INTRODUCTION

The study reported here was undertaken as part of a collaborative research study by a team investigating curriculum at the Children’s Centre - a kindergarten and childcare centre attached to the University of Melbourne.

EARLY CHILDHOOD EDUCATION IN VICTORIA - BACKGROUND.

Early childhood education for 4 year olds in Australia occurs mostly within childcare and/or preschool settings. In Victoria, as in most states, the state government supports the preschool settings with all 4 year olds being entitled to attend a subsidised kindergarten program for the equivalent of 4 half day sessions per week. Many 3 year olds attend a shorter, unsubsidised program. These programs are not part of the primary school education system but are regulated by the Department of Human Services.

On the other hand, most child care centres receive financial support from the Federal government in the form of child care assistance subsidies for eligible families. To attract these subsidies centres must meet national quality accreditation standards (Commonwealth Government, National Child Care Accreditation Council, 1993). Many child care centres also run approved kindergarten programs which also attract a state subsidy. Many kindergartens and community-based (non profit) child care centres also get some local government support. In addition, most private schools run full time preschool programs supported by school fees.

The use of the term “kindergarten” must be clarified. In Victoria, this term refers to the preschool program discussed above, while in several other states it refers to the first year at Primary school (5-6 year olds). In yet another state it refers to 3 year old programs.

Traditionally kindergarten has been seen as “educational” with professionals working with the children required to have “teaching” qualifications, while with child care the “care” aspects have been emphasised. Appropriately, these traditional distinctions between child care and kindergarten are becoming increasingly blurred.
CURRICULUM

The term *curriculum* is used in the literature to refer to many aspects of education (Smith and Lovett, 1990). Here it is used to mean the whole program as well as the adult's approach to programming. It can be best summed up by the Early Childhood Curriculum Guidelines (Victorian Government, Office of Preschool and Child Care, 1991).

"Curriculum therefore includes the day to day program of the early childhood staff, as well as questions of values, teaching methods and the overall organisation of a learning environment. It encompasses all of the decisions and actions that surround the design, implementation and evaluation of the program" (p.7).

Overall, it would be true to say that at present, there is no state or national educational curriculum for Victorian preschools, unlike primary schools where there are both national and state curriculum frameworks. However there are certainly regulations and guidelines which affect curriculum directly or indirectly.

Regulations set out by the state department of Human Services strictly control aspects of health and safety, adult child ratios and qualifications of the adults working with the children. In addition, a document entitled “Early Childhood Curriculum Guidelines - 3 to 5 year olds” was produced by the appropriate Victorian state department in 1991 (Victorian Government, Office of Preschool and Child Care, 1991). These advisory guidelines are broad and not prescriptive. Staff and parents are encouraged to develop their centre’s philosophy. In general these guidelines support programming that is developmentally appropriate and which recognises individual differences. Issues of equal opportunity are brought to the forefront. Learning through play is considered important and formal reading, writing and numeracy programs are generally not seen as appropriate. A more recent publication, the Pre School Quality Assessment Check List (Victorian Government, Department of Human Services, 1996) now exists. This is also a guide and not prescriptive. It lists broad "curriculum areas" such as Language, Science and Technology and Music. At the time of the research reported here, however, the 1991 document would have been widely accepted as an appropriate basis for centre philosophy and programming practice.

In addition, centres have in general, been strongly influenced by the statement of “Developmentally Appropriate Practice” (Bredekamp, 1987). This is a child-centred,
Piagetian based set of guidelines published by the National Association for the Education of Young Children in the U.S.A. which offers approaches that are age appropriate as well as those which endeavour to maintain the uniqueness of the individual child. Recently this publication has been revised. (Bredekamp and Copple, 1997). The revision incorporates the ideas of the Reggio Emilia educators. (The Reggio Emilia approach will be discussed in detail in chapter one). It is however the 1987 version which was available at the time of this research. A minority of centres have a particular labelled philosophy for example Montessori or Steiner pre schools.

**THIS RESEARCH**

The Children’s Centre at the University of Melbourne professed to follow the principles of *emergent curriculum*. Emergent curriculum will be discussed in detail in chapter one, however, in general, it is an approach which allows the curriculum to grow out of the interests of the children and/or adults in the class. This particular approach is one that has been explored in North America as well as one which is closely associated with the work of the centres of Reggio Emilia. These preschools and infant centres in the city of Reggio Emilia in northern Italy have attracted worldwide acclaim over the last several years. They are particularly noted for:

- their focus on the potential of the child;
- their support of the adult to learn from the child;
- the level of involvement of parents;
- the process of documentation of the children’s work;
- the processes by which children express themselves in a multitude of ways; and

One very visual aspect of these centres is the approach in which children are encouraged to express themselves in aesthetic and creative ways, often with the help of professional artists. Exhibitions of the children’s work have been touring the world since early this decade.

The particular research reported here looked in depth at a science project being undertaken in one of the four-year-old classes at the Children’s Centre. As there are limited research findings on early childhood science in Australia and almost no research findings on emergent curriculum, this investigation sought to illuminate and evaluate this
particular approach to curriculum in an early year’s science learning situation. Early childhood science is also a particular interest of the investigator.

In particular, this study sought to answer the question:

What form does a science learning project take in an early childhood class that purports to have an emergent curriculum philosophy?
   What are the processes involved?
   What are the roles of the main players?
   Was this curriculum truly an emergent one?
   How did it fit with the different perspectives being taken to emergent curriculum in the literature?
   Did science learning take place?
   How did this learning fit with current views on science learning in the literature?

Chapter one will discuss the current view of emergent curriculum in the literature. It explores the different ways this concept has been interpreted in Reggio Emilia in Italy and in the American context.

Chapter two will give an overview of science learning, particularly as it relates to early childhood.

Chapter three will outline the research methodology. A qualitative approach is used. In general this is a descriptive study which uses multiple data gathering techniques within a participant observation framework.

Chapter four will put forward the findings, in particular, how the topic of spiders was chosen, an overview of the progress of the project and an analysis of the roles of the adults and children involved.

Finally chapter five will draw conclusions and attempt to answer the research questions.
CHAPTER ONE

EMERGENT CURRICULUM

BACKGROUND

Publications on the topic of emergent curriculum are limited in number. An ERIC search 1/92 to 9/96 revealed one related reference while a search of the data bases APAIS and ACER in AUSTROM 1978 to 8/96 revealed no more. However a lively interest and dialogue as shall be discussed below is certainly occurring, mainly through the Internet and through conferences.

The term and the concept of emergent curriculum, despite the contemporary focus, has actually been around for some time. It was introduced by Betty Jones in 1970 (cited in Jones and Nimmo, 1994, p.vii). In general, the term refers to a view of curriculum that is not linear or totally pre planned as in the more traditional curricula, where objectives are set, a program is carried out and assessment of the objectives are made. Emergent curriculum is a curriculum that is responsive to the needs and interests of the children and adults in the learning situation.

The concept has been put forward in the American context by Jones and Nimmo (1994). It is also the term most often used to describe the approach to curriculum taken in the world-famous preschools of Reggio Emilia in Northern Italy (Rinaldi,1993). There is some debate however as to whether the Italian expression “progettazioni” is most accurately translated as “emergent curriculum” (Nimmo, 1994). Forman (1996) puts forward the term “negotiated curriculum“ to describe the Reggio Emilia approach. However, New (1992) sees the Reggio Emilia approach to curriculum most importantly as an “integrated curriculum”. Workman and Anziano (1993) use the term “webbed curriculum” to explain their approach which is based on Levin’s (1986) idea of “curriculum webs” and very close in concept to the “emergent curriculum’ of Jones and Nimmo, as is the “grassroots curriculum” of Cassidy and Lancaster (1993). Others prefer to use the term “child initiated curriculum” (Tinworth, in press). The “project approach” of Katz and Chard (1989) is also close in concept to the ideas of emergent
curriculum. There are several different terms used therefore to refer to the same or similar curriculum approach.

**EMERGENT CURRICULUM IN THE CONTEXT OF REGGIO EMILIA**

An emergent approach to curriculum is one of the cornerstones of the practices of the pre primary and infant toddler schools of Reggio Emilia. The basis of this approach is most eloquently expressed by Carlina Rinaldi, a "pedagogista" [consultant] attached to a group of these schools (Rinaldi, 1993). The approach grows out of a view of the child as a motivated and competent individual who is eager and able to learn. "The cornerstone of our experience ...is the image of children as rich, strong and powerful" (Rinaldi, 1993, p.102). In an emergent curriculum, the teachers do not plan a curriculum in advance but ... "they formulate objectives that are flexible and adapted to the needs and interests of the children. These interests and needs include those expressed by children at any time during the project as well as those the teachers infer and bring out as the work proceeds" (Gandini in Rinaldi 1993, p.102). The late Loris Malaguzzi, the founder of the Reggio Emilia preschool system, expresses his opposition to use of pre planned packaged curricula. "If teaching is mono directional and rigidly structured according to some 'science' it becomes intolerable, prejudicial, and damaging to the dignity of both teacher and learner" (Malaguzzi, 1993, p.77).

The Reggio Emilia educators view the child as learning in a social context in which the other participants are peers, teacher and parents. [the emergent curriculum approach] "offers to children the possibility of confronting special situations and problems as members of small peer groups. This approach requests that adults - both teachers and parents - offer themselves as resource people to whom the children can (and want) to turn" (Rinaldi, 1993, p.104). While the children learn from the adults the adults also learn from the children. This is the principle of *reciprocity* "which involves mutual guidance of the educational process by teacher and learner and responsiveness in the circular paths of caring and control" (Rankin, 1993, p.191). Work on projects often takes place in groups of five children or less as educators feel this size group is optimal for the social interactions so important for the children's learning. Rinaldi explains how social "conflict" leads to both social and cognitive growth for the child "It is our belief that all knowledge emerges in the process of self and social construction" (Rinaldi, 1993,
"Conflict is an essential element, in our view. Conflict which a child has with peers - opposition, negotiation, taking the other’s point of view, and reformulating an initial premise .... An emergent curriculum is one that allows for this social constructivist process to develop" (p.106).

The role of the teachers is a complex one. Rinaldi (1993) sees the adult as balancing several roles. The teacher is an observer, a researcher who documents the learning and reflects upon it. She/he is also a provider of a stimulating environment, materials and equipment. The teacher must be “present without being intrusive in order to sustain cognitive and social dynamics while they are in progress” (p.106). At other times the teacher takes a more active role to challenge children’s responses or revive a situation that may have been planned at an inappropriate level. Always the teacher, by observation, documentation, discussion with children and colleagues, and by reflection, attempts to be in tune with the children and therefore able to plan the next steps in the curriculum.

Rinaldi (1993) points out that a project which is a central aspect of emergent curriculum can begin in several ways. “A project which we view as a sort of adventure and research, can start through a suggestion from an adult, a child’s idea, or from an event, such as a snowfall or something else unexpected. But every project is based on the attention of the educators to what the children say and do as well as what they do not say or do not do. The adults must allow enough time for the thinking and the actions of the children to develop” (p.108). At another time the Reggio Emilia educators put forward the metaphor of the children throwing a ball which the teachers catch and throw back (Malaguzzi, 1990, cited in Edwards, Gandini and Forman, 1993, p.153). Children ‘throw a ball’ perhaps to begin a project and at points throughout the project.

The children express themselves through many symbolic “languages”. For example through drawing, modeling, block building, shadow play. Art is not seen as separate from the project or merely for decoration, but as an integral part of the learning process. This is what LeeKeenan and Nimmo call “the spiraling experiences of exploration and group discussion, the representation and expression through the use of many symbolic media” (LeeKeenan and Nimmo, 1993, p. 252).

Rinaldi, (1993, pp. 108-111) gives an example of a project to illustrate the key aspects of emergent curriculum. Teachers asked families to collect memories of their
summer vacation for children to bring back to school. (The Reggio Emilia educators are always endeavoring to keep open the family-school connection.) The teachers anticipated that this may have led to a project on some aspect of perhaps swimming, hiking, boats or waves. Instead the exploration of these mementos led to an investigation of the concept of “a crowd.” This was explored with drawings and visits to a crowded place and photographs and discussions. It led eventually to children acquiring skills of seeing and drawing people and objects as viewed from behind and in profile etc. So the curriculum “emerged” from the vacation experiences of the children in a way that the teachers had certainly not predicted but one that was meaningful for the children. The teachers trusted the children to follow worthwhile and important ideas and the children trusted the teachers to give them time and commitment to achieve this learning.

EMERGENT CURRICULUM IN THE AMERICAN CONTEXT

Betty Jones and John Nimmo who have written “Emergent Curriculum” are the spokespersons of this curriculum style in America (Jones & Nimmo, 1994). The Jones and Nimmo approach is very similar to that taken by the Reggio Emilia educators and is based on many of the same values of learning and teaching. The differences, which will be discussed later, are a matter of emphasis. Jones and Nimmo acknowledge the close ties with Reggio Emilia, while at the same time they point out there is also a basis for the emergent curriculum approach in the American situation. “In writing ‘Emergent Curriculum’ Betty and I were certainly inspired by both the work of Reggio Emilia and Katz and Chard, although the emergent concept has been brewing for 25 years” (email communication, Reggio Emilia preschool discussion group 27/1/96)

Jones and Nimmo (1994, p.77) start to attempt to clarify the essence of emergent curriculum by stating what it is not. It’s not:

a canned curriculum; i.e. one that comes from a national or state curriculum or one that is an “expert designed compilation of What All Children Need to Know;”

an embalmed curriculum; i.e. a package that a teacher rolls out year after year; or
an accidental or unidentified curriculum; i.e. one “that just happens that no one names or follows up on.”

In attempting to illuminate what it is, Nimmo, (1994, p.201) looks at the issues of:
the sources of the potential curriculum;
how thoughtful choices are made from all this potential;
the roles of spontaneity and planning; and
the place of keeping a record of the emerging curriculum.

The sources of potential curriculum include children’s and teachers’ interests, aspects of the physical and social environments, developmental tasks, unexpected events and values held by the school, family or culture (Nimmo, 1994, pp. 203-206).

With almost everything being a potential source of emergent curriculum, how then does a particular curriculum emerge? Nimmo maintains it is the responsibility of the teacher to make ‘thoughtful choices’ (p. 206). Jones and Nimmo (1994) claim that “Teachers need to have both ideas and a vision of where the players [the teachers and children] might adventure together” (p.5). These choices of course must ultimately be based on the teacher’s values. Nimmo reminds teachers that “a thoughtful emergent curriculum does not require teachers to actively pursue all of the interests shown by children.” “Genuine questions emerge from meaningful relationships and experiences.” (Nimmo, 1994, p.206). This does not of course give the teachers the right to impose a topic on the children in which they show no interest. The topic and indeed the whole curriculum is negotiated between teachers and children and engages both their interests. Jones and Nimmo (1994, p.126) represent this as a simple diagram of overlapping circles. Figure 1. below. One circle represents the children’s interests. The other represents the adult’s interests and where they overlap are common interests. In depth projects are most likely to come from topics in this central area of common interests.
Figure 1. Representation of children's and adult's interests
(from Jones and Nimmo, 1994, p.126).

Nimmo (1994, p.209) also suggests that the teacher considers possible topics to see if they will "engage the children's intellectual curiosity." For example are the topics able to be looked at from a number of points of view that will invite many questions and hypotheses from the children, and can they be tackled in a collaborative fashion? He points out that genuine topics also often have a strong emotional content. Possible suitable topics are also those that are able to be explored through many media - discussion, drawing model building etc.

In relation to the issue of spontaneity versus planning, Nimmo sees a role for both within the emergent curriculum framework. Brainstorming about possible ways the project could go would be an apt description of what Jones and Nimmo (1994) call "webbing." Webbing is a tentative plan - a plan that will undergo constant revision as the teacher works with the children. Webbing encompasses the teachers' hypotheses of what might become important to the children. Teachers are encouraged to "plan and let go." "If you are paying attention to the children an accurate lesson plan can only be written after the fact" (Jones and Nimmo, 1994, p.12).

Keeping a record of the process of the project is an integral part of the emergent curriculum. Referred to as documentation by the Reggio Emilia educators it allows teachers to reflect on the curriculum and make decisions about its direction. It also allows teachers to reflect back to children their words or aspects of their drawings etc. in
order to understand the children's thinking or challenge their thinking. Documentation also is used to communicate about the children's learning to parents and the wider community. Jones and Nimmo (1994, p. 30) promote record keeping. "Documentation of 'what happens' in a school settings provides teachers, parents and children with a storehouse of memories from which to research, plan and understand."

