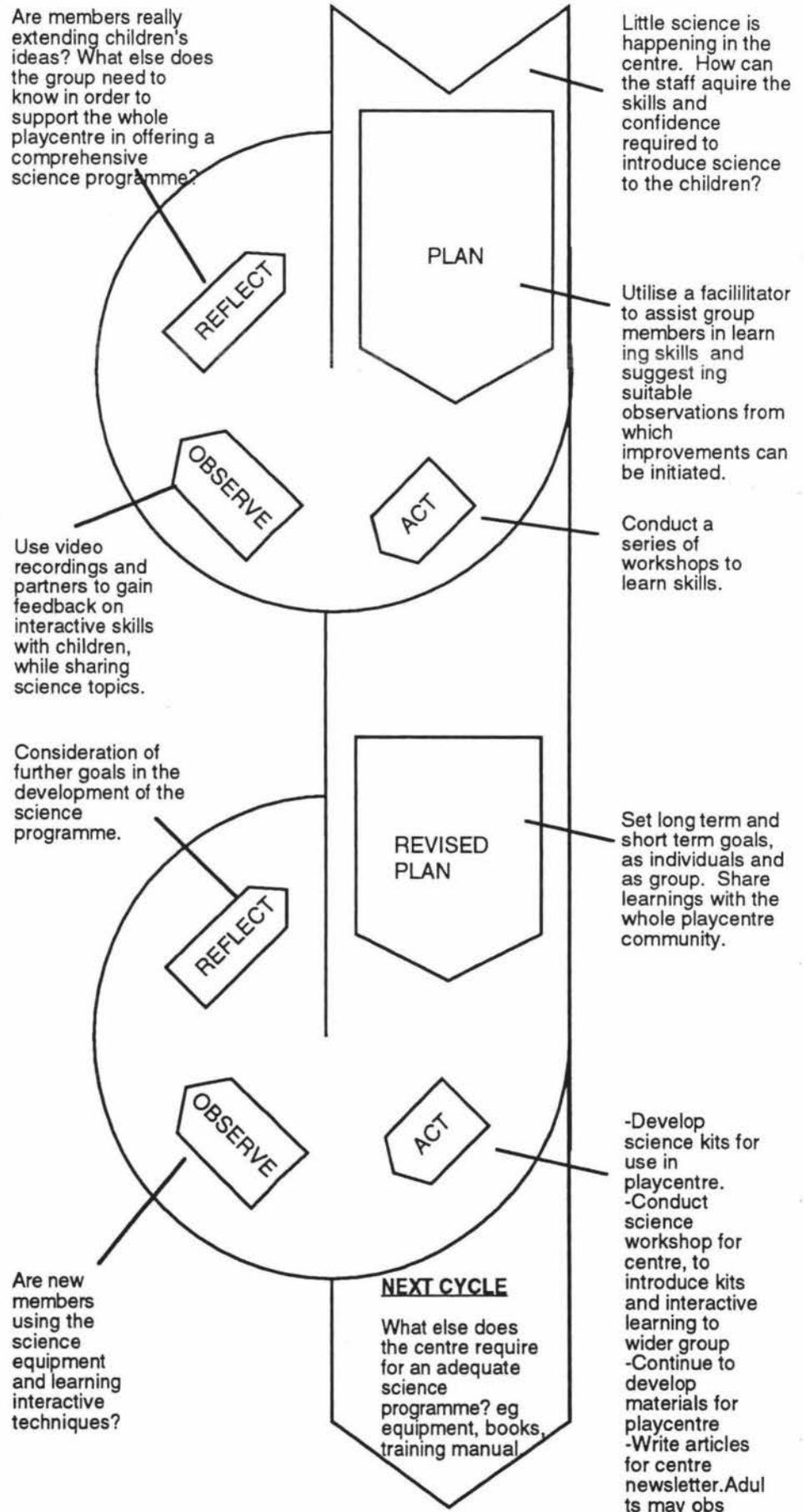
Specific planning for science in sessions:

"What specific planning for this session was carried out?"

4.7.2 Interviews

Structured interviews were carried out with each participant, after the completion of the course, to ascertain, amongst other items, whether or not short-term and/or long-term goals set during the course, were met, for the individuals. Participants also stated their perceived outcomes from the course, for both themselves and for the children in the centre.

**FIGURE THREE : TWO CYCLES OF ACTION RESEARCH AT TERRACE
END PLAYCENTRE**



Chapter Five

EVALUATION RESULTS

The results of the evaluation procedures contributed to the author's reflection of the overall process of the two cycles of action research completed by the project team. In addition, and in keeping with the ethos of action research, that the research belongs to the participating group, these results were shared with the group. A summary of the results of the questionnaire, the document search of dialogue counts and specific science planning, the interviews, and the transcript of one participant's dialogues with children reported in this document, were distributed to each member of the project, subsequent to the completion of the project.

The video recordings of project team members sharing dialogues with children were central to the participants' reflection stages, and were viewed by both individuals and the by group during the course of the project.

5.1 COURSE RECORDS

- (a) "What is Science?" Questionnaire.

What is science? and

Where does science occur in the centre?

Whether or not project team members had formal science backgrounds, only two (project team members Mc3 and Cb2; see references in section 4.2.2)) I thought that they had any science knowledge which would be of use to them in developing a science programme for their children. All stated early in the programme that their sessions did not address science sufficiently; "children are being encouraged to explore, but we don't know enough to be able to extend them to understand the science principles" (Eb2). When asked to consider "what science is happening now?", they replied, "very little, if any".

Results of parents' attitudes to science which were operating prior to the course commencement, gathered in the questionnaires completed on the first night of the course (see appendix 4), indicated that science was viewed as consisting of topics and concepts, with little reference to the process of exploring these topics. as. Responses to the question "what is science?"

were based on knowledge of either specific science topics, such as "earth, power; biology; how things work; the world around us", or on activities or equipment, such as "water; sand - textures, light, heavy, wet, dry; puzzles". Only one respondent mentioned any aspect of science as a process, identifying "the senses".

By the end of the project, participants realised that content and knowledge are no more important than the process and context of learning science. Responses to the same question as on the first night "what is science?" included the same topics as previously, eg "batteries; colour and light; sound", and the activity areas, such as "water; cooking; collage; sand; block, and outdoors". The major addition to these lists, which indicate the group's shift in perspective, were the items such as: "science is fun; helping children and adults to ask and answer questions; science is everyday experiences - looking, feeling, smelling, and tasting; thinking about what happens; working together on the 'what happens if.... questions'; discovering the world around us, all those things which we come into contact with all the time, and take for granted". Of particular note were the comments related to the context of science for each child, such as "science is motivating the child to go on from here; noticing the world around us from the individual child's point of view" (Ja2)

The major shift seemed to be that the adults gained confidence in their abilities in considering subjects which they would previously have thought they knew nothing about; they learned that they could investigate with the children, while leaving the children in control of their thinking, and supporting their lines of interests.

(b) Video Recordings and Case Study

(i) Video recordings

These were made prior to, throughout, and subsequent to the completion of the project. Typically project participants were observed as they worked with the children using the equipment they were developing for their workshops, with follow up recordings as requested by participants who were working specifically on their verbal interaction skills with children.