Documentation is pursued with even more intensity in the Reggio Emilia community. A good example comes from the "crowd" curriculum quoted above. The children talked about their understanding of what a crowd was. They were then asked to draw a crowd. Teachers took these drawings and critically examined them. It was noticed that the children's verbal explanations were much more sophisticated and rich than their drawn ones. Teachers talked to the children about this and from this an important aspect of the curriculum, that of exploring how to draw from different perspectives, emerged.

What then do these two perspectives on emergent curriculum have in common? Where do they differ. Because Jones and Nimmo are closely connected with the work of Reggio Emilia and influenced by it, as was reported above, these approaches are very close in principle. They both emphasize the non linear nature of the curriculum, the vast range of potential curricular opportunities, the central focus of the child, the constructivist way of looking at learning, the aspect of negotiation between the teacher and child, the central importance of the parents and community and both have a similar view of the means by which topics emerge.

The differences lie in matters of emphasis which stem in part from the vehicle expressing the ideas. The view of emergent curriculum at Reggio Emilia, as expressed in 'The Hundred Languages of Children' (Edwards et al., 1993) is conveyed in interviews with key long-term players in the system. The book comes out of 25 years of experience. From the Reggio Emilia perspective, emergent curriculum comes out of a dynamic set of philosophies and values and a particular view of the child. It is an academic type of approach to the subject. While it is a truly inspiring book especially if the reader has been privileged to see the exhibition, 'The Hundred Languages of Children' (Department of early education, City of Reggio Emilia, 1987) it would probably not encourage the average very busy child care worker to attempt to build these ideas into their program. Jones and Nimmo, on the other hand, are attempting to
bring out their ideas about emergent curriculum very much at a pragmatic level aimed at the practitioner in the American setting. Jones and Nimmo speak through the fictional character of Ruby, a post graduate student and experienced director of a multicultural child care centre. The issues are addressed through her and her fictional staff and children over the period of a school year.

Therefore in this American approach, the emphasis is on the teacher, teacher reflection, teacher negotiation, teacher growth and the collegiate nature of the process. The differences and similarities between the tentative planning and what actually happened in this mythical child care centre are explored in depth. Because of the audience for the book, there is less of a feeling of the approach coming out a philosophy or an academic understanding of the nature of the child than in the Reggio Emilia situation - though these aspects are not ignored. There is less emphasis on examples of the children reflecting on their own learning, and fewer examples of children's actual words from transcribed tapes. There is a strong feeling of the importance of the families expressed in both books - with the American authors having more multicultural issues to address.

OTHER VIEWS OF EMERGENT CURRICULUM

Levin (1986) does not use the term emergent curriculum. Instead she focuses on the planning recording, guiding and explanatory function of what she terms “curriculum webs”. Her resulting curricula are close in concept to emergent curricula. For example, they very often follow the interests of the children, are non linear in form and multimodal in their execution. The teachers regularly brainstorm ideas and directions the curriculum may take and the “plans” or “webs” as they are called can only be completed after the event. However the learning processes of the children are not so much the centre of attention and there seems to be a lingering adherence to a more teacher directed style of curriculum. “Curriculum webs can help teachers implement a curriculum which directs children’s learning in a well-planned and systematic fashion as it responds to the needs, interests and learning styles of individual children” (Levin, 1986, p.19).

Workman and Anziano (1993, p. 6) see their work as “an important extension of Levin’s (1986) approach.” Again there is a focus on webs, this time the framework is more complex with several interrelated webs being used. These webs form the basis of
brainstorming, planning and reflection for the teachers. This approach is very close to
the Reggio Emilia or Jones and Nimmo concept of emergent curriculum though it is not
labeled as such. The "grassroots curriculum" of Cassidy and Lancaster (1993) is
similarly an emergent one. They point out that "The curriculum was a delicate balance
of teacher-and-child contributed ideas, reactions and experiences" (Cassidy and
Lancaster, 1993, p.51) and "themes that emerge from brainstorming, a happening, or
introduction of materials, are interconnected and flow from one to the other as children
ask questions and develop new interests" (p.50). As children and groups are unique,
Cassidy and Lancaster see this approach as the only way to achieve a truly
developmentally appropriate curriculum.

George Forman is one of the editors of the book "The Hundred Languages of
Children" (Edwards, Gandini and Forman, 1993) which is still the most definitive work
in English on the history, philosophies and practices of Reggio Emilia including emergent
curriculum. Forman has, more recently, put forward the term negotiated curriculum to
better describe his interpretation of the Reggio approach (Forman, 1996). Forman
maintains that "Negotiated Curriculum keeps the reciprocal nature of the relations in the
forefront, the reciprocal relations between teacher and children, between teachers and
parents in order to establish a community of learners. The term ‘emergent curriculum’
does not capture these relations so well" (email communication, Reggio Emilia
preschool discussion group 9/11/95). The term also fits closely with Forman’s general
view of learning which comes firmly from a constructivist perspective (Forman and
Kuschner, 1977). "This term ‘negotiated’ captures the centrality of the social, co-
constructivist principles …" (Forman, 1996, p.84).

Another term often associated with emergent curriculum is that of integrated
curriculum. While the Reggio Emilia educators as well as Jones and Nimmo, certainly
see this as part of emergent curriculum, it is New (1992) who sees this as a central and
most important aspect of the approach. She maintains that based on the current
literature and research, "... a growing number of early childhood professionals are
advocating an integrated approach to early education - where the child rather than the
subject is the unit of concern..." (New, 1992, p.287). New describes the Reggio
approach as an “expanded interpretation of an integrated curriculum” (New, 1992,
p.303). She points out that it is the use of contextulized learning, real-life problem
solving and symbolic representation as well as the roles of the teacher and parents, "... that appear to be significant contributors to Reggio Emilia’s interpretation of an integrated curriculum" (New, 1992, p.313).

_The project approach_ (Katz and Chard, 1989) similarly has many of the concepts that are echoed in the work of the emergent curriculum proponents. Nimmo (1996) quoted above, acknowledges the project approach as one source of inspiration along with Reggio Emilia, for the concept of emergent curriculum he puts forward with Jones (Jones and Nimmo, 1994). Katz herself has visited and written on Reggio Emilia (Katz, 1990). The project approach, like emergent curriculum, attempts to give children experiences that are worthwhile and meaningful to them. The project approach model also sees children as having the intrinsic motivation and ability to learn in such a situation. "In project work children are seen as already having proficiencies and capabilities and should be encouraged to apply them in meaningful contexts" (Katz and Chard, 1989, p.14). As with the Reggio Emilia approach, cognitive growth is seen as having an important social component. "Young children’s intellectual development is probably best served by opportunities to interact with adults, each other, the environment and a variety of materials" (Katz and Chard, 1989, p.24). An important aim for learning is seen as creating "a community ethos in the classroom" and project work is seen as providing "ample opportunity for a cooperative ethos to flourish" (p.6). This is close in concept to the Reggio Emilia idea of "we." Reggio Emilia educators use the phrase "Io chi siamo" ("The I who we are") to express the idea that is within this shared space of "we" that each child can offer his or her best thinking, leading to a rich and fertile group exchange and stimulating something new and unexpected, impossible for any one person to create alone" (Rankin, 1993, p.193).

One of the differences between the project approach and emergent curriculum seems to lie in the attitude towards the choice of the topic. While the Reggio Emilia educators acknowledge that the topic can come from either the teachers or the children, the project approach seems to imply that it is much more the teacher’s responsibility. "Individual teachers may select topics for their classes, or schools may develop a policy of offering specific major projects in each grade each year." "Occasionally the children in a class select a topic..." (Katz and Chard, 1989, p. 87). This hardly seems to meet
“emergent” criteria, however once the project is started children have more control over what they or their group works on.

These differences may arise from the fact that the project approach is proposed not only for children in preschool but also for primary school children where there are more outside expectations about the formal aspects of the curriculum. On the other hand, the Reggio Emilia situation only deals with children six years and under, where these expectations are minimal.

Although in the Katz and Chard model teachers are encouraged to collaborate, there is also less emphasis on teacher reflection and the collegiate aspects of the process leading to teacher growth. There is also less emphasis on the reciprocal nature of the learning process with children learning from teachers and teachers learning from children as is so clearly spelt out in the Reggio Emilia situation. As with the other American emergent curriculum type approaches outlined above, there is a focus on a "webbing" procedure for "provisional" planning - called a "topic web" (Katz and Chard, 1989, p.88).

**WHAT IS THE THEORETICAL BASIS OF EMERGENT CURRICULUM?**

What learning theorists and philosophical positions underpin the concept of emergent curriculum? There is not a clear cut answer to this question. The Reggio position on this is an eclectic one, and while the other authors back up their positions with relevant research they mostly do not claim to come from any one philosophical or theoretical perspective. (Jones and Nimmo, 1994), (Nimmo, 1994), (Levin, 1986), (Workman and Anziano, 1993), (Cassidy and Lancaster,1993). Forman, as quoted above, sees negotiated curriculum arising out of a strong social constructivist position such as that put forward by Vygotsky (Forman,1995; Forman 1996). The constructivist approach will be treated in more detail section 2. Briefly, “The core commitment of a constructivist position, that knowledge is not transmitted directly from one knower to another, but is actively built up by the learner, is shared by a wide range of different research traditions…” (Driver, Asoko, Leach, and Mortimer, 1994, p.5). Children are not given knowledge. They create it or construct it from what they bring to the classroom as well as what happens in the classroom.
New (1992) who looks at the Reggio Emilia emergent curriculum from an integrated curriculum viewpoint, claims a basis for integrated curriculum in the writings of both Piaget and Vygotsky (New, 1992, p.294). The Reggio Emilia educators themselves, while maintaining that a unifying theory of education “does not and will never exist” acknowledge inspiration from Ferriere, Dewey, Vygotsky, Piaget, Mungy and Gardner among others. While they hold this eclectic view, they also maintain a constructivist point of view. Broadly they look to “…cognitive research founded on constructivist, symbolic interactionist and social constructivist perspectives” (Malaguzzi, 1993, p.81).

THE RELATIONSHIP BETWEEN DAP AND EMERGENT CURRICULUM

Early childhood professionals in America and Australia have been strongly influenced by the statement of “Developmentally Appropriate Practice” (Bredekamp, 1987). This is a Piagetian based set of guidelines which offer approaches that are age appropriate as well as those which endeavour to maintain the uniqueness of the individual child. How then does DAP, as it is commonly referred to, fit with the concept of emergent curriculum? Bredekamp, the leader of the team who compiled the DAP guidelines, visited Reggio Emilia. Her reactions (Bredekamp, 1993) illuminate this question. She sees both similarities and differences and a role for the Reggio Emilia approach to challenge some of the DAP concepts. “Fundamentally the principles of the Reggio Emilia schools are congruent with the principles of developmentally appropriate practice (DAP) as described by NAEYC (Bredekamp, 1987) presumably because both sets of principles share some of the same philosophical origins. At the same time, the educators in Reggio Emilia have gone beyond DAP, at least its current incarnation, especially in their emphases on the social construction of knowledge and their articulation of the teacher’s role as co-constructor with children and documentor of the learning process” (Bredekamp, 1993, p.13). Bredekamp feels the Reggio Emilia experience challenges American educators to re-define the definition of developmental appropriateness, their view of the competency of the child and their view of the role of the teacher.
IN CONCLUSION

In conclusion... As with any label, the term "emergent curriculum," is being used by different writers to mean somewhat different things. At the same time different terms are being used for approaches that are very close in concept to emergent curriculum. The published literature is not at a point yet of dissecting and debating these similarities and differences. What then is the essence of this "emergent curriculum approach"? What appear to be some of the general principles that characterize this approach? The following seem to be important:

- the non-linear nature of the curriculum;
- a belief that what is being taught is worthwhile and is an aspect of real life;
- an emphasis on the flexibility of the teacher;
- an emphasis on documentation;
- an emphasis on the reflective nature of the teaching/learning process;
- a valuing of the interests and ideas of the children; and
- a recognition of the important role of parents and the wider community.
CHAPTER TWO

SCIENCE LEARNING

INTRODUCTION

Science is an important part of children's learning in early childhood. The National Science Curriculum Statement (Curriculum Corporation, 1994) supports this. However, the area of early childhood science is not extensively documented. As Fleer (1992, p.12) points out, "Developments in teaching pedagogy in science have either not included early childhood, or approaches have been advocated which may not be appropriate for young children." She talks about "... the small pool of Australian research into early childhood science education." Also from an overseas perspective, Forman and Landry, (1992) state that "Research on science education helps us determine useful procedures to facilitate scientific thinking in young children. Such studies that deal with children under 7 or 8 years are difficult to find" (p.175).

What then does the general research, and the research directed towards early childhood, such as it is, indicate about the theoretical approaches to science learning and the pedagogical implications of these approaches?

TRADITIONAL APPROACHES TO SCIENCE TEACHING

Traditionally, science education has been looked at from one or more of the following points of view. The *expository approach* sees the teacher as the holder of the knowledge which is then simply transmitted to the learner. The children are told about science facts and shown evidence for science theories. The *discovery approach* describes situations where activities are set up so the learners can find out for themselves facts about science. The *process approach* has the stated aims of learners learning the processes or skills of science, for example, observing, predicting, measuring recording and communicating. Aspects of these three approaches are still considered important and are often incorporated into the constructivist view outlined below, but
the focus of these approaches is substantially different as will be discussed (Biddulph and Osborne, 1984; Symington and Kirkwood, 1995).

THE CONSTRUCTIVIST VIEW

Overwhelmingly, the current literature indicates that a constructivist point of view is held by researchers and writers in the field of science education (Appleton, 1989; Biddulph and Osborne, 1984; Fleer, 1990, 1991b; Forman and Landry, 1992; Gunstone, 1995; Symington and Kirkwood, 1995).

"...knowledge is not simply transmitted to the learner from a teacher or a book. We believe that the evidence available to us at this moment points to all people...constructing their own understanding of the sensory input they receive" (Symington and Kirkwood, 1995, p.194). Children are not given knowledge. They create it or construct it from what they bring to the classroom as well as what happens in the classroom.

INDIVIDUAL vs. SOCIAL CONSTRUCTION OF KNOWLEDGE

Constructivism is seen by some as being very much in the sphere of personal learning while others come down firmly on the side of a social construction of knowledge.

Constructivism has its roots in the ideas and investigations of Piaget (Forman and Kushner, 1977). Simply put, Piaget’s view is that learning happens on the individual level, through the steps of assimilation, disequilibrium and accommodation (Appleton, 1989, p.13). The child makes meaning through a process of cognitive conflict. This process involves the individual assimilating new material, which may not fit with existing understandings so this leads to what Piaget called disequilibrium. When the child comes to terms with the new material, accommodation takes place and the child is happy with the new knowledge. Equilibrium in Piaget’s terms has been restored. Those writers and educators who adhere most closely to the views of Piaget tend to see science learning as an individual construction (Appleton, 1989; Foman and Kushner, 1977; Gunstone, 1995).

Other theorists see science learning in terms of a social construction of knowledge (Driver et al., 1994; Fleer, 1990; Forman and Landry, 1992). While the
writers who see science learning largely as a personal construction are influenced largely by Piaget, (Forman and Kuschner, 1977) those who see it as a socially constructed process have often been influenced by the theories of the Russian psychologist, Vygotsky and the writings of Bruner which are based on Vygotsky’s ideas (Bruner and Haste, 1987; Bodrova and Leong, 1996). Driver et al., (1994) claim that science learning involves being introduced to a symbolic world which therefore necessitates a social construction of knowledge.

“There is an important point at issue here for science education. If knowledge construction is seen solely as an individual process then this is similar to what has traditionally been identified as discovery learning. If however, learners are given access to the knowledge systems of science, the process of knowledge construction must go beyond personal empirical inquiry. Learners need to be given access not only to physical experiences but also to the concepts and models of conventional science” (Driver et al., p.7).

Fleer (1990, 1991a, 1991b ) is a strong supporter of the view of socially constructed knowledge. “The notion of learning as a socially constructed process in opposition to the more individualistic orientation of Piaget has challenged much of our educational practice” (Fleer, 1990, p.114). Predictably she also rejects the closely related cognitive conflict model. “It was found that it was the teacher who was the crucial factor in developing children’s conceptual understanding, and not the cognitive conflict scenario advocated in the literature” (Fleer, 1991a, p.214).

Forman’s earlier writing supports the more personal interpretation of the construction of knowledge, (Forman and Kuschner 1977). However by 1992 he appears to be influenced by both Vygotsky and the work at Reggio Emilia. “Through a revival of interest in Vygotsky and the reconstruction of Piaget’s theory of knowledge .. basic and applied research has been forthcoming on how knowledge construction is basically a social endeavour” (Forman and Landry, 1992, p. 187).