Period 1: (Precourse). The four hours of video recordings of the adults working with children in the centre prior to the commencement of the project indicated that high levels of verbal interaction and extended dialogues. Many conversations between adults and children were occurring each session (65 in four sessions, or an average of 16 per session), and an adult was nearly always available to interact with a child as required, without this seeming to be in any way imposing on the child or preventing their autonomy. Children were playing at their self-chosen activities, sometimes in solitary play, at others in small groups.

One of the first extended dialogues recorded in this period, between adult Gc1 and four children, continued for some 35 minutes. In this sequence, the adult continually followed up on the children's interests, encouraging language with individuals and between children, and supporting them as they found suitable equipment with which to explore further. Activities and dialogues were spontaneous, and child-directed, with very little specific planning having occurred for the session .

An example from 'Process cooking'

Adult: (Ha2) what does the picture tell you to do next?

Child: put a spoonful of flour in here.

Adult: and then what do you think will happen?

Child: oh look, its still all sticky.

Adult: what could you do about that? What do you think you could put in it so it is not so sticky?

Child: I've got it all over my hands. I want to wash them.

Adult: Here, try rubbing some flour in your hands, to dry the sticky dough up a bit.

Child: Oh look, now I can roll it out. Look at my biscuit!

Here, the adult is in a supporting role, with the child directing the activity. Dialogue is in the 'here and now.' Although it continued for some time on this low-level running commentary, the language appeared to be contributing less than the experience of "doing", itself. The child appeared to be gaining confidence in his skills in following the diagrams setting out the sequence of events, which often culminate in edible products.

Period 2: The two recordings made in this stage (see transcript of one of these recordings in the following "case study") indicated a specific focus on particular science concepts, with equipment specially provided to demonstrate these concepts. Children were encouraged to participate in the "experiments", which at times developed into quite structured teacher-directed sessions, and the adults were very eager to demonstrate their new knowledge to the children. Often they appeared to be attempting to teach all the concepts they were themselves just becoming familiar with, to the children.

Instead of listening to the children's ideas, as they had been doing in previous recordings, the adults now tended to be doing the majority of the thinking, talking, and guiding of the conversations. These parents subsequently became aware of being overly directive because of their eagerness to share their own new knowledge with the children. Through sharing their understandings with the group, these parents enabled the other members to consider their own approaches to children with their equipment and ideas.

(ii) Case Study of Dialogues with Children, at Three Stages of the Project

Due to the technical difficulties encountered with inexperienced video camera operators learning to use new equipment, only fifty per cent of the recordings were both visible and audible. The choice of the case study subject (Gc1) was made on the grounds that video recordings with good sound and visibility were made of this subject at each stage of the project. By chance, this mother was attending her first week of playcentre during the first the week in which video recordings were made for the project, one week prior to the first project team meeting.

Period 1: Pre-course:

Scene: A group of children (6+-) outside, investigating trees and logs

Adult (Gc1): Have you seen the buds on this tree?

Child 1: There's a big hole.

Child 2: Look at the top of it. It's really big.

Child 3: I can't climb up there.

Adult: I wonder what was there at one stage? (responding to the "hole").

Child 2: It's very round.

Child 3: It's where a branch was chopped off.

(children with hands exploring the inside of the hole).

Adult: What does it feel like in there?

This dialogue continued for some 35 minutes, with the adult consistently responding to the children's interests, challenging their ideas, and assisting in the linking of children's experiences present, past and future.

Note that this adult was not aware that she was engaged in a science programme.

Period 2: Mid-course

Scene: The same adult preparing for her workshop at the course evening, on magnets.

Adult: (Gc1) What's happening?

Child: It's moving.

Adult: What's making it?

Child: The magnet.

Adult: If it works through paper, do you think it will work through...this? (glass)....this? (baking tray)....this? (wood).

(Adult tries each sheet).

Child: I want to try this sand.

Adult: There's sand in this box. Put the magnet underneath. What's happening, Dominic?

Child: They're moving.

Adult: OK. That's ironsand. This is ordinary sand out of the sand-pit. Will it work with this?

Child: No.

Adult: Why does it work with this and not this?

Child: Cause it's wet.

Adult: Yes, it's wet. Let's try with dry sand and with wet sand. (Adult made the sand wet). Now try the magnet. Does it work with wet sand?

Child: No.

Adult: OK. I'll show you something.

(sets up paper-clips in a cup, with the magnet on the outside to slide them up to the top).

Child: (shows little interest, and wanders away).

The child was initially very interested in the equipment, and wanted to experiment. However, the adult had her own, more pressing agenda; she, in effect, became quite didactic, doing all the thinking and setting up herself, - with the result that the child wandered off.

Period 3: End of course.

Having been through a stage of reflection, the adult was aware of the effects of what she called her "disastrous magnet session!". After viewing and evaluating the video clip, her "revised plan" was quite specific. She decided to improve her skills in "listening to the child's interest", while "keeping my new knowledge to myself, until it is relevant to the children to share it with them". Also to "become more aware of the books/puzzles/equipment available with which to follow-up children's spontaneous interests".

Because this adult agreed to share her video recording with the group, many others had the opportunity to be forewarned about the temptation to adopt the "transmission approach" to sharing information with children, at the expense of their "interactive learning".

Scene: Adult(Gc1) with two children doing puzzles, on the floor. The current puzzle depicts various water animals.

Adult: (Gc1) Tell me about all these animals.

Child 1: They are all living in the water. Look, here's a sea horse.

Adult: Wow! Have you seen a sea-horse?

Child 1: Yes.

Child 2: I have too.

Adult: Tell me about where you saw these sea-horses?

Child 1: We found a lot of sea-horses. And mmm mmm mm, some jelly-fishes. Some good ones and some squashed ones.

Adult: Were they alive?

Child 1: Yes, the good ones were. And we had to be careful so they didn't sting us. So we just played on the beach, and kept away from the squashed ones.

Adult: That was a good idea.

Child 2: Yes, because they might sting you if you go in the water. But sometimes they don't, because we want to swim there. Why do they want to sting us?

Adult: I don't know why they sting people. Perhaps we just get in their way. I think we've got a book about jelly-fish and sea-horses. Shall we go and find it, and see if we can find out more about them?

On reflecting on this short dialogue, the adult discussed the books available for extending and challenging the ideas on sea-horses and jelly-fish. She was well aware that she and the children were engaged in interactive learning in science, and that she did not know much about the topic which had arisen. She also knew that books were available in the centre, and that she and the children could together investigate - with the children taking the lead.

Note that these children talked more than the adult did, and that the topic remained in their control at all times. This adult seems to have reverted to her interactive learning style with the children, which she exhibited in the pre-project recording, with the addition of her now clear understanding of her own role in extending the dialogues and the thinking in science of the children.

The subject of these recordings, along with other course participants, viewed themselves on video recordings, as a means towards attempting to improve their interactive skills in the area of sharing science with children. Having themselves become very uncomfortable in the transmission approach style, usually without needing to view this on the video, which merely confirmed their discomfort, they each identified the changes they wanted to make in sharing this equipment with the children. These changes involved the use of equipment as well as listening skills.

(c) Document Search

**TABLE FOUR: SUMMARY OF DOCUMENT SEARCH
DIALOGUES AND PLANNING SCIENCE FOR SESSIONS**

	PERIOD 1 3-6/6/91 Pre-course	PERIOD 2 9/7-2/8/1991 Mid-course	PERIOD 3 19-23/8/1991 Post-course
Number children present	average 15 each day	average 15 each day	average 16 each day
Dialogues recorded for week	65 Average 16.2 per day	78 Average 19.5 per day	87 Average 21.8 per day
Specific Planning	socialisation *2 balancing large motor	magnets candles *2 batteries compost	large motor socialisation *2 log chemistry thistle compost light/colour

Key: *2 indicates 2 respondents making same entry in the week.

(i) Dialogues

Period 1: 3-6 June 1991, prior to course commencement.

The number of indepth dialogues with children which were reported during the week, was 65. This number gives no indication of how often each child engaged in dialogues each day, how long in each session these dialogues were maintained, or the topics of conversation. Since a dialogue was recorded only if it was of eight exchanges or more, these figures indicate that on average each child was engaged in one or more dialogues each session. However, in comparison to Meade's (1985) figures (120 in every 1/2 hour), it does appear to indicate that these parents were taking the time to listen to children's ideas sufficiently to develop dialogues.

Period 2: 9 July - 2 August, 1991, during the progress of the course.

The number of "children" with whom it was reported that indepth dialogues were held during the week, was 78.

Period 3: 19 - 23 August 1991, after the completion of the course. The number of "children" with whom it was reported that indepth dialogues were held during the week, was 87.

The number of children present at each session is normally 14 to 16., and figures for the four general sessions were tallied for each week. Thus, the number 65 represents an average of 16.5 children per day who shared significant dialogues with adults. Since each child's name is recorded only once each day, many more actual dialogues than 65 may well have been engaged in. All the recorded numbers are, then, minimal numbers for each session.

A steady progression in numbers of dialogues shared with children during the progression of the science project, and in the weeks following its conclusion, was recorded (period 1: 65; period 2: 78; period 3: 87).

(ii) Specific Science Planning

Mothers on duty recorded any planning they had achieved for the session, and recorded this on the form supplied for each session. Retrospectively, the researcher analyzed these records, with a specific interest in any science topics planned.

Period 1: Specific planning for this week included a focus on "socialisation", each day, and "balancing (in obstacle course)" and "large motor skills".

Period 2: At this stage, specific planning for the sessions indicate an obvious focus on the science topics which participants were researching for their workshops; "magnets; candles; batteries; condensation; candles - wax and ironing", with the addition of a particular interest in compost and rubbish, which were aspects of an ongoing project. Of interest is the fact that so many of these topics were included in this one week, of the three weeks which were available to participants to share their ideas with the children. Each topic was presented to the children on more than one occasion, as participants in the project became involved with their own individual action research, so it is likely that this level of planning for science occurred at least for these three weeks of the course.

Period 3: Specific planning for the sessions are now a combination of general socialisation/large motor skills, and specific science topics, such as investigating rotten logs, thistles, and light and colour.

5.1.2 Interviews

Structured interviews with participants

Subsequent to the completion of the course, and in fact four months later, each participant was interviewed, from a structured set of questions (see questions in Table 3). The purpose of the interview was to ascertain the participants' beliefs about their own learning from the course, and their understandings of any changes made in the programme due to their combined, and individual efforts. Their achievements of their short-term and long-term goals was also queried, as was any change in their interactions with their families, in science, and where they thought they would choose, now, to make any further changes in their own learning and sharing of science with children.

Table three records participants responses to each question are recorded. Note that a number following a statement indicates the number of participants who made the same, or a similar, response. Each question may have elicited more than one response from each project team member.

TABLE FIVE : INTERVIEW RESPONSES

QUESTION	RESPONSES
1. How/Where does science occur in your centre, Now?	<ul style="list-style-type: none"> - in play, everywhere *8 - at the science table *2 - in response to the children's interests - in the sand, water, outdoor, carpentry - it happens often - in the work with the kits; everything is there when I want them (candles, etc.) - a lot, especially in natural things - a lot in the water - lots of new ideas, creativity and diversity
2. Is this different in any way from the science which occurred prior to our science course?	<ul style="list-style-type: none"> - yes, for me it is *4 - the kits are used a lot - others don't seem to be using the kits, they seem to have forgotten all about them - yes, I picked it all up quickly - yes, science is happening more *2 - I notice more, because I am more aware - it opened people's minds - at a different level - batteries, candles, bulbs - more aware of kits - I got a lot out of it - focused people on "lets make.." in the whole centre
3. What has changed, for you, in offering science to the children, as a result of the course?	<ul style="list-style-type: none"> - a focus on changing - sharing things from home a lot more, and with the other children - I can do it! - my knowledge in different areas has increased *2 - I have more confidence in science subjects, and in my finding of the resources - I'm not scared of science words, now *4 - open questioning is happening a lot more *3 - people are using the kits frequently - science is fun, and even more fun with children - science is simple things **5 - now I know I am doing science *3 - now I use books for more learning - I hadn't thought of doing that before, and didn't know we had all those books
4. What has changed for the children? For the centre?	<ul style="list-style-type: none"> - resources have improved *3 - we are more aware of what we need, and purchase any equipment accordingly - the biggest change is talking to the children for longer; we now discourage reading to them at the morning tea table, and encourage simply talking instead - children are learning more concepts, through exploring and experimenting - the pooling effect is important. With so many adults interested, the children are getting a lot more interesting things - there are more opportunities available for the children - there is a more positive attitude generally - there is more interest in science, and this hasn't waned at all
5. Is science more available in any way? To you and/or to the children?	<ul style="list-style-type: none"> - yes *3 - for me and the children I work with, yes *2 - especially with my own children (eg noticing air on a cold morning; bringing shells home from the beach; discussing the whiteness of the water when disinfectant was added) - occurrences are being brought to the children's attention - there is more of a focus *2 especially at the science table - dialogue with the children is different; children are extended more, with more language and greater confidence in experimenting - we know that we are doing science; it is good for the centre and good for our self-esteem - the kits are a part of it, because the pyramids and cellophane are all there

cont....