Other writers do not overtly distinguish between the personal and the social but the implication of their work is, is that both are important (Biddulph and Osborne, 1984; Symington and Kirkwood, 1995).
CHILDENR'S ALTERNATIVE THEORIES OF SCIENCE

The notion that the child brings to any situation existing knowledge and ways of knowing, is central to the constructivists' position. In terms of science learning, this has been a rich source of investigation. Much research has been carried out on what are variously called alternative theories, intuitive ideas, commonsense theories, children's science, naive theories, informal science ideas etc. The term alternative theories will be used here. These alternative theories persist for a number of reasons. They are of a logical or common sense nature. They are also often of a pragmatic nature and they fit with science and non-science models or ways of knowing that the child has already acquired. Often they fit the observable facts whereas the accepted scientific theory may, from the child's perspective, not appear to. For example one commonly held alternative theory is that matter can disappear, for example, by burning. "As far as people's everyday experiences are concerned the informal ideas are often perfectly adequate to interpret and guide action. Fires do burn down to result in a small pile of ash" (Driver et al., 1994, p.8). They can also be brought about by the everyday use of language. Fleer (1995, p. 325) gives the example of a child's misinterpretation of the term flat in relation to batteries. Because of their common sense nature, these alternative ideas are often very resistant to change.

Fleer (1991a, 1994) cautions that little research has been done in the early childhood years regarding alternative theories. She also shows in her research that some young children of 3 or 4 years of age, have not yet acquired an alternative theory about particular phenomena eg. electrical current flow (Fleer, 1991a, p.214).

IMPLICATIONS FOR PRACTICE

What then are the implications for pedagogy arising from this widespread constructivist perspective? Driver et al. (1994, p.11) feel that this link is not clear cut. "We have argued that the relationship between views of learning and pedagogy is problematic, and that no simple rules for pedagogical practice emerge from a constructivist view of learning." However they do go on to put forward some general principles. Many other contemporary writers put forward definite teaching approaches that arise out of their stated or implied support for a constructivist point of view (Biddulph and Osborne, 1984; Carr, 1994; Gunstone, 1995; Segal and Cosgrove, 1993).
“Together, the works of Piaget and Vygotsky have contributed substantially to our understanding of constructivist theory and to the challenge of translating theory into educational practice” (New, 1992 p. 295). Piaget has been discussed above in relation to the process of individual knowledge construction. Vygotsky is closely associated with the idea of learning as a socially constructed process through his concept of the Zone of Proximal Development. The zone of proximal development represents the differences between level of learning a child can achieve independently compared with the level of learning that child could achieve with the help of an adult or a more competent peer (Bodrova and Leong, p.35). Bruner takes this notion and uses it as a basis of his concept of Scaffolding (Bodrova and Leong, p.42). The process of scaffolding is one carried out by the teacher to move the child through the zone of proximal development. The teacher does more than just provide settings and resources. The adult needs to carefully construct the learning experience with appropriate questioning and modeling of the learning process based on the child’s current science understanding. At first the child and the adult take a shared responsibility for task completion and gradually the teacher releases more responsibility to the child. Fleer (1990) supports scaffolding as an appropriate way to approach early childhood science learning however she cautions that the quality of the adult child interactions closely affects learning outcomes for the children, i.e. there is “successful” scaffolding and scaffolding that can be “ineffective”.

**THE INTERACTIVE APPROACH**

One science teaching method popular in New Zealand and Australia that fits firmly in the constructivist tradition is the interactive teaching approach proposed by Biddulph and Osborne (1984). This has been used extensively in primary and secondary schools. In the interactive approach the questions on the topic under investigation that the children bring to the classroom are of central importance and form the basis of how the learning progresses. The children are encouraged to speculate about possible answers to their questions. The children then use a variety of approaches to find answers to their questions with the teacher playing a mediating role. They may use hands on discovery, or get the views of experts first hand or through books. The children are given opportunities to record and communicate what they have found out. Fleer (1992, p.22) contends that the interactive approach needs to be modified for use in
a preschool classroom. Teachers need to use their judgment to select topics that can be investigated in sufficient depth. Children need help to frame questions and teachers need to engage in considerable one-to-one interaction particularly when children are recording their observations and conclusions.

THE ROLE OF THE TEACHER

The importance of the teacher’s role is a common thread in contemporary science education discussions. Fleer (1992 p.22) when assessing the interactive teaching approach in early childhood classrooms says, “What became apparent in the case study was that the teacher was fundamental to the whole process... The factor that influenced the ultimate success and the depth of learning was the teacher’s interaction with the children.” Driver et al. (1994) while retaining the reservations discussed above regarding the link between theory and practice, maintain that, “If students are to adopt scientific ways of knowing, then intervention and negotiation with an authority, usually the teacher, is essential” (p.11). Gunstone (1995, p.18) affirms that constructivist learning is indeed student centred, however “I am arguing [it is] student centred learning of a form which requires strong teacher control.” Appleton (1989 p. 20) shows that in his research on floating and sinking that the teacher’s role was crucial. “It was established in the early trials of the teaching sequence that little new learning would occur if the teacher did not intervene. It was estimated that around ninety five percent of the children would have left the activity with a wrong idea reinforced, had the teacher not intervened.”

THE ROLE OF THE PARENTS

Although a consideration of young children’s alternative theories implies a significant role for the home environment in early science learning, very little has been published on the role of the parents. Fleer (1996) reports on the positive effect of involving parents directly in the early childhood science learning in child care.
THE IMPORTANCE OF CONTEXT

What other elements of the teaching /learning practice do writers /researchers agree on? One important element is context. Appropriate contexts are defined as familiar real life situations that are meaningful to the children. New (1992) strongly supports this notion. "The importance of active involvement in learning situations that are genuine - that is that are related in some way to the context of the children’s lives - has been noted repeatedly in generalized studies on children’s creative thinking and problem solving abilities as well as research on children’s emergent literacy, numerical, and scientific thinking” (p.295). Segal and Cosgrove (1993, p.276) describe familiar context as one of three “…extensively researched educational strategies,” when putting forward their “learning package” on light and shadows for 5 and 6 year olds. Fleer (1991b) chooses the familiar context of torches for teaching 3 and 4 year old children about electricity. “Contextualizing the teaching experience ensures that the transfer of knowledge and skills is direct and relevant” (p.99).

THE IMPORTANCE OF OTHER LEARNERS

Another element extensively discussed is the importance of the social aspects of learning - the importance of peers and adults in the learning process.

Segal and Cosgrove put forward the term “cooperative learning” and show in their study with 5 and 6 year olds on light and shadows the need to have situations where children talk with children as well as situations where children talk with teachers. “In small group conversation with peers, we have seen that children are confident to express their implicit ideas, seemingly unperturbed even if these ideas differ from their peers.” “It appears that much of what is discussed in such settings is not, and might never be revealed for a class teacher’s inspection” (Segal and Cosgrove, 1993, p. 283).

Carr, (1994) puts forward a complete model of early childhood science learning based on the premise that children develop science learning strategies out of general social learning strategies. Carr maintains that such strategies as are primarily involved in the relationships with peers and adults, in the learning of rules of behaviour and in the learning of cultural expectations. These social strategies gradually develop into general strategies of inquiry such as asking questions, making analogies and reasoning.
deductively etc. As children venture into science investigations these strategies become available for inquiry specifically in science domains.

REPRESENTATION OF CHILDREN’S IDEAS THROUGH DRAWING

Children’s drawing is advocated as an important technique for communication in early childhood. Gardner (1980) firmly links the ability to draw with cognitive functioning. He places it on a par with language and mathematical abilities etc. as one of his seven “multiple intelligences” (Gardner, 1983). In Italy, the Reggio Emilia educators are totally committed to this method of expression. For example, the children’s science understanding of shadows, as shown in drawings, is quite remarkable and requires no words (Exhibition Catalogue “The Hundred Languages of Children” Department of Early Education, 1987). In Britain the SPACE project (Qualter, Schilling and McGuigan, 1994) specifically integrates drawing as “diagnostic assessment” to help the teacher plan effective learning experiences. In the Australian context, Hayes and Symington (1989), have done some innovative work in the lower primary school which shows that children can communicate their science ideas to others via drawings. In New Zealand, Carr (1994) in her early childhood science learning model sees “representation” as one of the important strategies that moves from the social to the science domains. In the U. S., Forman argues strongly for drawing as a way young children can understand and reflect on their science experiences. It is also a way teacher’s can access young children’s thinking. Forman talks about “drawing to learn” as opposed to “learning to draw” (Forman and Landry, 1992, p.185). In attempting to illuminate the Reggio Emilia approach for American professionals, Forman and Edwards (1993, p.310) suggest that teachers “go beyond art as aesthetics; instead see art as a thinking tool [and] integrate drawings from both observation and imagination.” Other writers see the need for more work to be done especially in the preschool area. “Although some creative solutions have been used with children’s drawings in science [a reference to Hays and Symington, 1989] generally little attention has been given to this area” (Fleer and Hardy, 1993, p.69).
CHAPTER THREE

METHODOLOGY

TYPE OF STUDY

This study uses a qualitative, multifaceted approach. This diversity of methodology has been adopted in order to reflect and capture the complexity and depth of the learning lives of these children. As Krathwohl (1993) has pointed out, "Qualitative data may be gathered in as many ways as the researcher's creativity permits."

This research cannot be easily labeled as a particular "type" of investigation. In part it is a case study. A case study of the progress of a science project within one classroom was a central element of the study but was not the entire study. The study is also ethnographic. The view of Burns (1990) is used as a yardstick here rather than earlier writers such as Genishi (1982) who feels that studies in the school situation cannot be classified as ethnographies. However, the particular research design, used in this study is potentially more translatable and less idiosyncratic than the typical educational ethnography.

This study is also, of course, descriptive. Variables involved in the situation under scrutiny were reported, described and interpreted but no attempt was made to manipulate them in any experimental way. The term descriptive can apply to a wide variety of study types and, therefore, is not a definitive label on its own. The strongest defining feature of this study is its participant observation framework and the multifaceted approach within this.

In general this is a descriptive study which uses multiple data gathering techniques within a participant observation framework.

RATIONALE FOR APPROACH CHosen

Searches of publication data bases did not yield a great deal of research literature concerning early childhood science. Even less has been written about emergent curriculum in the Australian context. This study was designed to increase
understanding of what was happening in a real classroom situation in relation to the science aspects of one early years’ curriculum. Information was being sought which would illuminate as far as possible the points of view of all the participants. Understanding of the unique relationships between science and the emergent curriculum in this preschool setting, was the purpose of this study. In order to achieve this, experience of a natural situation was sought.

The qualitative research approach in general is seen to be ideal for understanding processes within natural settings. Robson (1993, p.191) describes participant observation in particular as being “preeminently the appropriate technique for getting at ‘real life’ in the ‘real world.’” For instance, Jorgensen (1989, p. 12) states that “the methodology of participant observation is exceptional for studying processes and relationships among people and events…” This view of the value of participant observation is also held by others (Burns, 1990; Borg, Gall and Gall, 1993). Qualitative methods are seen as being particularly appropriate to understanding the complexity of many educational situations. “...overconcern with quantitative data may miss significantly important links and relationships within an educative process” (Burns, 1990, p.225). Observation is seen as particularly useful “Educators who want to know how learning occurs in classrooms realize that test scores and questionnaires are insufficient to tell us about educational process. Regardless of the specific phenomenon they seek to understand these investigators all view observation as necessary for the accomplishment of research” (Genish, 1982 p.586).

A logical and philosophical match occurs between emergent curriculum and qualitative investigation. Emergent curriculum by its very nature is a dynamic responsive process. A qualitative approach to investigation is also a dynamic on-going process. A qualitative approach of the type used in this study allows for flexibility and change just as emergent curriculum purports to do.

A study with very similar objectives “...to study the course of one single project” is that of Rankin (1993). She employed a very similar methodology to that at the centre of this study. She followed through a particular project on dinosaurs within a preschool in Reggio Emilia which has an emergent curriculum philosophy. Rankin was a participant observer who made extensive use of observation notes, video and audio tapes and actively sought out the insights of the class teacher and the children. She
started as an observer but became very much a participant in the group. This current study reported here had much in common with Rankin’s.

**SCOPE**

This study sought to understand science learning in two classrooms in a children’s centre that professed to have an emergent curriculum approach. One classroom (A) was the primary focus of the observation. Data were collected in class A throughout a single science project that lasted nine weeks. The investigator was very much a participant in this classroom as part of the teaching team. In class A data were collected by the class teachers as well as by the investigator. In the second classroom (B) the author was only one of a team of several investigators. The aim of these investigators in classroom B was to look at all aspects of the curriculum, from which data that applied to science learning were sampled over a one week period for the study reported here. In the classroom A, elements that related to the progress and process of the science learning were the focus of the data collection.

By using two major sources of data, one from class A and one from class B, this study was specifically considering the effect the researcher had on class A. Every observer inevitably has some effect on the group being studied. In classroom A the author partly took on the role of a teacher and to some extent a scientist. (In response to a question of how we could find out more about spiders one child replied, “Ask Ann [the researcher] about spiders. Go to her house. She could lend us her books and we could read them.”) The investigator also took decisions along with the class teacher about the direction of the program. While there is a precedent for a research role as part of the teaching team (Rankin, 1993), the impact of the investigator’s role in such a situation must be considered. The potential for the researcher to influence the program was therefore much greater in class A than in class B were the researchers took a role of minimal participation. Many of the data were collected almost concurrently in both classrooms. In classroom B the investigator had very little influence on the program, she was merely one of several researchers taking turns to sit making notes or use a video camera. It must be noted that seven different researchers were involved in the collection of these data in classroom B, however, the analysis and interpretation of data presented in this thesis has been the responsibility the author alone.
SOURCE OF THE DATA

Data were gathered in an established children's centre. This centre ran a kindergarten program four mornings a week as part of a day care program for children from 3 to 5 years. There were three separate classes each with a teacher and assistant teacher. Around two-thirds of the children attended some part of the day care program and all attended the sessional kindergarten program. Observations were carried out with the 4 and 5 year old children in classes A and B. The class of 3 year old children was not involved. Observations took place on an average of three times a week during the kindergarten part of the program. The average age of the children at the start of the project in classroom A was 4 years 10 months. In classroom B it was 4 years 5 months. Data collection in class A represented a case study approach centered around a specific science project - namely a study of spiders.

Instrumentation - Data gathering tools.

Multiple techniques were used. In class A, the case study classroom, the following were the main tools used:

- observation followed by the writing of field notes;
- observation with video taping and photographs;
- open ended interviewing of the children on four occasions throughout and one after the project;
- documentation of the children’s work, notably drawings;
- documentation of children’s contributions in terms of resources; and
- documentation of parents comments.

Data from classroom B were collected mainly using observation schedules which involved observers noting the time and writing a description of aspects of the children’s or teacher’s activity as well as transcribing verbatim quotes where possible. In addition many sessions were simultaneously recorded on videos. Children’s drawings were also used extensively as records of their activities and development of their thinking. Appendix A contains examples of the observation schedules, questions asked in the children’s interviews, examples of field notes and video transcripts.
Why were multiple methods of data collection used?

As with the work in both classes A and B, this too was a means of achieving triangulation and hence verification and validation of findings. This approach makes intuitive sense and is also supported by the field (Jorgensen, 1989; Burns, 1990; Hurworth, 1995). “It is encouraging to note multimethod case studies incorporating participant observation being advocated...” (Robson, 1993, p. 193).

The main data gathering techniques used are outlined below.

Observation.
Observation (with field notes) was a widely used technique.

Interviews.
Another very important data collection approach used in this study was to interview the children. Interviews were designed to get insights into the process being explored, from the children’s point of view. Interviews were used to illuminate the children’s understanding of the content. Had they learned anything about spiders? Also interviews helped the researcher to understand the affective aspects of the curriculum. Had the children enjoyed/disliked/ found difficult etc., particular parts of the program?

Video taping.
In this research many, though certainly not all sessions, had some part video taped. Often this was accomplished with a fixed camera as the researcher was interacting with the children at the same time. Videos were particularly important in very visual situations such as dance sessions. The children were fortunate to have regular sessions with a dance specialist and these were routinely taped.

In the dance session and in the general classes, video tapes allowed the author to reflect on the children’s ideas and actions after the session and make notes or transcriptions of key aspects.

Children’s work.
As well as expressing themselves in words young children use drawings, movement, models and other means to communicate their thinking. This use of a variety of “languages” is indeed confirmed by the Reggio Emilia educators. (Edwards et al., 1993). These types of children’s work were used in this study as valid sources of data.
children in both classes contributed to a portfolio of their work. Appendix B contains examples.

Parent response.

Field notes were made which exemplified parent roles within the program or recorded their comments on the program. On one occasion parents were also invited to give written responses regarding one aspect of the science project in class A.

**DATA ANALYSIS**

As discussed above, qualitative researchers use a great range of data collection methods. They also use multiple methods of data analysis - often in combination (Potter, 1996 p.134). Potter puts forward twenty methods of data analysis used by most qualitative researchers. The analysis in this particular study can be seen as fitting into several of these categories. These are discussed briefly below.

Potter lists grounded theory as one framework utilized by researchers. In a grounded theory approach, “The process follows inductive reasoning - looking for patterns across individual observations and then arguing for those patterns as having the status of a general explanatory statement” (Potter, 1996, p.151). It will be clear from the discussion below, that many aspects of the process of data analysis in this study were based on such an approach.

Potter sees triangulation as another method of inductive data analysis. “The method of strengthening of one’s argument by building in many different dimensions is called triangulation” (Potter, 1996, p.153). The investigator in the study being reported here, holds the view that this is a method that guides both data collection as well as data analysis. However it is certainly central to this study as has been discussed above.

Thick description is another of Potter’s categories. This refers to analyzing data in such a way as to provide the reader with layers of meaning to understand the usually complex human situation being investigated by qualitative researchers. “In order for the reader of the qualitative research report to understand how those actors construct their meaning the researcher must provide enough description” (Potter, 1996, p.155). The approach taken in this study allowed for the provision of thick description.
Analytical induction is a further method outlined by Potter which is reflected in this study. In this method (possibly misnamed) both an inductive and a deductive approach is taken. "The procedure is to look at one case and construct a generalization, and to look at the next case and to determine if it fits the generalization, if it does not, the generalization must be adjusted and so on." (Potter, 1996, p.156). This method has much in common with a grounded theory approach but differs in that there is a search for more universal and transferable ideas. It will be seen from the discussion below that aspects of analytical induction were used in class A but it is in treatment of the data from class B that method is seen most clearly. Ideas and explanations that were arrived at in class A were tested out in a more deductive way in class B.

While it is valuable to see the data analysis in this study projected within a framework of several recognized approaches, it is of more value to describe the particular approaches taken in this study. As Potter (1996, p.157) states "Methods are tools, they acquire their value according to how useful they are in helping the researcher move from evidence to conclusions." What was actually done in this study would seem to be more important than seeing where or where not the analysis fits certain labels.

The investigator's task was to reflect on and interpret the data in order to formulate themes and key ideas which would illuminate the research questions. Data analysis was tackled in a different way in class A from class B.

In class A the investigator was in a teacher/researcher role as part of a team with the two regular class teachers. The investigator was totally immersed in the science program and in the collection of data. This led to a more informal, more intuitive and at the same time a more in-depth approach to data analysis in class A than in class B. The investigator was intimately familiar with all the data. She was able to reflect on these on a daily basis. Being so immersed in the data enabled the investigator to formulate key ideas and questions as they emerged. Data from many sources were analyzed to find support or lack of support for these ideas. The initial research questions and the questions that spontaneously emerged, focused the investigator in on particular aspects of the data. They also influenced the direction of the subsequent data collections as the investigator sought to answer these questions. Often a type of spiral approach, consisting of questions, data collection, data analysis and more questions, occurred. As
Robson, (1993, p.195) expresses it, “Analysis takes place in the middle of the data collection and is used to help shape its development.” In qualitative research the investigator is the instrument of analysis. Therefore there is a strong intuitive element in the selection of these ideas and questions and interpretation of the data. “Human judgments and perceptions and abilities to hear, see, notice and record are of primary importance in the collection and analysis of data” (Genishi, 1982, p. 564).

The process by which data were analyzed and findings formulated was one where layers of meaning built up over the whole period of data collection and analysis. Burns (1990, p.242) likens the process to the putting together a jigsaw puzzle. The edge bits which are obvious go in first followed by the strong pattern pieces and at the end the holes are filled in.

Specifically, in this study, data were analyzed and used in the followings ways.

**Observation and videos.**

The investigator wrote field notes after the sessions spent in the classroom. If a video tape was available this was viewed. Video tapes from the specialist dance or art sessions were scrutinized for any reference made by the teacher or children to the science investigation. The investigator then reflected on these data, and noted ideas, actions, patterns that seemed to stand out. These patterns or ideas stood out for several different reasons. They stood out because they were repeated or because they related to questions posed previously, or because they indicated some important insights into the children’s or teacher’s thinking. They stood out because they summed up or exemplified what had happened that day or they showed a typical or an extreme example of what was happening or they showed something quite unexpected.

**Interviews with children.**

Interviews were included in the research design in order to get insights into the children’s thinking and understanding. Specific questions were put to all the children, such as “How could we find out more about spiders?” and “What do spiders eat?” Because specific questions were being asked, analyzing these data was relatively straightforward. The investigator was able to note patterns in the responses and count how many children gave certain types of answers. These response patterns were then considered in relation to the key ideas that emerged from other data gathering sources.
Did they lend support for these ideas? Did they offer additional insights from the child's viewpoint?

Children’s work.

Children’s work was a valuable source of data. Children's drawings were particularly useful. Any reference in these drawings and painting to spiders was noted. Where spiders or webs had been drawn either spontaneously or at the suggestion of the teacher, these drawings were analyzed for evidence of level of understanding of scientific information, for example correct body structure of spiders. They were also analyzed for evidence of the level of observation and communication skills the child displayed. For example did the spider in the drawing have the correct number of legs attached to the correct body part? Did the children look at a tangle web but draw a stereotypical wheel web? Children’s games, which proved to be important in this project were treated in a similar fashion. Did children ask to play spider games? Did they play them in a way that demonstrated scientific understanding? When children chose to make their own games what did these show about their understanding of spiders? Similarly what sort of interpretations of spiders did children show in role play and models? Children’s work in general was used to confirm and explore further data obtained form observation and interviews.

Children’s contributions.

The books and specimens that children brought from home were analyzed in terms of the number of children who contributed and how appropriate the contribution was in relation to the science investigation. Other evidence of the child's/parent’s enthusiasm for the topic were noted. For example had the child read the book they brought in at home with the parents? Did the child talk about being taken to the library to find the book?

Parent response.

Did parents choose to comment on the science project or become involved in any way? Spontaneous comments on the program and their child’s reactions to it were noted. What were the parents’ perceptions of the science project? Were the comments positive or negative? Was there evidence that children discussed aspects of the project at home? Parent's were also invited to make written comments at the end of the project. These comments were analyzed in the same way.
Photographs.

While these were not a primary source of data, photographs served several purposes. Importantly they gave a visual record of some of the children's work, particularly the larger group projects such as web weaving and outdoor spider games, and allowed these projects via the photographs to be part of the portfolio of children's work. Analysis of data from children's work has been discussed above. Another function of the photographs was to communicate visually to the parents some aspects of the science investigation. This helped inform parents who could then provide feedback - the analysis of which has also been discussed above. Displaying photographs of the activities and work also celebrated the children's achievements and provoked reflection and discussion on their part. Any insights gained from the children in this way were noted by the investigator.

Tentative findings were therefore generated in class A. Analysis of data in class B was carried out to see if these findings could be supported. In class B the investigator had access to very large amounts of data. Decisions needed to made on how best to make selections of these data. A sampling technique was used. Data was taken from a single week. This was a data rich week. There was more than one observer for most of the sessions. Eleven sets of observation sheets or transcripts were available. As the specialist art teacher was absent this week observations from the next available videoed art session were added. This week was also chosen because the full range of experiences in the kindergarten had been observed. For example, teacher directed activity, free choice activity, indoor and outdoor activities as well as the dance program.

The investigator took these eleven sets of observation data and marked all passages that related to science learning. Next a matrix was set up to organize and display the relevant data. See Appendix C. Several issues (key ideas and questions, to be investigated) formed the horizontal axis of this matrix. These issues were generated from two sources; the theoretical literature and the real experience in class A. Key findings had emerged from the data collected in class A. Would these findings hold true for class B where data were collected in a much more detached way? The horizontal axis of the matrix listed the range of settings or aspects of the kindergarten program. Cells were filled in at the level of ideas and short quotes obtained from the marked passages.
CHAPTER FOUR

FINDINGS

FINDINGS CLASS A

While all aspects of the project are interrelated at some level, I have chosen the following key headings under which to report the findings of this study:

- how the topic of spiders was chosen;
- the overall progress of the project;
- roles of the teacher, children and parents;
- the multimodal nature of the learning experience;
- the use of games as teaching strategies;
- the findings of the interviews with the children;
- judging the success of the learning; and
- a general developmental curriculum.

Looking at these aspects will best answer the research questions.

CHOOSING THE TOPIC

Who initiated the topic of spiders? This is not a simple question to answer. The children initiated the topic in the sense that they displayed an in-depth interest in the area. If it was not for their interest, the teacher, with her known fear of spiders, might well have avoided the topic. The assistant teacher and the researcher also supported the teacher to begin to tackle this fear. Angela the teacher had a real fear of spiders and the children were very aware of this.

Here is how one of the girls described an incident that had occurred on a home visit.

"... and I said close your eyes Angela' cos I went round and I put it [a plastic spider] on her lap and she screamed....she was frightened of mine. She said 'please keep it away'. She had tears in her eyes."

One of the boys, like other children in the class, was also aware of his teacher's considerable fear of spiders.
"I'll tell you a story. I gave Rae a woolly jumping spider for her birthday and she brought it in [to kindergarten] and she made it jump, she made it jump and Angela got so frightened."

So Angela's fear of spiders and the children's awareness of this, led to the choice of the topic for this project. However the children had also displayed an interest in other science topics, and the teacher could have chosen one of these. So in this sense the teacher chose it. Like other aspects of emergent curriculum which will be discussed below, the children displayed an interest and the teacher chose to explore and extend that interest in appropriate ways.

The importance of emotional involvement as a factor in the direction learning takes also became clear. Children too had some fears of spiders. This was exemplified by the children's overwhelming interest in Red-back spiders.

The Red-back (*Latrodectus hasseltii*) is the only potentially lethal spider in the Melbourne area (Walker and Milledge, 1992). It is, however, unlikely to be seen in houses as it seldom leaves its web. Many people have never encountered one. Antivenenes are readily available and the last recorded death was in 1956. This spider has however acquired a high profile in the Australian imagination, as the children's comments show.

Andrew: "Red-backs are poisonous."
Nathan: "Yeah."
Hugh: "Daddy long legs aren't."
Andrew: "Are!"
Hugh: "Are not!"
Andrew: "Are!"
Hugh: "Are not!"
Andrew: "Daddy long legs are the poisonest spiders in the world but they can't bite you because."
Nathan: "No Red-backs are the poisonest."
Andrew: "No Daddy long legs are but they can't bite you."
Teacher: "Could we write that down as one of our first questions?"
THE OVERALL PROGRESS OF THE PROJECT

Set out below is a summary of the main events that occurred in each week of the spider project. This has been drawn up from all sources of data. It is an overview of the main events and does not reflect the many brief informal interactions that took place all the time between adults and adults, adults and children, and between children.

The project was spread over nine teaching weeks. It began with the teachers and the researcher meeting and brainstorming about how to get started and the way the project might develop. Work with the children began with small groups talking about spiders and drawing webs or spiders. This was to gauge the children’s interest, if any, in the topic. It concluded nine weeks later through a celebration of the children’s learning at a spider night party with families.

In the interim, children’s learning developed through many approaches. The children talked about spiders. They read books about spiders. They looked for spiders. They danced their ideas about spiders. They drew spiders. They made models of spiders. They played games about spiders. They wrote stories about spiders. They role played with plastic spiders and they had a spider expert visit. Not all children used all approaches but most children used most of them. As is seen from the list below there is a definite peak in activity in the middle of the project (week four) as judged by the number of different activities that occurred and the number of contributions made by the children. The other trend of note is that from late week six onwards an increasingly important aspect of the learning was directed towards how an activity might be used at the spider night party.

WEEKLY SUMMARIES

CLASS A

The process of the project.

During week one the project started with small groups of children drawing and talking about spiders. One small group was set up on the basis of this and teacher’s knowledge of the children. RN Education, (1993) picture set of invertebrates and the book *Spiders of Melbourne* (Walker and Milledge, 1992) were introduced to the children as well as plastic spiders and plastic insects. The small group seemed very enthusiastic about learning more about spiders.
During the second week the initial small group met again. The children were very interested in a game and web diagrams in Gould League book, *Australian Spiders: A Survival Publication* (Gould League of Victoria, 1988). They asked to play this game. Early in this week a decision was made to open up the spider project to the whole class not just the small group. An area of classroom was set up with a table, posters, and the children's drawings from the previous week. Resource books were placed where children could have access to them. eg three books in the *Sunshine Science Series* (Biddulph and Biddulph, 1992) and *Keeping Minibeasts - Spiders* (Henwood, 1988). The first interviews with the children began. They were asked,"What is a spider?" "What does a spider look like?" and "Are spiders dangerous?" Chrissy brought a plastic scorpion and Bronwyn brought a plastic spider. The children helped make the game from Gould League book. Several groups played and enjoyed the game. The children looked for webs and spiders in playground - first with the teacher and after that often spontaneously when at outside playtime. Jenny brought a beetle in a jar. The researcher attempted to establish two small spiders on branches in a terrarium with slaters and fruit flies as food source. However the spiders escaped.

In week three the interviews with children were completed with the addition of a further question. "How can we find out more about spiders?" Answers to this question were discussed with children in large group time. A decision made to invite an expert. The children "wrote" a letter to Dr. Ken Walker at the Museum - with many drawings. The story *Aranea* (Wagner, 1975) was introduced by teacher and read at group time and discussed. A notice was sent to parents re Ken's visit. Children and teachers went for a walk at Rosina, the near-by unused convent gardens, to look for webs and spiders and to generally enjoy the area. During the week, six children made clay spiders at the teacher's suggestion. Eight children made spiders out of fruit packaging sections and pipe cleaners at one child's suggestion. The children dictated spider questions to the teacher ready for Ken's visit. Emma brought in a photocopy of spider on a web she had coloured at home. Also she and her dad brought in a prepared set of questions about spiders as she was be on holidays the day of Ken's visit. They had done some research at home and found answers to most of their questions. Emma was particularly interested in symbols for male and female that her father had showed her. They talked about the book they used to find answers to the questions. Several
children brought in books this week. Jane brought in the fiction book The Little Miss Muffet Story (Egan, 1989). Jenny brought in a fiction book House by Mouse (Mendoza, 1981) which featured a spider. The teachers and researcher met and decided to invite the children to make a ‘thank you’ cake with spiders on it for Ken in following week. They also decided to encourage children to have a more detailed look at different kinds of webs as the children seemed very interested in webs. They decided to try some other games. The researcher introduced a felt ‘build-a-spider’ game. Andrew climbing on the cargo net told the teacher “I’m a spider stuck in a web.” The teacher brought in an egg sac. Rachel brought in a fun tape called Spider in the bath and other songs.