<p>6. What science have you shared with the children in the last week?</p>	<ul style="list-style-type: none"> - light and colours (pyramids, cellophane and mirrors) *4 - nature; looking after and feeding caterpillars - block corner; painting; the sandpit - bone-carving, with lots of questions about bones - magnets - cooking - a lot in the sandpit, with waterfalls - sponges, from the beach; butterflies; caterpillars; now I see all these as science - the science table is right there inside the door, which is brilliant for sharing children's offerings - batteries, at home, with the younger one showing the older one how to connect a circuit in series! - investigating the mouldy vegetables, and finding all sorts of insects, maggots, with a magnifying glass. It smelled OK and was fascinating
<p>7. Would you have been likely to have shared this science with the children without having done the course?</p>	<ul style="list-style-type: none"> - it would have happened, but it is now more indepth, the children more extended, because of the course - not in the same way; it is more natural, Now - we are more aware *3 - no, not the magnets; nor the batteries - some, I wouldn't have recognised as science - definitely not. I knew nothing about it at all! - no. I wouldn't have been so excited, or realised it is so neat! - no. I would not have brought back such messy things from the beach. Last year we were "neat and tidy" - this course has changed the whole way I talk with children. Especially watching Irene on video, I know I can pick up interests and ideas on another day
<p>8. What were your short - term goals? -</p>	<ul style="list-style-type: none"> - to complete the science folder - to complete the kits: (water; candles, light; magnets; colour and tie dying; chemistry)
<p>9. What were your long - term goals?</p>	<ul style="list-style-type: none"> - to incorporate science in all areas of play - to buy a crystal for the window, for 2 year olds - to do volcanoes in the sandpit - to make my own children more aware of the science around us *3 - making sure that new people know about the kits and what they can do with them
<p>10. Which of these have you achieved or planned for?</p>	<ul style="list-style-type: none"> - yes, all of them have improved *4 - yes, the short-term ones *3 - yes, the long-term ones *4 - more equipment has been purchased, and this is ongoing - it is ongoing, but nearly complete at this stage - I have continued my science studies as a focus in "focus on play" - at home, yes there is much greater awareness - not quite, but I still plan to
<p>11. What were your major learning from the course?</p>	<ul style="list-style-type: none"> - the importance of dialoguing with children *3 - open questioning of children - finding the child's level of knowledge and understanding - answering children's questions; the children are asking more - not answering children's questions, but extending their thinking *3 - realising how different children's perception is from my own - to research, using books - that science is fun *3 - specific concepts in science *3 - confidence in what I already knew *3 - ideas in how to implement science with children - greater awareness of what science is *4 - that science is everywhere, and I have the ability to share it with children! - that some things were really simple, I knew them already, and this was very reinforcing.

cont....

<p>12. What did you like/dislike about the course structure? Did it cater for your requirements, and if so, in what ways?</p>	<ul style="list-style-type: none"> - it was great to have the chance to just work with things; and it didn't matter if it didn't work out - I appreciated the follow-up evening to extend our knowledge to others - I could tune in to people who had already done the experiments and they could help me answer my questions - I really liked the "hands on" *5 - working together as a group was special - everyone was a participant - your enthusiasm was inspiring, and we caught on - the course could have gone on and on.... - I would have liked another couple of sessions; it was appropriate and practical the way it was done - evaluating ourselves, and watching the videos of our own children with members of our group, was very enlightening - I liked being shown how to conduct a workshop - I never felt scared or inadequate, as I expected to
<p>13. What changes would you recommend for a similar course to be held in the future? - none. It was great the way it was *6</p>	<ul style="list-style-type: none"> - I just really enjoyed it - invite other Playcentres to share the experiences - two hours an evening was really good; I appreciated your maintaining the time limits - well done - just great - the course was a bit long *2
<p>14. What do you think your group needs to do, now, in order to maintain/improve your science programme for the children?- share with other centres and parents</p>	<ul style="list-style-type: none"> - more science education for the parents - need better storage for the equipment - to get together again to share the kits with the new parents - new parents need the information on what we are doing - the worksheets need laminating

Participants stated that they were aware of science occurring with greater frequency as a result of their participation in the project. (responses to questions 1,2 and 6). They reported learning that science can be fun, reducing their fear of science, and extending the number of activities in which they were conscious of sharing science with children (responses to question 3). As a group, participants reported greater awareness of and more interest in the opportunities for science, and science resources were reported to have improved (questions 4 and 5). Dialogues with children were more extensive, and recognised as having a science content (responses to 4,5, and 7). In most cases goals were declared as having achieved. Learning from the project was identified by participants as including greater expertise in listening to children, extending their conversations and ideas in dialogue, and gaining confidence in sharing science with children.

5.1.3 Evaluation Results Summary.

Results from the "What is Science?" questionnaire, administered at the commencement and repeated at the conclusion of the project, indicated that during the project, the participants had broadened their definitions of science. The transcripts of video recordings of participants interacting with

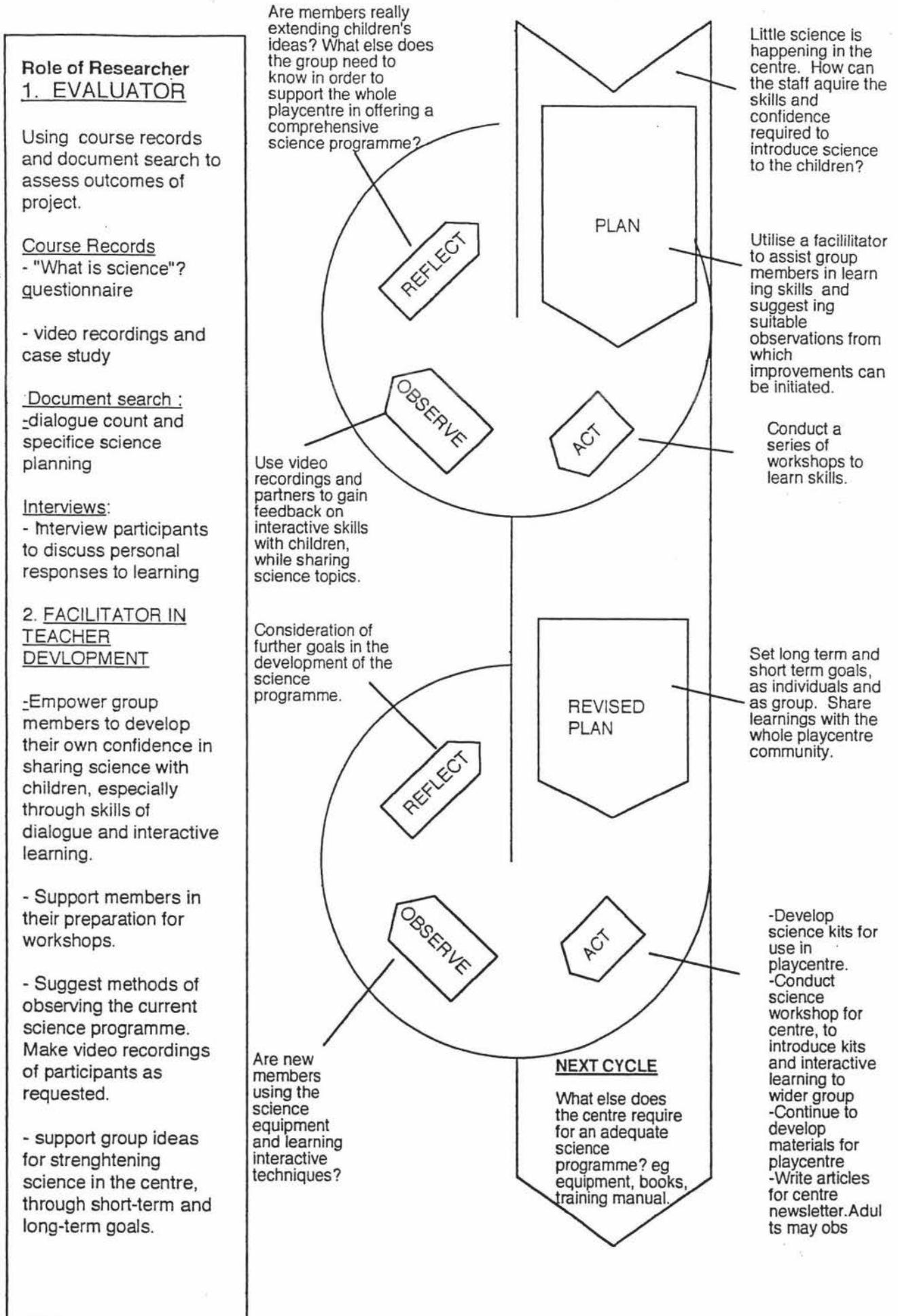
children on topics and processes of science provided evidence that reflection did contribute to improved listening skills. Specifically, the subject of the case study of transcripts identified her intentions, as follows:

- To be aware of the value of her dialoguing with the children, and of the science she was experiencing with them.
- At times to specifically plan to follow-up specific interests of the children, so that projects become ongoing, with children knowing that their ideas are valid, and that they can themselves plan their activities.
- Encouraging the children to do more of the talking and the thinking than the adult.

The retrospective document search of Terrace End Playcentre session records provided clear evidence that the number of dialogue between children and adults conducted during playcentre sessions increased during, and subsequent to, the course of the project. During the same period, planning specifically for science prior to the commencement of each session also increased.

Participants reported, during structured interviews with the author, that they had gained confidence and skills in listening to children's ideas about science, and in extending these ideas.

FIGURE FOUR : MODEL OF PROJECT



Chapter Six

DISCUSSION

6.1 RESEARCHER REFLECTION

The two major areas to be addressed in this project were identified as: the provision of science as a curriculum area in early childhood; and the changing of teacher attitudes, especially concerning teachers' own knowledge about and confidence in sharing science with young children (Page 2).

The provision of science in the Terrace End Playcentre sessions improved during, and subsequent to the completion of the project, from at least two perspectives. Planning specifically for science to occur improved, as did the number of dialogues between children and adults. These increases appear to be the result of participants in the project having carefully considered their curriculum goals, and deciding on methods of organising materials and activities " into a coherent programme for optimal development (Lazar, 1983, p1).

The implied outcome of adults planning and providing for an improved science programme, which includes increases in numbers of dialogues with children, is that the children will have benefited. The children at Terrace End Playcentre, especially those of the mothers engaged in the project, were provided increased opportunities to engage in interactive learning with adults. From the constructivists' perspective, these children have had the opportunity to extend their personal knowledge bases; their ideas have been heard and extended through dialogue, and through the provision of additional equipment relevant to their interests. In the language of the social constructivists, the increased number of dialogues shared with adults in the programme will have provided the children with opportunity to "clarify and legitimise their ideas" (Solomon, 1987, p64).

The problems inherent in developing the science curriculum in early childhood, as outlined in Chapter 1.1, have clearly been addressed through this action research project. The women in this project, all mothers at, and at various stages in their playcentre training, have come to realise that they are capable of understanding science, and of sharing it with their children. This change of attitude was effected in part by their realisation that science is much more available in their lives, and in

their children's daily activities, than they had previously been aware. Having been introduced to, and/or reinforced in their current practices of, listening to the children's ideas, and researching the children's interests, wherever possible with them, has led to their greater confidence and commitment to providing an adequate science programme. Having the opportunity to practice this listening/research/follow-up process in a safe environment, and receiving constructive feedback on their progress, has largely overcome their initial feelings of their inability to "do" science. This has allowed them to experience the real potential for children's cognitive development inherent in science topics.

The group was not interested in observing any differences in programme provision, especially in the area of science, between the boys and the girls. The outcomes of the group's life experiences, specifically their lack of confidence and self-perceived lack of knowledge about science, seemed so obviously based in issues of gender, that the author expected that participants would choose to examine any evidence of gender inequities operating in their programme. Nevertheless, through focusing only on developing their own competence in science, they will have gone some way towards rectifying the problem of a lack of models for the children, of women as competent to engage in discussion on topics of science. Elden (1981) expresses some of the author's frustrations well: "In participatory research compared to other types of research the researcher is more dependent on those from whom data come, has less unilateral control over the research process, and has more pressure to work from other people's definition of the problem" (Elden, 1981, p.261).

In Tripp's (1990) language, these women have been engaged in an "emancipatory" form of action research. Science is now seen by at least this group of women, and by at least some of their families, as less of a masculine subject. They are now aware that science is an integral part of their curriculum; in sharing science, their skills of extending the children's ideas, through good dialogue techniques, and through being prepared to research topics with them, will assist the children in developing their curiosity and their needs to make sense of their world, their skills in problem-solving, and their reasoning and other cognitive skills. Participants' responses to the structured interview provide ample evidence that the mothers' learning does, in fact, extend to all her children, and continues to be effective long past the completion date of the course. Educating the Playcentre parent educates not only an individual but also a whole family of at least two generations.

In terms of changes in registers (section 3.2.4), results indicated changes in language, to more orderly discourse, including a great deal more science planning and dialogues. Activities in science have developed into justifiable practices, again evidenced in planning and session records. The centre's educational goals in science are being met, through newsheets, science kits, ongoing workshops and centre discussion.

As Young-Loveridge (1991) noted in reference to young children's experiences in learning mathematics, children in early childhood are unlikely to have experienced failure in a formal science learning situation. Any science programme at this stage will 'support and boost' children's emerging skills in science. Children who experience success in science in the early years will be supported in greater success in their future. Where their parents are also involved fully in this learning, as they have been in this project, the children's attitudes and skills in science will be continually reinforced at home.

It is clearly possible, and desirable, to change the attitudes of early childhood staff and parents towards science in a positive direction. As skills and knowledge develop, so do confidence and ability in sharing a wide range of often new materials and ideas with children.

6.2 IMPLICATIONS FOR TEACHER EDUCATION

All change measures utilised in this project indicate that this group of playcentre parents has been empowered to initiate and to evaluate educationally worthwhile changes in their science programme. Several possible implications can be made for future teacher education programmes:

- Preservice teacher education programmes should clearly address the likelihood that the majority of students will lack confidence in science. Students should be provided with an adequate foundation for developing confidence in their own scientific knowledge, as well as an understanding of the important role which science has to play in childrens' cognitive development, and their role as teachers in developing good science programmes. Where their courses require them to observe and develop science in the centres in which they are engaged in teaching practice, the staff members in those centres will also have the opportunity to realise some of the potential in science for childrens' learning.

- Inservice teacher education programmes are offered for teachers at different stages of their careers. As discussed earlier in this project, it is necessary to address both the content and the process of the desired change. Teacher development is most effective when it provides time and opportunity for "practice, reflection, and collaboration", as well as "ongoing, interactive, cumulative learning" (Gilbert & Osborne, 1981, p.12). Such opportunities for teacher development in science should be provided in inservice programmes on a regular basis. The Kemmis & McTaggart (1988) model of Action Research was found in this project to be a very effective one in terms of empowering the participants.