During week four Emma brought a in book Spiders of Australia (author not recorded) that she and her father had used the week before. Several children made a thank you cake for the museum expert with prune, cherry and licorice Red-back spiders on it. Almost all children made spider biscuits for their snack. The researcher showed a Black House Spider set in Perspex to the children. Rebecca brought in large plastic spider. Andrew brought a plastic snake because as he said, “Snakes eat spiders.” Chrissy brought in a plastic ant which she thought was a spider. This was a good opportunity to discuss the differences between insects and spiders. Heidie brought in large dead Huntsman spider from her house. Her dad had trapped it in the vacuum cleaner. Angela, the class teacher, actually touched this spider. Rachel brought in two live spiders. One was a Daddy Long Legs. Teachers couldn’t identify the other. The teacher brought a newspaper article on spiders that eat their mates and a species where spiderlings eat the dead mother spider. This was read and discussed with the children. Rachel brought the classic fiction book Charlotte’s Web (White, 1963). Rachel could tell the whole story. The teacher began to read one chapter a day. Maree brought in three books on spiders her parents had helped her get from her local library. Two were junior science type books that were very appropriate and one was a Fiction book. These were Spiders (Thomas and Stuchbury, 1990) In the Backyard (Atkinson, 1989) and Nobody Likes my Spider (Gillham, date unknown). The teacher read them with the large group and discussed the difference between scientific and creative stories about spiders. The children sang Incy Wincy Spider at group time. They discussed other versions e.g. Ipsy Whipsy Spider. A small group of children made a wheel web with wool following
diagrams children found in week 2 in Gould League book (1988). Different type of wool for sticky and non sticky parts of the web were used. Jeannie Baker’s book One Hungry Spider (Baker, 1982) was read at group time and her string web and use of collage was discussed. This was related to children’s wool web. The dance teacher interviewed the children about their current interests and followed this up next day in dance class with a dance/drama “bird on the lookout for a tasty dinner” with small groups of children being spiders or birds. Andrew brought in several Cicada nymph shells. The researcher discussed the cicada life cycle with him and why these shells were split down the back. He put them in the wool web. Rachel reported that she went to the Coburg library with her dad and found twenty books on spiders on the computer and one hundred on the shelves. They could not borrow any because they forgot their library card. The children put plastic spiders in the wool web. The art specialist teacher brought a Huntsman in formalin. She set this up with Heidie’s Huntsman and Rachel’s spiders. The children were invited to do spider ‘still life’ with water colours. Several children attempted this. Andrew commented that the protective metal cage on the art room fan looked just like a spider web. The researcher introduced the outdoor web game. Andrew’s mother gave positive feedback about the project. Jenny brought in two books. The Usborne Complete First Book of Nature (Usborne, 1990) and Small Creatures of the Australian Wilderness (Press, 1984). A felt board game introduced to small group by teacher. Nathan brought in The Fancy Dress Party Book (Gordon, 1993). It had instructions on how to make very unscientific paper spiders. Jenny wore a Fimo spider badge made by her sister. The museum curator of spiders, Ken Walker, visited the class. He brought slides, preserved specimens, a live scorpion and best of all, from the children’s point of view, the giant live Tarantula called “Cuddles”. Four parents also attended.

In week five, Jenny’s mother came in to say how interested Jenny was in the project, and to give the teachers the written transcript of some of the things Jenny discussed with her mother the evening after Ken’s talk. Jenny did some drawings to explain her ideas and her mother brought these also. See Appendix D. A Tarantula was added to the felt board game. This was played again several times giving more children the chance to participate. Some unwelcome competition seemed to be creeping in. There were references to football and particular teams. Books with pictures of different types
of webs were used in group time. The class went on a walk to near by convent gardens equipped with drawing materials. Children were encouraged to find at least one web to draw. Heidie brought in a book on insects (Stodart, 1991). Teachers and researcher had meeting to assess where the project was going. They discussed when it should end. They looked at learning considerations as well as practical considerations. Term holidays were to start in two and a half weeks. A student teacher had to take over the class early in the following term. A decision was made to end with a parent night / party in the first week of the following term - children to suggest ideas. The competition that seemed to be creeping into games was discussed as were possible way to diminish it. The teacher suggested that some children may be ready to attempt to make their own board games. Rachel brought a plastic spider. Nathan and Elia started to make their own board games. The teacher brought a non fiction book Cicada Sing Song (Clyne, 1992) for Andrew to look at. She read it with him.

In week six Fiona’s father commented positively on the project in general, and on the wool web in particular. A weaving web dance with cotton thread was instigated in dance session by the specialist dance teacher. The researcher introduced a set of slides of six common Australian spiders, with notes, to a small group of children. The children were particularly interested in the Bolas spider in the slide set, so the researcher devised the Bolas spider game. The children enjoyed playing this game. Nathan did considerable work on his board game. Fiona and Heidie started their board games. Hugh, Louise, Jane, and Anna helped them. A meeting was held with children to get their ideas for the spider party. The teacher documented their ideas. Questions put to the children were for example, ‘Who should come to the spider night’ and ‘What should we do at the party’? The children wanted to invite Cuddles the Tarantula and their own families. The children were very enthusiastic about the whole idea. Three sub-committees of children were formed, ‘invitations and decorations’, ‘food’ and ‘activities’. The idea of raffle emerged from the children. Sub committees met separately. Maree came in from out door play time to give more suggestions - she seemed very involved. The teacher introduced the idea of an animal quiz game to Andrew. The teacher helped other children make up quiz games in group time. This was a very popular format for all children. A decision was made to have children’s quizzes
at spider night. Fiona’s mother reported that Fiona had drawn a birthday card with both
a spider and an Egyptian symbol (the previous project had explored Egypt) in it.

In week seven the children started dictating fictional spider stories to make a
class book. There had been several group discussions about creative versus factual
stories about spiders. Party invitations were completed and sent home. Jenny and her
mother brought in a small web ‘captured’ on black paper. Andrew reported seeing a
web at home. At kindergarten he found a picture of one like it in a book to show the
teachers. Hal and Hugh worked on a board game together. Fiona and Heidie finished
their games. Maree suggested making spider jigsaw puzzles. Several children started
making their own jigsaw puzzles. A papier mache spider model was started. The
children chose to make this a model of a Red-back spider. Samantha, the student
teacher, brought in information on “Spider Plants” (Chlorophytum sp.) This was read
and discussed in group time.

In week eight a string web for an outside web toss game was made by Fiona,
Rachel and Maree. Several children made ‘insects’ - small rice filled bags with an insect
drawn on them, to toss. Heidie sewed them shut - her idea when staples didn’t work.
Fiona reported going to the Northcote library with her mum, dad and baby sister to get
some spider books. She was excited when her mother found Ken Walker’s book listed
on the catalogue - however they could not find it on shelves. [Ken Walker was the
museum expert who had visited]. She brought in one junior reference type book and one
more adult reference book from the library. These were, Spiders in Australia (Cullen,
1986) and Australian Spiders (Mascord, 1978). Parts of these books were read at group
time. The teachers discussed the concept of a of raffle in group time. The parents
started sending some prizes, mostly plastic spiders. The teachers decided to restrict
prizes to “science” objects. A group meeting of children was held to review the games
and activities that will be used at party. Several children demonstrated the animal
quizzes they were to have on display. The papier mache model Red-back spider was
finished. Children decided on rules for playing web toss game. The class went for a
walk in the convent gardens. Several webs, three small spiders were observed and
several other invertebrates. The Harlequin bugs were still mating. A branch for a string
‘web’ was brought back. Many children worked on a tangle web in string on this
interesting branch back in classroom. This led to a lot of spontaneous role play with
plastic insects and spiders and Andrew's remaining Cicada nymph shells. Several children made dioramas in shoe boxes featuring gardens and spider webs at the teacher's suggestion. Hal made a 'Venus villain trap for flies' in the art specialist's session, using chicken wire cardboard etc. The children's fiction stories were typed up. The children added drawings. The jigsaws were completed. Rachel's father discussed Rachel's positive involvement in the project. Andrew completes his board game. The second interviews with children were started and were mostly completed by end of the week. "Tell me what you know or have learnt about spiders." and "What do spiders look like?" were two of the key questions. Emma brought in a small black spider with yellow and white spots. The teachers were unable to identify it.

Vacation Weeks - two weeks.
Spring Vacation. No Kindergarten.

A letter to the children from Ken at the museum arrived.

In week nine the teacher read Ken's letter to the children. They were very pleased that Cuddles the Tarantula would be able to attend the party! No new projects were commenced. The children helped with cleaning and rearranging the classroom and displaying their work. A display of raffle prizes was put up. All children's interviews were typed up and displayed. The children's drawings, dioramas stories quizzes and board games etc. were displayed. Children enjoyed looking at photos and slides from throughout the project as they are set up for the party. Also the video of web weaving dance session and other clips from videos were set up for the parents and children to view. The party was held. Only one family was not able to come. The children were interviewed the following day regarding what they enjoyed about the party. Parents were also given the opportunity to comment.

(Seven weeks later.)

In week eighteen the follow up interviews were conducted.

Overall, the weekly summaries showed a flexible and dynamic approach to the project by the teachers and the children. It showed that the direction and momentum of
the project was influenced by both the teachers and the children with input also from the parents. The roles of the adults and children are analysed further below.

**ROLES OF THE TEACHERS, CHILDREN AND PARENTS**

Broadly speaking, the data revealed eight main roles that the teachers, children and parents took in relation to the curriculum.

1. Teacher initiates learning experiences.
2. Child expresses an interest. Teacher responds by initiating or facilitating learning experiences.
3. Child expresses an interest but teacher does not follow up with planned learning experiences.
4. Child, often supported by parents, brings material which is incorporated into or triggers the learning experiences.
5. Teacher expressly seeks out children's ideas and preferences and follows these up with specific learning experiences.
6. Teacher provides feedback to parents, and parents provide feedback to the teacher about their child and the curriculum which may led to setting up specific learning experiences.
7. Teacher, children and parents together celebrate the children’s learning
8. Parents take on a direct teaching role.

It must be stressed that these are broad categories. Individuals at times take on other roles. It must also be stressed that the relationship between the teachers, the children and the parents is a very complex one. There is a high degree of interdependency. An initial interest shown by a child may lead to a particular learning experience being set up by the teacher which in turn may lead children to display an interest another etc. The Reggio Emilia educators use the term *reciprocity* particularly when looking at the teacher/child relationship. “A central principle is that of reciprocity which involves mutual guidance of the educational process by teacher and learner and responsiveness in circular paths of communication, caring and control” (Rankin, 1993, p.191). Also, these eight categories are not mutually exclusive. A particular action may
be able to be placed in more than one category. The list of roles is in no way hierarchical. One role is not more important than another.

Some examples of these eight categories or roles are taken from the weekly summaries and set out below. (The role of the children and the teacher in initiating the topic has already been discussed.)

In week 1 the teachers deliberately sought out the ideas of the children through drawing and discussions in order to see if there was enough interest in the topic and what direction, if any, the curriculum might take. Acting on the interest displayed and the Reggio experience of effective group size (Edwards and Forman, 1993 p. 309) the teachers decided the project should go ahead and selected a small group of five children to participate in the project. [Role 5 - teacher expressly seeks out children’s interests and acts upon these.] By the middle of the following week it became clear that many other children were interested in participating. For example, three children had brought in plastic or live specimens. None of these children was in the initial group selected for the project. A decision was made to open the project to the whole class. Here the interests of the children had led to major decisions in relation to the project. [Role 2 - children’s interests led to teachers’ response.]

In week 2 some children found a simple board game in a resource book which they asked to play. This led to an interest in games which was maintained throughout the project. This game was played many times by small groups of the children. [Role 2 - children’s interests led to teacher response.] The learning from this game about spider predators and prey was significant. This learning was reflected in the children’s own board games and the knowledge displayed in the follow-up interviews. Teachers took further steps however which were somewhat less directly related to the initial children’s interests. That is, they introduced more games (see below) to explore other aspects of spiders and their life styles. These games proved to be very successful learning strategies. [Teachers were reacting to the children’s interest in the initial game but at the same time they were initiating their own games with specific learning in mind. So both roles 1 and 2 were involved.] The teacher also initiated the opportunity for children to create their own original games which reinforced earlier learning and introduced a diverse range of skills. [Again both roles 1 and 2 were involved.]
Similarly, in the same resource book, the children were very interested in a series of diagrams of how a spider makes a wheel web. Andrew was particularly interested and understood the sequential nature of the diagrams. “Look a web, a web! See 1, See 2, See 3, See 4!” Later in the project the children were able to use the diagrams with the help of a teacher, to construct a wheel web out of wool, and later again a tangle web out of string. These webs led to much spontaneous role play with the plastic spiders and insects. [Role 2 - the child expresses an interest and the teacher responds.] Week 2 also saw the teachers making a special place in the room where spider learning could be the primary focus. The children’s drawings from week 1 were displayed here and teachers chose suitable posters and reference books. [Role 1 - teacher initiated the learning experiences.]

In week 3 the teacher initiated the construction of model spiders from clay as one means of getting children to focus on the body structure of spiders. [Role 1 - teacher initiates learning experience.] The next day a child suggested making models from fruit packaging material and pipe cleaners which were available in the classroom. [Role 2 - child’s interest leads teacher to facilitate a learning experience.] Both options (clay and pipe cleaner model making) were available to children that week.

Week 4 as mentioned above was a very full week. Again there was a balance between children and teacher input. Five children brought a total of nine books to kindergarten. Four were fiction and five were non fiction. Teachers read and discussed these books with the children. [Role 4 - child brings in resources.] Two children this week reported going to their local library to find books. Rachel talked about her library trip with her father. “We found 20 books about spiders on the computer but we found 100 on the shelves! But we forgot the card so we couldn’t get any out.” [Role 4.] As well as ongoing use of the books already chosen, teachers this week supplied another good fiction book and a newspaper article on unusual spiders. [Role 1.] Children supplied three plastic spiders or related animals and three real spiders plus several Cicada nymph “shells”. [Role 4.] Teachers and researcher supplied a Huntsman in formalin and a Black House spider set in perspex. The Museum expert brought many wonderful slides and specimens. [Roles 1 and 2.] The children had prepared a set of questions to ask him. [Roles 1 and 2 - teacher suggests writing question which reflect the children’s interests and the expert in the teaching role responds]. Teachers created
opportunities for the children to draw spiders, dance spiders, sing a song about spiders, discuss spiders and hear factual and imaginative spider stories. [Roles - 1 and 2.]

Some examples have already been given showing how parents facilitated their children’s contributions in terms of library visits. There were other ways they showed their commitment. In week 3, Emma and her father brought in a list of questions about spiders as Emma was to be absent the day the expert came. They had actually been able to find most of the answers themselves in a book. Emma was particularly keen to show the teachers the symbols for male and female her dad had taught her. Here her parent had actually taken on a direct teaching role in response to Ellie’s interest. [Role 8.] Fiona also gave evidence of direct parental teaching [Role 8] in week 7 while drawing spiders for her game. She told her friend “My mother says they’re not called palps.”

Parents were involved in still other ways. They often chatted informally to the teachers about spiders or their child’s interest in the project. In week 5, one mother wrote down the detailed discussion she had had at home with her daughter following the museum curator’s visit. She brought this into the teachers along with Jenny’s drawings. (See Appendix D) This was very encouraging as it showed how interested Jenny had been. (Jenny was a rather shy child and did not always take an active part in group discussions.) It also allowed the teachers to pick up one misconception that had occurred. It was clear from the drawings and the words her mother had recorded, that Jenny believed that only male spiders had palps. [Palps are the short leg-like appendages on the front of the spider used to manipulate food and other material.] [Role 6 - parents supplying feedback to teacher who was able to discuss the use of palps with the large group.] Parents were also very supportive of the spider night party - supplying food and raffle prizes. They also showed their support by coming along.

Teachers often chose not to follow up on the children’s ideas or questions. [Role 3.] It is the intrinsic nature of children of this age that they have a never ending list of areas of the world about which they want to learn, so interests were displayed by them in a wide variety of fields. There were many wonderful opportunities for maths learning which were not followed up in a systematic way. For example Andrew’s understanding of the sequencing of the web diagrams in the book quoted above, could have been explored with other children to establish their level of understanding in this area. Also Rachel’s statement of the number of spider books in the library quoted above, could
have been followed up as well as Hugh’s claim that he had “...a million, a thousand, an
infinity of cousins.” (week 2). There was also a lot of discussion about how much
money raffle tickets should cost. (week 6) The children who made board games also
experienced numerous opportunities to explore maths concepts as did the children
creating rules about the throwing distance for the outdoor web toss game.

While these maths opportunities were sometimes expanded upon at the time
they occurred, they were not usually consciously followed up in an in-depth way
afterwards. For example Fiona (week 7) when making her game with two friends stated
that she’ll be quicker to finish her game than Nathan was. To explore her thinking
processes, the teacher immediately asked her why. She replied that its because she has
three children working on the game and Nathan only had one. A little later she states
there are 12 sleeps till her birthday. The teacher asks, “If it’s 12 sleeps till your
birthday and you have one sleep, how many sleeps left till your birthday?” - “
Fourteen” is Fiona’s reply. By asking this question, the teacher took the opportunity
to try to further understand Fiona’s mathematical thinking but did not correct the child
or set up any experiences to try to help her work towards some understanding of the
subtraction process involved. Similarly there were several opportunities to follow up
other science questions the children were obviously interested in. For example the
children brought in specimens of plastic and live insects and the cicada shells. On the
web walks children observed many other insects and were particularly interested in the
large population of colourful Harlequin Bugs (*Dinbymus versicolor*). Any of these
insects would have provided a rich area of study.

Later the teachers reflected on why they did not follow up on some interests.
The sorts of reasons articulated by them had to do with loosing momentum and focus in
the spider area as well as in Angela’s case a very personal commitment. “You can’t do
everything at once. There just isn’t time and the children would get confused.” “I felt
very involved in the spider learning because of my original fear of spiders, and I wanted
it to continue.”