6.3 SUGGESTIONS FOR FURTHER RESEARCH

The focus of the current project has been on the parents staffing the centre. This is justifiable, since the quality of an early childhood programme is dependent, among other aspects, on the quality of the supervision, and therefore on the understandings and knowledge of the staff members (Meade, 1985). However, there are many variables which have not been addressed in this study, especially those related to individual children. Research on how children learn science in their early years is meagre.

Some questions which arise from the current project are:

- How should science be structured in an early childhood programme, to ensure that all children are given real opportunities which have the potential for leading to "the making of a good scientist"? (Woolnough, 1989).

The practice of offering a free play programme may, in fact, lead to a continued encouragement of boys into active, objective, and reasoning activities, and girls into the more passive, nurturing roles; intervention seems necessary if girls and women are to have any chance of realising that they are capable of being scientists, at whatever level they choose.

Research in the area of gender differences could focus on aspects of the early childhood programme which influence the adequacy of the science offered. These aspects include the allocation of time, space, equipment, and numbers, ages, groupings, and attitudes of the children and of the adults .

- Can and should metacognitive skills be taught to children in early childhood? This study, and all the literature related to it, indicate that staff members generally struggle to engage in dialogues with young children, at the level of the constructivist approach to learning. The parents in this study significantly increased their rate of dialoguing with their children; it is unclear whether this occurred because of practice in how to conduct dialogues with children, or whether the dialogues were the result of having topics in science which they wanted to share with the children. It appears that a step beyond the sharing of dialogues would be teaching of metacognitive skills. The author has seen no evidence of metacognitive skills being taught in any early childhood centres in New Zealand at all, as Pramling (1990) has done in Sweden.

- In this project the focus was on the improvement of the science programme, with action research foremost only in the mind of the researcher. As a result, the emphasis of all the change efforts, for the participants, was at all times on science, and talking with children. Should action research be taught to early childhood practitioners, as a teacher development project in its own right?

- How generalisable are the results of the programme to other aspects of the early childhood curriculum? Would an emphasis on action research, perhaps related specifically to science, have been as effective in helping participants to learn about science? Might a greater emphasis on the specific teaching of action research be of more utility in supporting effective and worthwhile change in early childhood programmes? A longitudinal study, perhaps investigating any continuing outcomes of the current group of participants, would be valuable.

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Appendix One
PLAYCENTRE FACTS 1992

Appendix Two:

**NEW ZEALAND QUALIFICATIONS AUTHORITY EQUIVALENCE TO A
DIPLOMA OF TEACHING (EARLY CHILDHOOD EDUCATION)**

Appendix Three
SAMPLE FORMS FROM TERRACE END PLAYCENTRE

15. PHs to sign the roll.
16. Session Supporter make PHs drinks.
Session Supporter pen and paper available to make notes.
Session Supporter see that roll is marked and signed.
Session Supporter circulate evaluation sheet at end of session.
17. Specific planning for this session including follow up from previous sessions & monthly plan (enter these also on the evaluation sheet section 5). Note any extra resources provided.

(ii) TERRACE END PLAYCENTRE SESSION EVALUATION FORM
DATE:

Comments to be filled out by all PHs and other parents present at the session.

1. Which part of the session did you enjoy?

2. Which part of the session didn't you enjoy?

3. Did you feel happy with you role? PH1 PH2 PH3 PH4
Y/N Y/N Y/N Y/N

If not why not? PH1

PH2

PH3

PH4

4. Did you get enough support? PH1 PH2 PH3 PH4
Y/N Y/N Y/N Y/N

What else did you need? PH1

PH2

PH3

PH4

5. What specific planning for this session was carried out:
PH1 PH2 PH3 PH4

6. Areas notused?

7. Do you need a workshop on any particular area?

8. Did you deal with unsettled children? Who?
How?

How long did they take to settle?

9. Are there any children causing concern? e.g. discipline, language, co-ordination, social? Refer to wall chart "areas of unmet needs", Identify the unmet needs for the child.
10. Which children were listened and responded to (8 minimum exchanges) at one time?
11. Which children were not communicated with?
12. Did you welcome visitors? Who were they?
13. Were any visits made e.g. river, walk, etc?
14. Did anyone require first aid? Have accidents been recorded in the book?
15. PHs have you given positive feedback to other PHs about their work?

SESSION SUPPORTER:-

Did all the adults help clean up?

What emergency drills were held?

Did all PHs arrive 1/2 hour before the session?
If not state the reason.

Has everyone signed the roll? (chase up)

Have you given feedback to parents about children?

To ensure CONTINUITY from session to session ring tomorrows co-ordinator on the roster at playcentre with reference to resources needed and follow up ideas for the next session.

COMMENTS: including from other parents.

Appendix Four
CHANGES IN THE GROUP'S PERCEPTION OF SCIENCE

Appendix Four
CHANGES IN THE GROUP'S PERCEPTION OF SCIENCE

Group pre- and post- course response to "What is science?" and "Where is science found in your centre?"

PRE-COURSE	POST-COURSE
How things work Earth Power Engines Telephones Nature/Biology Electricity The senses The world around us Puzzles Magnets Water Cooking Sand Colours	How things work Earth Power Engines Telephones Nature/Biology Electricity The senses The world around us Puzzles Magnets Water Cooking Sand Colours Outdoor play Candles/batteries Food/light Fun/Children's interests Everyday experiences Learning together Thinking Things we come into contact with all the time Helping children and adults to ask better questions Motivating children and adults to take their questions that step further - and then keep on going

Appendix Five
WORKSHOP INFORMATION

Appendix Five WORKSHOP INFORMATION

WHY RUN A WORKSHOP? (Why me?)

- so that parents get to know each other
- to enjoy working together
- to share knowledge
 - about specific topics
 - about children's stages of development
 - about parenting
- to have fun
- to encourage involvement in the centre
- to make adults feel welcome/useful

WHAT IS A WORKSHOP?

"a group of people engaged in study of work on a creative project or subject"
(Collins)

- more than a lecture
- more than a discussion
- learning through experience

WHO CAN RUN A WORKSHOP?

ANYONE!!

The tutor is nearly always well ahead of her group members, because of:

- recent reading on the topic
- preparation of materials

WHO LEARNS MOST FROM RUNNING A WORKSHOP?

- the tutor (and her children/centre)

YOUR FIRST WORKSHOP?

- if possible, work in pairs
 - = more fun
 - = good modelling of shared leadership
 - = good emergent leadership principle
- don't be afraid of that ex-teacher, ex-lecturer in your group, she can be a big support for you.
- do realise your group is your biggest resource.
- You are not an "expert", you are a facilitator.
 - Build on what they already know and are good at i.e. working with children.