As is discussed above, the children were constantly making a contribution and
only some of these were followed up. Sometimes the children’s interests were too
strong to be ignored even though the initial adult reaction was that this was not relevant.
Such was the case in the request for a raffle at the spider party. The teachers’ initial
reaction was that children probably did not really understand what a raffle was and that they (the teachers) might be seen as encouraging gambling. There was also the problem of a potentially happy occasion being marred by the disappointment of the children who did not win a prize. However the interest was so strong that teachers overcame these problems and the raffle went ahead. In an interview later, it was rated by the children as the second most enjoyable thing at the spider party - after food and drink!

Role 7 is that taken on by the teachers the children and parents in celebrating the children's learning. This is exemplified by the wonderful spider party which occurred at the end of the project. As one parent wrote, "What a fantastic project and a fantastic night! What lucky kids. This seems to be the ultimate - creative, fun, imaginative, informative and a lovely sense of caring and friendship. Thank you all!"

Overall, what were the respective roles of the children the teachers and the parents? These roles were often interdependent. In broad terms, children had a significant influence on the curriculum. Parents usually played a more supportive role which gave their children permission to throw themselves wholeheartedly into the learning, though sometimes they took on a direct teaching role. The teachers' role in terms of the curriculum was to exercise their professional judgment about what should be included, based on their own ideas, the children's contributions - in terms of resources and ideas - and to a lesser extent based on feedback from parents.

THE MULTIMODAL NATURE OF THE LEARNING EXPERIENCES

One of the important things that characterized this science project was that children were encouraged to learn in a variety of ways.

Dance/drama.

All classes at the centre were privileged to be able to have an hour each week with a specialist dance teacher. This teacher collaborated with the generalist staff in class A in an attempt to integrate dance content in the development of the spider project. Movement stimuli such as spinning, opening and closing, creeping, rolling, and crawling offered the children the opportunity to experience and learn about the topic through their bodies. Small and large group dance dramas were developed by the teacher and children, with the children initiating content and creating scenes. There were wonderful whole group web weaving dances where a fine thread was used to connect the
children and the teachers together in the space (week six). The children became very excited about the interpretations of spiders escaping from birds (week four), spiders catching flies, and spiders "playing dead" with legs curled up (week five). The content of the sessions was supported by a wide range of percussion instruments and vocalizations. The glockenspiel provided an appropriate stimulus for the weaving web dances. Following each dance class children were asked to reflect on and record some aspects of their dance experience through drawing.

**Drawing/painting/model making.**

Children were also had one session a week with a qualified art specialist in a wonderful space called the discovery room. Again this specialists did not act in isolation. She liaised with the classroom teachers and the children before presenting her weekly program. For example in week four she brought in a preserved Huntsman which she set up with two specimens of spiders that the children had brought and encouraged to children to paint still life representations of spiders.

Drawing, painting and model making were an important part of the program back in the regular classroom. Drawing has always been an important way that young children can express their ideas. The beautiful and sophisticated drawings of the children of Reggio Emilia in Italy (Edwards, Gandini & Forman, 1993) have shown how powerful this teaching/learning tool can be.

Children drew extensively throughout the spider project. One of the teachers' aims was for the children to develop an awareness of the correct body structure of a spider. Looking at the children's drawings was a way of assessing this understanding. One early strategy was to ask the other adults at the centre to draw a spider and then compare these drawings with some clear pictures and diagrams. The children were able to conclude that the grown ups had indeed "got it wrong" and not drawn a scientific picture of a spider at all. (They had, as had the children, drawn the legs attached to the abdomen or given the spider only one body part or two eyes etc.) These comparisons led to looking at the children's own drawings in the same way. The term "wrong" was avoided with the children's drawings, rather they were referred to as "creative" or "scientific" drawings. Another opportunity to discuss body structure was created when many children made edible spiders out of prunes, dried apricots, preserved cherries,
chocolate buttons and thin strips of licorice. This was preparation for making a thank you cake decorated with spiders for the museum curator.

Children found it very hard to draw the legs originating from the cephalothorax [the first body part which is a fused head and chest] rather than from the abdomen. As mentioned above, four weeks into the project children were shown two large specimens of Huntsmen (dead) and encouraged to observe and paint them. Only one child of the ten that chose to do this activity drew the legs in the correct position. Gradually however many children did begin to draw scientific spiders. In week 8 when children were given the option to do easel painting of spiders and encouraged to paint a scientific spider, 6 out of 14 children had the correct number of legs - (8), the correct number of eyes - (8), and the legs originating from the cephalothorax. See Appendix E. In the same week however the children did illustrations for their creative spider stories. Of the twenty children who did this illustration only six drew a scientific spider as defined above.

While a focus on correct body structure was important, this did not mean that every drawing a child did of a spider was analyzed or discussed. It was felt that it was also important that children be largely free to express themselves in the way they wished. A few children never drew a scientifically correct spider. However, most did acquire a good understanding of body structure as the follow up interviews, seven weeks later, showed. On this occasion sixteen of the twenty children were able to choose the scientific drawing of a spider from six drawings, three of which were obviously spiders. [See Figure 2 later in this chapter]. It would seem from this that it was easier for the children to recognize the correct spider drawing than to construct one.

As well as dance, drama, drawing, painting and model building, children sometimes used other forms of bodily kinesthetic representation (Gardner’s term, Gardner, 1983) to express their understandings of spiders. For example in week 3, Andrew climbed on the cargo net outdoors and told the near by teacher, “I’m a spider stuck in a web.” In week 8 when Fiona and her friends were making the large outdoor web for the web toss game, the teacher commented that Fiona wasn’t spinning the web in quite the same way as a spider would do it. Fiona said nothing. She merely held the spool of string under her bottom and ran off letting it unwind. She demonstrated very
graphically that she understood the relative position and function of the spider’s spinnerets.

**Role play**

A further mode of expression that the children used was role play with plastic spiders and plastic insects. This happened spontaneously after the wool and string webs were made.

**Observation and discussion.**

Children were also encouraged to practise their observation skills in looking for spiders and webs. The teachers and children went on regular web walks. On one of the early walks children were asked to draw webs and any spiders they saw. (This allowed the teachers to introduce the idea that there were different types of webs. This was reinforced back in the classroom with clear pictures from a junior science text.) None of the traditional orb (wheel) webs was found on this early walk, though interestingly enough, several children still drew the webs this way. This allowed the teachers to encourage more careful observation and talk about how scientists have to record accurately what they see. Another question raised by these early walks was, "Where are the spiders?" Webs were there but children couldn't see many spiders. Teachers discussed the fact that many spiders are active at night and in the day they hide. They also discussed the fact that some spiders build a new web each night and destroy it at dawn. Jenny Wagner's beautiful story *Aranea* (Wagner, 1975) demonstrated the persistence that spiders show in rebuilding broken webs. Other pictures were found back in the classroom to show children spiders which "hid" more openly on webs such the Leaf Curling spider (*Phonognatha graeffei*) which pulls a leaf into its web, curls it up by winding silk around it, and has the perfect hiding place. The children looked for these clever little spiders on subsequent walks but were not able to spot one.

Luckily a "dead" spider, which was actually a cast off skin, was found on one of the walks. Teachers were able to talk about the fact that spiders get too big for their skins as they grow. Spiders moult by crawling out of their old skin. Children were able to compare this spider skin with the cicada shells that had been brought in, and teachers could point out that the nymphs or larvae of insects also moult. Some pictures showing the process in both cicadas and spiders were found in books.
Overall, children had diverse and creative opportunities to explore the topic of spiders. One of these opportunities was to learn about spiders through games.

THE USE OF GAMES

Games proved to be important teaching/learning tools. One of the books read by an initial group was a small and inexpensive sticker book produced by an environmental education organization for elementary school children. (Gould League of Victoria, 1988). Something in it really did "engage the children’s minds" as Katz, (1989) puts it. This was a game which the children asked to play.

The game was a simple one. Animals could move one square at a time and either eat or be eaten by the other animals. The aim was to try to get the spider successfully across the board to its web. The game introduced the children to spider predators and prey. It started an interest in games that was maintained throughout the project.

The teachers used games as a direct way of teaching and reinforcing many of the scientific concepts relating to spiders. At the same time skills involved in social interaction, logical thinking, problem solving, language, mathematics, and motor coordination were constantly being practised by the children. Such was the wonderful integrated nature of the project. It is however the science learning that is the focus of this project. Through the initial game and those described below, children explored the concepts of:

- the predator prey relationships of spiders;
- the life cycle;
- the broad environmental needs of spiders;
- the body structure; and
- the various uses of silk in trapping prey.

"Build a spider" game.

Children explored body structure and habitat in this felt board game.

Web game.

This was played outdoors with children being insects or spiders and it explored the concept that web spinning spiders don’t have good eyesight but rely on feeling vibrations to capture their prey.
Bolas spider game.

This game helped children see the variety of ways spiders use silk to catch prey. A paper spider on the end of a ruler had a thread with a blob of sticky tape on the bottom. The aim of the game was to hold the ruler and have the "spider" catch several moths (small pieces of Kleenex tissue).

Web toss game.

This was a simple bean bag toss game that was played outdoors.

Quiz games.

Quiz games proved to be something all the children were able to enjoy and, after a little practice, participate in. The type that starts "I am thinking of an animal. It has..." These quizzes related to all animals not just spiders.

Games designed by the children.

Children were also enthusiastic about designing their own original games. Some made board games, (suggested by the teachers in week 4) and some made jigsaw puzzles (suggested by a child in week 7).

At the developmental level of a four or five year old the process of designing a board game is challenging indeed. An adult needed to work with only one or two children while they were making their games. She needed to help them to think about the problem solving process they were engaged in. One important feature was the similarity of the children's games to those games that the teachers had introduced. It clearly demonstrated that modeling is a very powerful aspect of the learning process with young children. Many of the children's games were based on a predator/prey relationship which had been the basis of the very first game in the Gould League book.

FINDINGS FROM INTERVIEWS WITH THE CHILDREN

Children were interviewed five times throughout the project. Three interviews were to judge the overall progress of the project in terms of knowledge and understanding while two were to judge the impact of specific events - namely the expert's visit and the final spider night party.

Children were interviewed:

1. in the early stages of the project;
2. in the later stages of the project;
3. seven weeks after the end of the project
to judge knowledge and understanding, and

they were also interviewed:
4. after the expert's visit; and
5. after the spider night,
to judge the impact of these events.

All interviews were designed and carried out by the class teacher in class A,
except the final interview seven weeks after the study (Interview 3.) which was carried
out and designed by the researcher. No interviews were conducted in class B.
The interviews were important in shedding light on learning outcomes, particularly those
in the areas of knowledge and understanding. Learning outcomes in the area of skills and
attitudes are discussed later. The indications from the interviews were very positive.
The children appeared to have gained knowledge about spiders during the project and
this knowledge persisted for at least seven weeks after the completion of the project.

The first interview. (Interview 1.)
This occurred during the early stages of the project. (week 2.)
The children seemed eager to be interviewed. The teacher had a very warm approach
and accepted all answers as being equally valid. The interviews happened over several
days - mostly during outdoor play time. Children were interviewed individually.
Children were asked, "What is a spider?" "What does a spider look like?" and "Are
spiders dangerous?" Other questions were asked if necessary to clarify a child’s
thinking.

Legs seemed to be a defining feature of spiders for the children. Six of the
twenty children referred to legs in answering the first question - "What is a spider?"
When asked "What does a spider look like?" eighteen of the twenty children referred to
legs.

The next single most given answer in relation to the question about what a spider
looks like was that it was black. Five out of twenty children gave this as their answer or
part of their answer. Most importantly the interviews showed that the children had an appropriate understanding of what spiders were and that some children came to the project with quite sophisticated levels of knowledge. Eight out of the twenty children when asked what a spider looked like said it had eight legs. Others individually showed understanding at a high level. One girl said in response to the first question "It's not an insect. It eats insects." One boy talked about spiders being able to "inject venom".

All children stated that at least some spiders were dangerous. There was a preoccupation with Red-back spiders. Eighteen out of the twenty children mentioned Red-backs as dangerous. Three said Daddy long legs, three said White tails and two said Huntsmen. Tarantulas and Funnel webs got one vote each for being 'dangerous.

At the end of the period when these initial interviews were taking place (week 3) the children were all individually asked an additional single question - "How can we find out more about spiders?" The children's answers were again very appropriate and showed that many of them understood basic research approaches. This was demonstrated through their response to the question, "How can we find out more about spiders?" predictably most children said we look at the real thing. (14 out of 20)

For example.
"Explore spiders to see what they're like - with a net. Catch them in a net or a bug catcher. Touch it and see what they feel like."

"Find them in the country. Remember what they look like. Take photos of them."

"We should catch a really large one and a really small one. A male one and a female one."

Two children suggested looking at models.

"I have a toy spider at home."

"By looking at a plastic spider."

Only four children suggested asking for outside help. Some of these replies showed a high degree of awareness of sources available.

"Ask somebody. Think about it."

"Go to a school. See their webs. Go to a Zoo to see spiders - or university."

"The bug museum. Ask someone who knows about spiders.

Ring up "Our House" [a television program] cos they've caught funnel webs."
Only one child mentioned using books as a resource, which was surprising as they spontaneously used this method of learning throughout the project.
"Ask Ann about spiders. Go to her house. She could lend us her books and we could read them."

The Second Interview. (Interview 2.)

The second interview was held in week 8, five to six weeks after the first interview. Children were asked a varied set of questions but all were asked two key questions "What have you learned about spiders?" and "What do spiders look like?"
This latter question had been asked in the first interview so a direct comparison of answers was possible.

In response to the first question children gave a range of answers including habitat, anatomy, spider prey and names of particular spiders. The most popular answer to this question concerned things children had learned about spider's webs. Seven of the twenty children mentioned webs. In the second interview of the project children exhibited more scientific knowledge about spiders than in the first interview and they seemed confident about this knowledge.

In response to the question "What does a spider look like?" seventeen of the twenty children said a spider had eight legs, fourteen said it had eight eyes and thirteen referred to its having two body parts. Many gave a combination of these answers.

For example.
Early interview .10/8/95 (Interview 1.)

Teacher: "What is a spider?"
Rae: "It's an insect."
Teacher: "What does it look like?"
Rae: "It looks like a very big insect."
Teacher: "How many legs does a spider have?"
Rae: "Six."
Teacher: "What's a web?"
Rae: "A thing that catches flies."
Teacher: "What's it made of?"
Rae: "Lots of stuff, thick gooy stuff."
Teacher: "Are spiders dangerous?"
Rae: "Some are." Red-backs and the ones that eat ants.

Five weeks later 18/9/95 (Interview 2.)

Teacher: "Tell me the things you know or have learnt about spiders."
Rae: "They make their webs in different spots, the web’s made of silk."
Teacher: "What does a spider look like?"
Rae: "It has eight legs and eight eyes."

Early interview. 15/8/95 (Interview 1.)

Teacher: "What is a spider?"
Kirsty: "A spider is something that’s got four or six legs."
Teacher: "What does a spider look like?"
Kirsty: "It has black spots on the back."
Teacher: "Are spiders dangerous?"
Kirsty: "Yes."
Teacher: "Which ones?"
Kirsty: "Red-back spiders. I don’t know any other spiders. I saw one spider with lots of bugs near it and it was a Red-back spider."

Second interview. 20/9/95 (Interview 2.)

Teacher: "What have you learned about spiders?"
Kirsty: "They have eight legs, eight eyes, they eat flies, they’ve got two body parts."
Teacher: "What do you know about webs?"
Kirsty: Tangled webs, sheet webs wheel webs. Spiders catch dinner in the webs."
Teacher: "Where do spiders live?"
Kirsty: "In trees, in their webs in trees.

In the second interview children expressed many accurate scientific concepts in their own words.

Some children such as Andrew were very involved in the project and highly articulate.
(Interview 2.)
Teacher: "Tell me things you know about webs."
Andrew: "It's made of silk. There are different types of webs. Sheet web. Tangle web. Orb web."
Teacher: "Tell me about spiders."
Andrew: "A spider is a spider. Some spend their time underground, and some spend their time in the web."
Teacher: "What does a spider look like?"
Andrew: "We all know that. Well its got a eight legs, a big fat body, eight eyes, the knife and fork [the palps] at the back spinnerets where they spin silk."

Others expressed ideas in a more original way:
(Interview 2.)
Teacher: 'How do spiders make their webs?'
Jane: "They eat their food and then silk comes out from their bottoms."