PREPARING FOR YOUR WORKSHOP

- 1) What do you need to know before you begin preparing?
 - a) the topic - exactly e.g. Science - for parents OR for teachers OR a mixture of beginners/advanced
 - b) time available e.g. a 1 hour workshop (repeated?) OR a 4 hour/full day?
 - c) approximate number - 5 or 50 or 250?
 - But, don't be discouraged if you plan for 15-20 and only 3-5 turn up (and 2 of those are your colleagues!). Your preparation will never be wasted and 3-5 can learn as much or more than 15.
 - d) How to involve your participants?
 - bringing accessories
 - preparatory "homework".

- 2) Collect Information
 - Read
 - "Children at Play" A. Grey
 - "Work and Play" Gwen Somerset
 - "Vital Play in Early Childhood" Gwen Somerset
 - "Parents at Play" Canterbury PC Association
 - Special texts for your topic

Consider:

- value of the activity to children
- equipment/materials required. Check availability/who's to bring
- adult's role
- children's stages in learning.

3) Climate Setting

- introductions are important
- tea relaxes
- name-tags help, especially the new person
- welcome the large group, then arrange for contributions in small groups, early
- consider room arrangements - chairs around tables encourage work straight away
- make it easy for latecomers to join in
- accept each person at her own level

4) Planning time (Theory/practical)

- no more than 20 minutes talk at a time
- plan time roughly be prepared to finish on time and be prepared to scrap plan if different interests and needs become apparent
- consider audio-visual aids
 - charts
 - OHPs
 - film/video/slides/photos
 - equipment
- plan to
 - tell the group what you're going to do
 - do it
 - tell the group what you've done

5) Involve adults in children's activities

- we want the adults to know how children feel
 - eg. being interrupted
 - being frustrated by
 - over-crowding
 - lack of adequate equipment and materials
 - being successful

being accepted

being engaged

- when giving instructions to the group, make sure they are very clear
 - e.g. - time limits
- exact question for discussion (write on OHP?)

6) How do you know its been a success?

- Have people enjoyed themselves?
- Has anyone
 - got to talk to a new person?
 - come to feel more comfortable in the centre?
- Have you got one of your favourite points across?

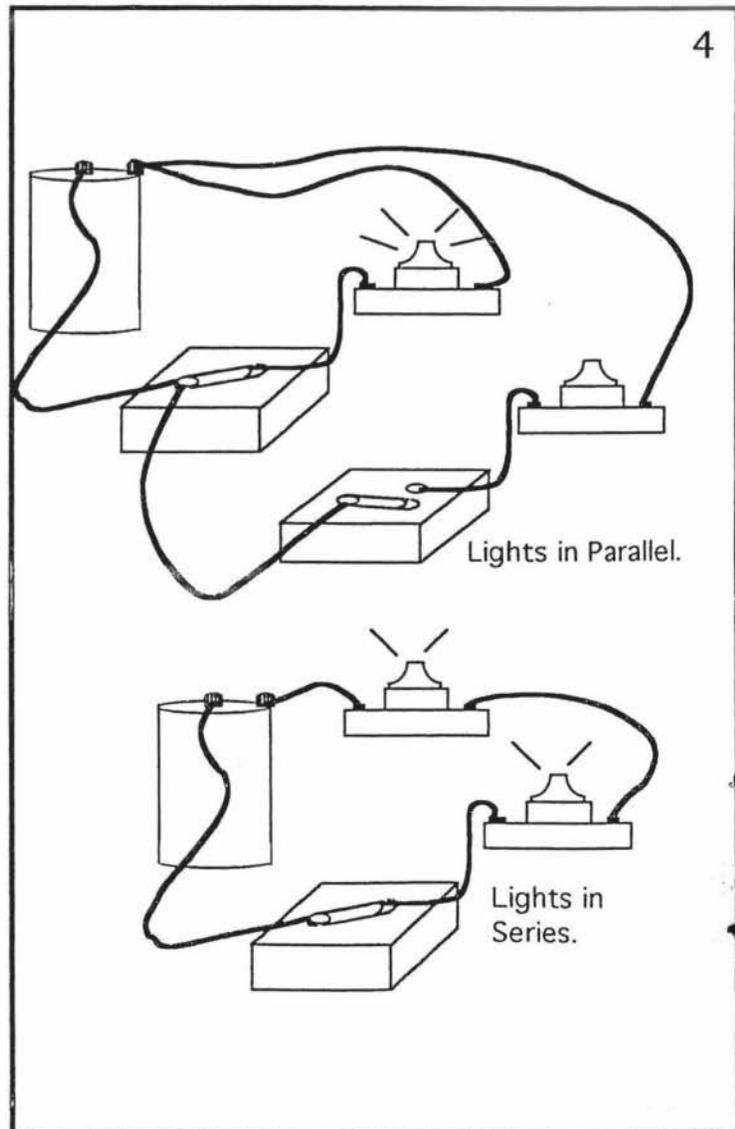
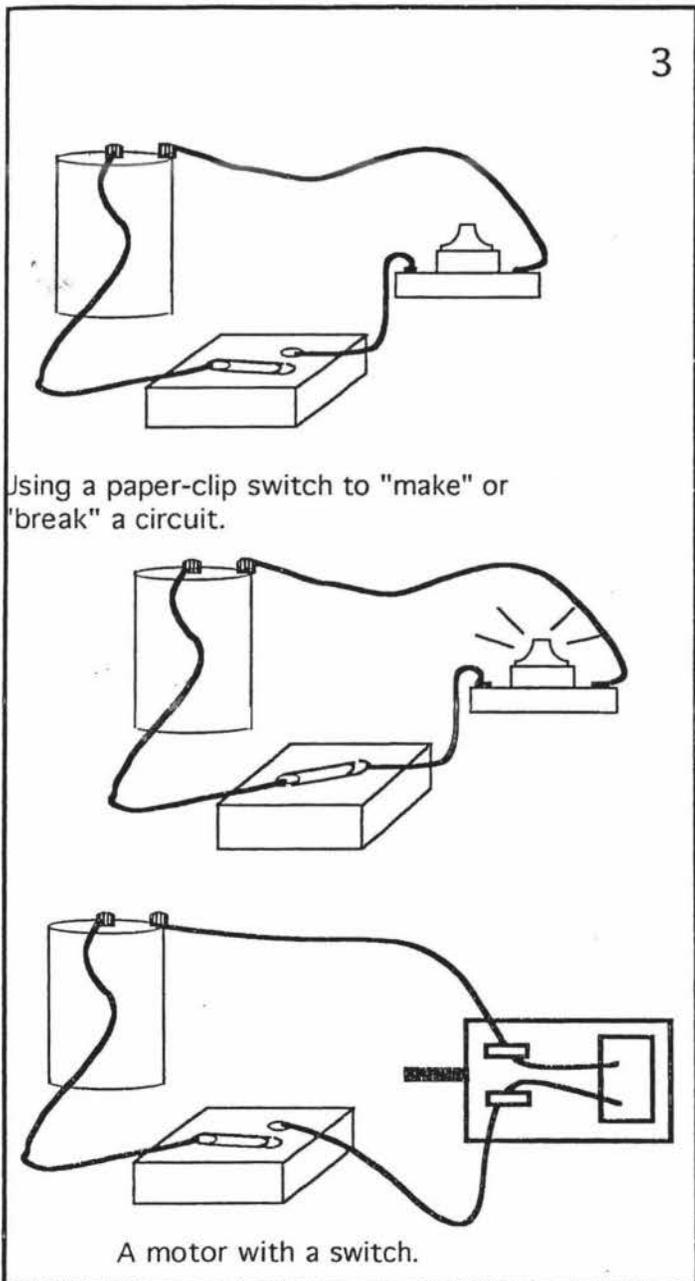
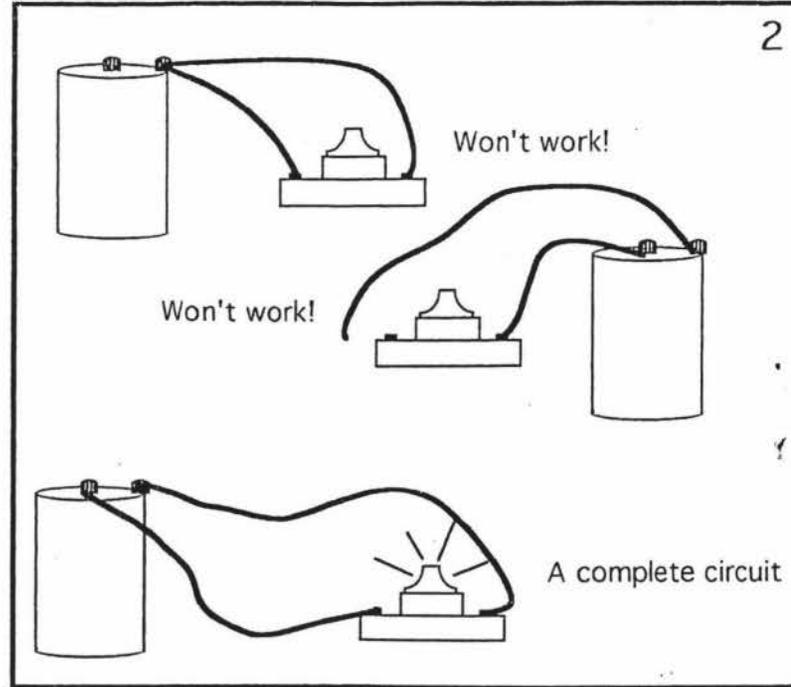
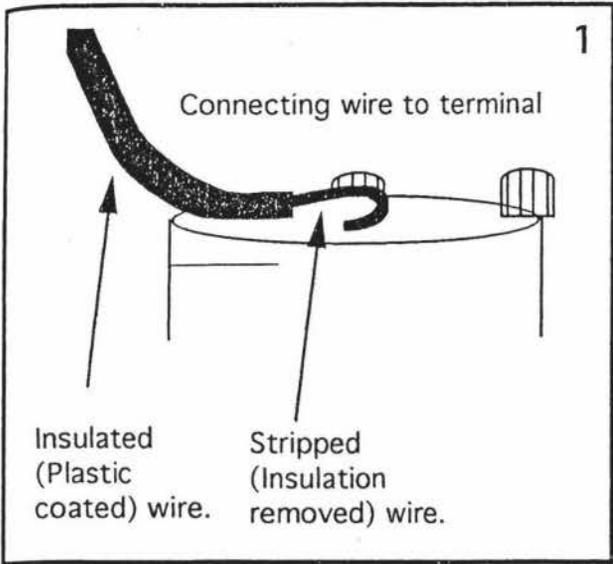
Don't worry if you didn't or didn't get round to carefully summarising (as planned). It's far more important that people enjoyed themselves and shared ideas.

- Consider asking for feedback - through verbal or written evaluation.

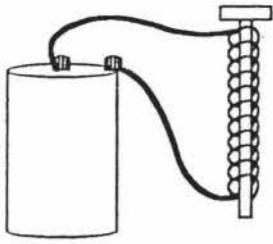
1. - What was one significant learning from this workshop?
2. - What have you enjoyed about it?
3. - Any suggestions for improvement?
4. - What, next, would you like to learn?

Appendix Six
SAMPLE WORKSHOP HANDOUT
BATTERIES, BULBS AND CIRCUITS

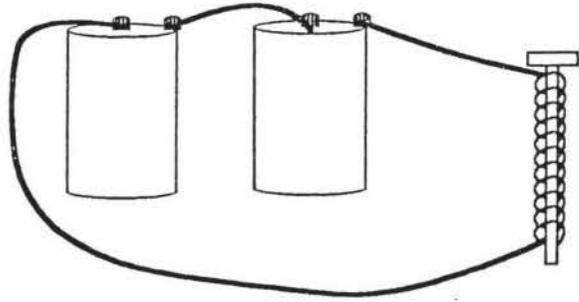
BATTERIES, BULBS, AND CIRCUITS



5

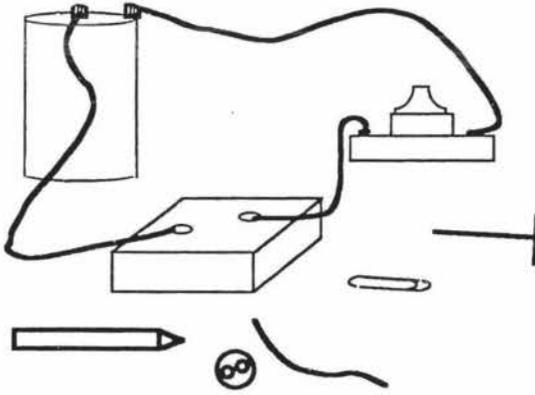


An electromagnet



More Grunt! (N.B. Batteries in series, +ve to -ve).

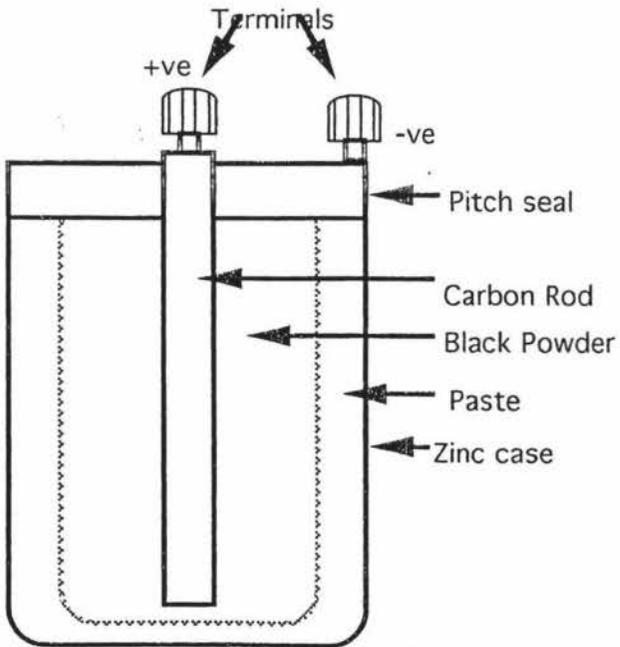
6



What things conduct? (and which are insulators)

Inside a battery, take a look!

7



8

Traffic lights.