Teacher: "What do spiders look like?"
Sarah: "They have 8 legs, 8 eyes. It looks like a number 8" [A description of the two body parts.]

However, not all children were equally interested in scientific achievements. When asked about what things she had learnt from the spider project, Sarah's first answer was: "Lots of things. Spider webs, spider cakes, spider cookies, spider milkshakes."
Interview seven weeks later. (Interview 3.)

The appropriate knowledge about spiders that the children had acquired seemed to persist as the interviews conducted seven weeks later show. At this stage the class was busy preparing for summer holidays and the festive season so time permitted just a brief interview with each child. The researcher wanted to look at a few scientific ideas about spiders and see what the children's understanding of these were at this point in time. The children were shown 6 drawings of small invertebrates - including 3 that were obviously intended to be spiders - and asked to choose the best scientific drawing of a spider.

![Figure 2](image_url)

*Figure. 2 “Choose the best scientific drawing of a spider.”*

Children were also asked the names of some types of spiders, where spiders lived, what spiders ate, how spiders caught their food and what spiders' predators were. The results were very encouraging. In terms of body structure, sixteen of the twenty children chose the correct drawing (#5). Children also gave appropriate answers to the questions.
Teacher: "What are the names of some types of spiders?"
Hal: "Black and yellow spiders, Daddy long legs, Red-backs, Cuddles, Tarantulas, Huntsmen, Trap doors, Web casting spiders."
Teacher: "Where do spiders live?"
Hal: "Under the ground, in webs, in houses, in bushes, in a doormat or under a doormat, in dark corners or under a rug."
Teacher: "What do spiders eat?"
Hal: "Flies, small bugs, other spiders."
Teacher: "How do spiders catch their food?"
Hal: "Web casting. Some sit in the web and jump. Some jump for their prey."
Teacher: "What eats spiders? What are the spider's predators?"
Hal: "Bird, snake, marsupial mouse and sphink [skink]."

Hal's last reply showed a good memory of the game he had created based on the very first game that the children had played.

Even children who had seemed less involved in the overall project had a reasonable understanding.

Teacher: "What are the names of some types of spiders?"
Shannon: "Red-back, White tail, normal spider with skinny legs [Daddy long legs], lobster - that's not a spider."
Teacher: "Where do spiders live?"
Shannon: "In tanbark. Jammed in a glass bottle. In the shed. In the grass. They can spin a web on a tree. They can spin a web on the leaves. They can curl up the web to be their home."
Teacher: "What do spiders eat?"
Shannon: "Crushed up leaves, flies."
Teacher: "How do spiders catch their food?"
Shannon: "When the flies are caught in their web, they curl it up to drink the blood."
Teacher: "What eats spiders? What are spider's predators?"
Shannon: "Wasps eat spiders. They're scared of persons. Dinosaurs with long necks."

These interviews allowed teachers to see a misconception that had been picked up in a much earlier interview had not been cleared up and still persisted.

Earlier interview.
Heidie: "I know that spiders are poison. My sister told me that spider webs are poison because the spider leaves its poison in the web."

Seven week interview,
Heidie: "Red-backs are poisonous - they have poison webs."

While these three interviews gave insights into the children's knowledge and understanding, the other two interviews with the children (Interviews 4 and 5) were to find out what the children had enjoyed. After the museum expert's visit children were asked, "What did you enjoy about Ken Walker's visit?" (Interview 4) A clear winner here was the large Tarantula that Ken had brought. Fourteen out of eighteen children mentioned this spider named Cuddles.

When children were interviewed after the spider night - a party at the end of the project - an attempt was made to tap their feelings. (Interview 5.) "What did you do on spider night and what did you enjoy?" All children were very positive about the night. The food or drink were ranked as the things they most enjoyed. Sixteen out of nineteen children nominated one or other. The raffle came in a close second with fifteen children in the group having this on their list. Having Cuddles the Tarantula at the party was mentioned by eight children in response to this question. Making badges and doing quizzes with parents were also very popular.

Interviews were important in showing children's level of scientific understanding of spiders. They also allowed the researcher some insights into which aspects of the program the children enjoyed.
JUDGING THE SUCCESS OF THE LEARNING

What did the children learn by participating in the project? Some of the easier things to measure are those in the area of knowledge and understanding. Less easy to measure are those gains made in the area of skills. Hardest to measure but just as important to achieve are those gains made in the area of attitudes/dispositions.

Knowledge and Understanding.

As discussed above, the interviews with the children gave some valuable and very positive insights into children's level of knowledge and understanding about spiders.

Many small group activities as well as class discussions were recorded on audio or video tape and these also yielded valuable insights into the children's understanding. In addition "evidence" came from the children's drawings, their games, their dances and their stories.

Skills

The children's more accurate recording of spiders and webs as the project progressed, would indicate that their observation skills had improved.

In terms of their general research and investigative skills, teachers and parents alike modeled a range of appropriate scientific processes. Children had used all of these. They had an opportunity to investigate real spiders and webs, use books as a resource, and talk to experts.

In terms of communicating their ideas and questions, dozens of opportunities occurred during the project for each child to express their scientific ideas. The child's contribution was always treated with respect.

Attitudes/Dispositions

The sphere of attitudes and dispositions is much more elusive. To really see if they had been successful in this area teachers would have to look at children's behaviour in the future. However many very encouraging indicators occurred throughout the project. The children's understanding had definitely increased. Knowledge is empowering. It helps children increase their level of confidence and their level of positive feelings about science learning. Another indication of the children's positive attitudes was the level of participation in all aspects of the project. With most activities
children had a choice whether or not to participate. Children clearly showed that they chose to be involved, that they chose to learn. The amount of material that the children contributed from home was another indication of how they felt about the project. If the children had not been truly motivated they would not have sought out these materials or the parental help needed to do so. Parent feedback was also valuable. Parents dropped in to tell the teachers about their child’s enthusiasm for a web hunt at home, a spider book they had read together or a relevant conversation they had with their child.

A GENERAL DEVELOPMENTAL CURRICULUM

As well as the spider exploration that was going on, teachers were constantly working on general developmental skills for children. This was sometimes planned but more often was of an informal nature. For example when a teacher was reading a story she was giving children practice at listening, focusing, and probably speaking about what they heard. The teacher was almost constantly working on social skills and very often on motor skills as well as literacy and numeracy concepts and general problem solving skills.

PARENT QUESTIONNAIRE

After spider night parents, too, were given the opportunity to comment about this and the project in general. They were invited to comment on seven specific things displayed on the spider night most of which showed aspects of the whole investigation. For example, interviews with the children were displayed as were their stories games and drawings. In addition parents were given an open ended section where they could comment on any aspect of the project. These were all very positive on all aspects. The only negative comments involved not having enough time to look at all the displays in detail and play all the games etc. and one comment questioning if children really understood the concept of a raffle. Parents used adjectives such as great, wonderful, imaginative to describe aspects of the project and displays and commented on the children’s sophisticated knowledge.
FINDINGS CLASS B

As was set out in the Methodology section, the researcher was not actively involved in class B. One week’s worth of data was considered as well a data gained from an interview with the teacher.

Choosing the topic.

The topics of eagles and reptiles were explored very vigorously by class B.

How these topics were chosen cannot be illuminated from this particular week’s data. However in order to discover this, the teacher was interviewed after the project. She saw the reptile theme as arising from an earlier interest in dinosaurs. The eagle interest was sparked initially by one child - Adrian. The teacher had been going through an alphabet frieze that she had placed on the wall. There was a “V” for vulture on it. Adrian had asked the teacher if there were vultures in Australia. The teacher had replied that there were not but there were eagles which were very similar. The teacher described the intensity with which Adrian subsequently pursued his exploration of eagles. “I could tell he really wanted to learn about eagles” were her words.

As with the spider project, both topics had a fairly high degree of emotional investment on the part of the children. The children were interested in which crocodiles eat people and if there were any crocodiles in Melbourne. A similar fear of snakes existed. With the eagle explorations children seemed to be interested in the power aspects and were fascinated with the bird’s claws (as they showed in their dance/dramas and their drawings See Appendix F). The eagle image held a particularly strong emotional connotation for the child who introduced it - Adrian.

The overall progress of the project.

As only one week’s data is sampled it is impossible to tackle the overall progress of the project from the data. However, even these data and the teacher’s reflections show the same sort of approaches to learning being taken as those taken in class A, for example:

- children talked about eagles and reptiles in small and large groups;
- they read scientific and fictional books about them;
- they drew them;
- they painted them;
- they made models to represent them;
they expressed their ideas through drama dance and role play; and
they went on an excursions to an animal sanctuary and to the zoo to see birds of prey
and snakes.

**Roles of the teachers, children and parents.**

In class A, eight roles of the teachers, children and parents were identified.

These were:

1. Teacher initiates learning experiences
2. Child expresses an interest. Teacher responds by initiating or facilitating
   learning experiences
3. Child expresses an interest but teacher does not follow up with planned
   learning experiences.
4. Child, often supported by parents, brings material which is incorporated into
   or triggers the learning experiences.
5. Teacher expressly seeks out children’s ideas and preferences and follows
   these up with specific learning experiences.
6. Teacher provides feedback to parents, and parents provide feedback to the
   teacher about their child and the curriculum which may led to setting up
   specific learning experiences.
7. Teacher, children and parents together celebrate the children’s learning.
8. Parents take on a direct teaching role.

In class B, six of these eight roles were also very evident. Evidence of roles 7 and 5 was
not found in these data.

Role 1. The teacher initiates learning experiences.

Role 2 - The child expresses interests and the teacher responds by initiating or
facilitating learning experiences.

Considerable evidence of the teacher initiating learning experiences is available
from these data. Again as found in class A, the role 1 and role 2 overlap on many
occasions and it is a complex relationship which depends more on the degree to which
the teacher’s choice depended on the children’s interests. The teacher had set up a
reptile corner with resource books, pictures and models - plastic crocodiles, lizards and snakes. Also two crocodile skulls were on display and a stuffed crocodile. Clearly she was acting on the children’s general interest in the area but she had taken the initiative to set up a specific learning space and choose specific resources. [Roles 1 and 2.] She had also taken the initiative to go on further from the children’s interest. The teacher had provided books on dragons and prehistoric animals. [Role 1.] The dance teacher specifically introduced the exploration of space, expression and body awareness [Role 1] but she did this through the children’s interest in reptiles and eagles. [Role 2.] “Beautiful. I like that swooping.” “Let me see the eagles in the nest stretching out in different shapes.” She deliberately provided simple pieces of cloth for children to use as wings if they wished as well as a small area of the room designated as a “nest” for the baby eagles.

These data also gave other examples of role 2. While playing outdoors Adrian, the child who was deeply involved in the project, asked to play a game being an eagle. The teacher specifically facilitated this. “Adrian wants to play eagles. Does any one else want to play?” The art teacher responded to the class’s exploration of reptiles by borrowing the crocodile skulls to set up as a still life drawing activity, as one choice among six activities in this session in the discovery room.

Role 3 - “The child expresses an interest but teacher does not follow it up with a planned learning experience.”

There were many occasions when this happened during this week. In the art session the children noticed a ray of sunlight striking the jar of water as the teacher demonstrated how to wash brushes. The children got quite excited as did the teacher. The image was particularly beautiful. The teacher held a sheet of white paper behind the jar so children could see more clearly. The children had some wonderfully creative descriptions of the phenomenon. They said “It’s shiny like a star.” “It’s a shiny shadow.” “It’s like a diamond.” The children indicated an interest in light and shadows which could have meaningfully been extended with science and aesthetic experiences. However this was not done.

Another interesting example happened when all the children were together in a group near the beginning of this week. The teacher planned to read the children a book about the differences between salt and fresh water crocodiles. [Role 1] This she did,
however the centre of the children's interest moved to the colour of water. The salt water being depicted as blue and the freshwater as brown in the book. The teacher deviated from her plan of focusing on the crocodiles to ask questions such as, "what colour is water?". She reminded the children about a trip they all took to the sea and also put some tap water in a glass. They discussed why this was not brown but "plain" as one child called it. Then the teacher mixed some coffee grains in it. One child concluded that the river is brown because of the pollution in it. Another said the sea is blue because of blue clouds and blue sky above it. At this point the teacher took the whole class (and two researchers) to the near by Yarra River, to look at the colour of the water and bring some back to look at more closely.}[Role - 2.] After snack time several children made rivers in the sand play area at kindergarten and did a lot of adding sand to water. Children obviously had a strong interest in questions about why is the sea blue and issues of appearance of river water and pollution. Here the teacher had started to explore the water questions but this was not followed any further. The next day the teacher went back to planning possible activities relating to reptiles and eagles.

This situation where the teacher chooses to maintain interest in the current project and not follow up in detail other interests indicated by the children was also found in class A. The teachers did not ignore these secondary interests. They often clarified them and followed them up to a limited extent but these topics did not at this time become a major project. When questioned subsequently the teacher in class B stressed that she often based the decision of what to pursue on an intuitive feeling of what the children were really interested in, what they had a burning desire to follow up. She also mentioned the practical consideration which the class A teacher had brought out - that it was not possible to focus in detail on too many topics at once.

Role 4. - "The child often supported by parents brings materials." During this week Adrian wore his eagle shirt on two occasions. This shirt was made by his mother from chicken feathers collected at a farm and washed and sewn on a shirt. This led to considerable role play. On another day Adrian wore his dragon costume. This led to a discussion about the differences between crocodiles and dragons. Also this week two children brought in toy crocodiles. Michael's was bought by his grandma and Sean's by his mother. This led in one group time this week to a drama initiated by the teacher. Adrian, wearing his eagle shirt swooped on Sean's toy crocodile and took it back to feed
the baby eagles in the nest played by three other children. At that point, Michael arrived at kindergarten with his crocodile. Almost without missing a beat the teacher stated “Lurking in the bush is an even bigger crocodile.” This one was too big for the eagle who had to go back to the babies empty handed. Considerable child initiated role play was observed in the following free choice session involving eagle families and getting food. Children stated they were making “crocodile stew” in the home corner. In this same group time the teacher also read and discussed the book on crocodiles that another child had brought.

Role 5. - “Teacher expressly seeks out children’s ideas and follows these up with specific learning experiences.” While the teacher was obviously responding strongly to the children’s questions and interests, as seen above, there is no evidence in this week that she formally sought out their ideas in a systematic way to give program direction. The children were not interviewed as they were in class A.

Role 6. - “Teacher provides feedback to parents and parents provide feedback to teacher which may lead to setting up specific learning experiences. The generalist teacher as well as the dance and art teachers regularly wrote notices for the parents to read about what had been happening that day. See example in Appendix F. There is no evidence in this week’s data of the parents giving feedback to the teacher. When this was raised with the teacher after the project, the teacher stated that it did happen often on an informal basis throughout the project, and the comments were very positive.

Role 7. - “Teacher, children and parents together celebrate the children’s learning.” No formal celebration, equivalent to the spider night party for instance, was held in this class.

Role 8. - “Parents take on a direct teaching role.” There was one clear example of parent’s direct teaching in these data. This was in discovery room. Laura was talking to the art teacher about the volcano with lava she had put in her picture. She pointed to the lava and said, “This is the lava that is in the middle of the ground. … well my daddy told me it comes up, that’s up, up, up.”

THE MULTIMODAL NATURE OF THE LEARNING EXPERIENCES

As with the project in class A, children were encouraged to learn in many different ways. The class had a dance session and an art exploration session taking place
during most weeks. The data here indicate a strong commitment by both these specialists to giving the children opportunities to explore the project ideas. That the art teacher set up the crocodile skulls for drawing has already been mentioned. Eagles and snakes were the overriding themes that were explored in the dance session. As described above these themes were strongly encouraged by the dance teacher. The children were obviously very involved in the movement and the ideas. As with the class A, these children were encouraged to draw after the dance session. “Draw the part you enjoyed the most when you were dancing.” Eight out of the eighteen children drew something relating to flight or eagles, while five out of the eighteen drew snakes. See examples in Appendix F. In the overall program, drama and role play were a very strong learning medium in this class. The generalist teacher was a very dynamic outgoing person who confirmed that this was one of her preferred teaching strategies and that she saw it as one of her teaching strengths.

**THE USE OF GAMES AS TEACHING STRATEGIES**

While this had been an important aspect of the learning in class A, there was no evidence of it being used as a teaching strategy in class B. Why? The most obvious conclusion is that the children did not discover any games to “engage” them. Other reasons can be put forward. It is possible that these children as a group may not have been so developmentally ready for group games. Their mean age was 5 months younger than the mean age of the class A children. It is also likely that they may have not been as ready as the class A children for the challenge of making their own board games. It may have also been related to the personal preferences of the teacher regarding learning strategies. It could also have been a consequence of the fact that class A often had another adult in the room, in the form of the researcher, so one adult could spend time with the children who were devising or playing games.

**INTERVIEWS WITH THE CHILDREN**

Again these were not carried out in group B. The generalist teacher in Class A confirmed that this was one of her preferred learning strategies.
JUDGING THE SUCCESS OF THE LEARNING

As there were no interviews with the children to refer to, and with only one week’s data being looked at in detail, it was hard to get a picture of the children’s knowledge and understanding of the topics of reptiles and eagles. In the teacher’s view the children had learnt an enormous amount in the area of content.

Skills.
As with class A, the children had had appropriate science skills of research modeled for them e.g. using books and visiting the animal sanctuary to listen to experts and observe the real animals. (This very successful field trip was held not during this particular week but was reported by the teacher). Children also had many opportunities to practice their communication skills and work through their ideas about reptiles and eagles through listening to stories, discussion, dance/drama/role play and drawing and painting.

Attitudes/Dispositions
As with class A, the sphere of attitudes and dispositions is difficult to measure. To really see if they had been successful in this area teachers would have to look at children’s behaviour in the future. Again many very encouraging indicators occurred throughout the project. One indication of the children’s positive attitudes was the level of participation in all aspects of the project. Again with most activities children had a choice whether or not to participate. Children clearly showed that they chose to be involved, that they chose to learn. The amount of material that the children contributed from home showed how they felt about the project. It showed they were motivated or they would not have brought in these materials or asked for the parental help needed to do so. Parent feedback was also very positive.

HOW DID CLASS A FINDINGS COMPARE WITH CLASS B FINDINGS?

Overall, class B findings confirm those from class A. The way the topics were chosen, the level of emotional investment in the topics, and the roles that the teachers, children and parents took, were very similar. They differed in areas that were more related to the teacher’s individual teaching styles and nature of the topic. For example the teacher in class B did a lot of teaching using role play and dramatization and had a very outgoing style in general. The teacher in class A on the other hand felt that
interviewing the children was a very valuable tool and she carefully recorded their ideas and questions. Games were not used in class B because the children had not expressed an interest in them. There was however, the same commitment to a multimodal approach to learning in both classrooms. Also in both classes a general developmental curriculum was being pursued with children practising motor skills, social skills, and exploring the building blocks of literacy, numeracy, creativity and problem solving skills in general with or without any reference to the topics of spiders, eagles and reptiles.

THE INFLUENCE OF THE RESEARCHER IN CLASS A

Did the researcher influence the findings in class A? The researcher feels that this influence was minimal. As described above the findings were very similar in both classes. One area where the researcher probably had an influence was in the use of games. The researcher enjoyed devising games with the teachers. Also the existence of an additional adult in the room for significant periods allowed activities that required large amounts of adult interaction to take place. Such was the case when children were making their own board games.
CHAPTER FIVE

CONCLUSIONS

WHAT FORM DID THE LEARNING TAKE?

The processes.

What processes were identified in the progress of the science project?
The weekly summaries in chapter four give an overview of the processes involved in the
spider project in class A, while the findings from the one week’s data in class B support
the findings reached in class A.

As with projects described in the emergent curriculum literature, the overall
process was non-linear in format. There were no objectives or lists of sequential
activities decided on by teachers in advance. Also in line with the literature, the teachers
started with an initial brainstorming session involving the two teachers and the
researcher. They discussed ways of introducing the topic to the children and ways of
gauging if the interest was likely to sustain an in-depth project. Basic scientific
concepts to be used as a framework for this investigation were also discussed by the
teachers. The basic scientific concepts that the teachers had in mind were those that
made spiders unique. Over the course of the project these concepts were all explored by
at least some children.

Adults and children both contributed ideas, questions and resources which
shaped the project’s direction. An interdependent, webbed framework of processes
emerged. This is made clear in Figure 3 which shows an example of some aspects of the
program. For example, an exploration of spiders on a particular day could be triggered
by a child bringing a specimen, a book or a plastic spider; a teacher introducing a book,
game, art or movement activity; a child asking to play or make a game or the weather
being suitable for a web walk. Similar “webbed” “plans” are put forward in the early
childhood emergent curriculum literature (Levin, 1986; Workman and Anziano, 1993;
Jones and Nimmo, 1994).
Figure 3. Processes involved in the spider project.

As well as the science project, many other things were happening in this busy class. The children enjoyed a wide range of traditional developmental pre-school activities unrelated to spiders, including block play, dramatic play, construction activities, art, dance, group discussions, field trips, outdoor play, celebration of birthdays and holidays, and each week, an exploration of a different musical instrument brought in by a parent. There was also an art curriculum being followed by the art teacher and a dance curriculum being followed by the specialist dance teacher. Many, though not all, aspects of these specialist curricula were integrated into the spider project. On some days there was no reference to spiders. Other days a considerable amount of time could be spent by a small or large group discussing a book or specimen or playing or preparing a game.

As findings show, a multimodal approach was a distinctive feature of the process of the spider project. The Reggio Emilia literature strongly supports this curriculum approach to learning. Children were able to use a range of different "languages" to explore spiders. They were able to talk about spiders, read stories about
spiders, observe real and plastic spiders, draw spiders, play games about spiders and
dance spiders etc.

The end of the project was marked by a celebration. The children’s ideas and
products were on display to communicate their interests and achievements to parents.
This idea of an event that directly communicates to parents is typical of the Reggio
Emilia approach. Planning for this party became a part of the learning process as it
became a focus for activities. For approximately two weeks before the actual event it
seemed to provide a strong motivating force for children to create and refine stories,
drawings and games etc.

The players.

It is very difficult if not impossible to separate the processes from the players.
Who caused what to happen? Who had control or ownership over which events? How
did individuals respond to the ideas or contributions of other individuals? This has been
looked at in detail in the findings above. Eight roles were identified.

These roles are expressed below in terms of the contributions of the three groups
of players involved - the teachers, the children and the parents.

All three groups contributed to the curriculum. Without any one group’s
contribution it would have been a very different program. The data revealed a range of
roles were taken on by these three groups of players.

The role of the teacher.

Contrary to some misunderstandings of emergent curricula, the teachers did not
just sit back and wait to see what emerged. Certainly the children could freely express
their ideas and interests and these often, as the data show, became an important part of
the project. It was, however an active role that the teachers took, not a passive one. It
was a role that involved the teachers exercising their professional judgment. A role in
which the teachers had “ideas and vision” (Jones and Nimmo, 1994, p.5).

Teachers really had a key role to play in the projects in both classes. While they
did not set out objectives or timetables and sequences of activities, teachers did
brainstorm together both informally and at planned meetings. In these meetings they
reflected on what was happening and proposed possible directions for the project.
Flexibility was probably one of the most noticeable aspects of this “planning” process.
This flexibility extended to the whole framework of the project. However, within this
flexible framework, teachers in this study, played a very key role regarding the direction of the project. For example, there was considerable evidence of the teachers choosing to follow up some interests that related to the current project and not follow up others that seemed to equally engage the children, such as the Harlequin Bugs found on the web walks with class A and the colour of water question raised in class B. Also there was considerable evidence of the teacher being in a position to choose the focus of all activities, even those initiated by the children. For example several children in class A asked to make a spider’s web. The teacher responded and facilitated this. However she added an idea of her own. She was the one who chose that it should be made out of two types of wool to reflect the sticky and non-sticky strands of a web.

Although teachers were constantly making such decisions, this is not to say that the teachers did not respond to the children and learn from them as well. For example the teachers in class A abandoned the initial plan to work with only a small group of children on the project in favour of a whole-class project, when many more than the small group showed an interest. Despite an initial reaction not to do so, the teachers also included a raffle in the spider night party as the children’s interest seemed so strong.

Most importantly, teachers were constantly in tune with the children’s interests while at the same time exercising their professional judgment. Teachers in class B chose the field trips based on their knowledge of the excellent exhibits of eagles at this particular sanctuary. Teachers in class A designed several other games after the children had requested to play the initial game. Teachers could often choose if something would be discussed in a large or a small group.

Teachers also made decisions that gave specific direction to the curriculum based on their personal interests and teaching styles. The teacher in class A systematically interviewed the children to find out their ideas, while the class B teacher included large amounts of drama and role play in her program for children to use as a vehicle to express their ideas. This key role that the teachers took is strongly supported in both the emergent curriculum literature and the science teaching literature. One aspect that was noted was the enthusiasm of the teachers for the topics. There was a definite sense of ownership for the topic on the part of the teachers in both classrooms and this was absorbed by the children.
Role of the children.

As has been discussed in chapter four, both children and the teacher played an important somewhat equal "chicken and egg" type role in the choice of the spider topic in class A. Class B's topics of crocodiles and eagles would seem to have been a little more influenced by the children. Indeed the emergent curriculum literature describes both these possibilities among the range of ways topics emerge.

As the transcripts of the children's early discussions and the early interviews reveal, many children came to the spider project with considerable knowledge and understanding regarding spiders and some firmly entrenched attitudes about spiders, particularly Red-backs. These data support the constructivist view of learning in this regard. Children came to the projects with varying degrees of knowledge and ended the project with some shared knowledge and some different understandings and attitudes. The science education literature puts forward the concept of alternative theories which are often very resistant to change. This was evident here. Video transcripts revealed that Andrew maintained his view that Daddy long legs spiders were more poisonous than Red-backs well into the project despite the teacher specifically reading him a book which pointed out this was a myth. The interviews revealed that Heidie still believed that spiders had poison in their webs even after the project ended.

The importance of the social aspects of learning has been put forward strongly in both the emergent curriculum literature (Edwards et al., 1993) and the science learning literature (Biddulph and Osborne, 1984). This was also shown to be important in the findings of this study. For example, when given a choice, children usually chose to work with other children. This was particularly evident when they were working on their individual board games and they could have had the teacher or researcher's undivided attention and help in this challenging, problem-solving situation. Instead they almost always chose to also have one or two other children to help. The transcripts reveal children reflecting on the process of making their games and sometimes modifying their ideas as they talk to another child or to an adult. Children also demonstrated a strong sense of community and shared purpose when planning and organizing the spider night.

Children played an influential role in day to day process of the exploration of the topic.
The role of the parents.

The emergent curriculum literature points to the central position of parents in the learning process (Edwards et al., 1993; Jones and Nimmo, 1994). Some recent science learning literature (Fleer, 1996) similarly shows the importance of the parents’ involvement in young children’s science learning. The findings of the study being reported here show that the parents’ role in the curriculum was not as influential as the teachers’ or the children’s. Never the less it was integral to the whole learning experience - more so for some children than others.

Children had probably acquired most of their existing knowledge through their parents directly or indirectly supplying learning situations, for example, by exposing them to television, books, observations or discussions at home. Parents also sometimes played a direct teaching role during the project, such as when Emma’s dad helped her find the answers to her questions in a book and taught her the biological symbols for male and female. Usually parents played a more supportive type role. They took time to discuss the children’s learning with them and help them to acquire resources by taking them to libraries, making them costumes, or by buying them toy spiders or crocodiles. They also gave feedback to the teachers by discussing their child’s reaction to the learning project outside the classroom. Sometimes parents brought in relevant drawings their children had done at home or a transcription or summary of the children’s words an ideas. In addition they played a more traditional role in supplying food and prizes for the party. Teachers’ commitment to the involvement of parents was shown by the quality of the documentation at the spider night. Not only were the decorative pieces of work displayed, but also all the children’s ideas contained in the words of the early and later interviews. Documentation used to communicate to parents in this way is an important element in the emergent curriculum literature (Jones and Nimmo, 1994; Edwards et al., 1993).
AN INTERDEPENDENT RELATIONSHIP BETWEEN PROCESSES AND PLAYERS.

What then is the overall pattern or model of processes and players that emerged from the findings of this study? It is a very interdependent model where processes are dependent on the players and the players are dependent on each other. The model is a non-linear. The processes derived from the interests and ideas of the children and of the teachers. These were tempered by the overarching influence of the teachers’ judgement. The children had opportunities to learn in a wide variety of ways. The teachers judged that dance, art and discussion etc. were worthwhile ways for children to learn. Children had choices within and between these genres. Teachers, children and parents all had an integral part to play but the teacher had a key role. This key role was not seen so much as one of power but rather one where the teacher was taking a legitimate role of exercising her professional judgment. The teacher was making the “thoughtful choices” outlined by Nimmo (1994, p.206).

WAS THIS CURRICULUM AN EMERGENT ONE

The investigation of spiders in this class definitely fits within this framework. The topic came out of the children’s and teachers’ interests rather than being a topic that the teacher puled out of the air, or always “did” in third term etc. Further, the topic was a worthwhile one that was a part of real life. The topic also had the emotional content seen by Nimmo as an element which is often part of emergent curriculum (Nimmo, 1994, p.209). The form that the project took was likewise of an emergent nature. While tentative plans were made by the teachers, the program really took on a life of its own, based on contributions of both the children and the teachers. Some of the tentative plans were carried through while others were not. Teachers took time to reflect on the teaching learning process and the contributions of other teachers, children and the parents were valued.

Which type of emergent curriculum was being followed?

Every class and every project have aspects that make it unique. The approach to emergent curriculum as displayed in class A was at times closer to the range of American perspectives on emergent curriculum, and at others closer to the Reggio Emilia perspective.
In terms of the size of the group of children carrying out the investigation, this was in line with the American way of looking at things. For example the whole class was involved rather than a small group, as recommended by the Reggio Emilia educators.

In terms of documentation, this class can also be compared with the Reggio Emilia situation and some of the American approaches. It must be remembered that while large amounts of documentation were done in class A during the study, less would be done in a “normal” situation when no researchers were present. However it was evident from discussions with the teacher and from the display of the previous project done by class A, that a considerable amount of documentation had taken place in a non-research situation. For example, in the previous project, the children in this class had been interviewed and their drawings and their ideas had been displayed, along with many photographs and teachers’ explanations, to communicate their learning to the rest of the preschool and to the parents. However in this previous situation, transcripts from video and audio sources had not been used. By contrast, audio transcripts would seem to be very much a part of the day to day program in the Reggio Emilia situation. At the same time, the level of documentation done in the class A in this previous non-research situation, was greater than that done by “Ruby’s” fictional teachers who exemplify the Jones and Nimmo (1994) approach, or that advocated in the project approach (Katz and Chard, 1989). However it would seem to be close in concept to Forman’s (1996) idea of documentation in a negotiated curriculum.

In line with the philosophy that children learn and express themselves in many ways, class A children enjoyed many opportunities to draw and paint about their ideas. They had access to a specialist art teacher once a week. However their products did not, in general, display the same level of sophistication that is associated with the images created by the Reggio Emilia children. It can be speculated that this could be related to the fact that the children at Reggio Emilia work with a resident artist, “the Atelierista,” on an ongoing basis, as well as the fact that they have a long cultural history of artistic endeavour. While the Reggio Emilia art work is accessible in detail through the touring exhibition “The Hundred Languages of Children” and the related catalogue (Department of Early Education, city of Reggio Emilia, 1987), there are few comparable examples available of children’s work based on the American approaches. Comparison with the drawings of the children in the study reported here is therefore not possible.
Another fairly obvious comparison was that the children at Reggio Emilia stay with the same teachers for three years. Children in the classes being studied had different teachers each year. This must impact on the teaching/learning process in some way, however there would seem to be no published research available at this point in time.

While an emergent curriculum approach was indeed being taken in the class under investigation, the approach in class A was still a unique one and does not fit squarely into any particular camp.

**DID SCIENCE LEARNING TAKE PLACE?**

The next important question that must be asked is, "did science learning take place?" The "findings" section on learning outcomes above shows that science learning did indeed occur. The emergent curriculum approach would seem to be an appropriate one for science learning. The way the topic was chosen gave the children a sense of ownership. Respect for all the contributions the children made to the project continued this sense of ownership and was a motivating force. The flexibility and the aspect of choice involved allowed the children to have a sense of control over their own learning and focus on aspects they were interested in. The amount of time allowed for the project led to the topic being explored in depth. The multimodal approach to the topic again gave children a degree of choice to pursue learning in the ways most meaningful to them. It also gave children many ways to express their ideas, with drawing being particularly useful for the teachers and the researchers to assess the children's understandings.

**How did this learning fit within the science learning literature?**

Most of these aspects also are consistent with best practice put forward in science teaching literature. The notion that not all children will learn the same things in a science learning situation is an underlying principle of the interactive approach (Biddulph and Osborne, 1984). Fleer’s work advocates that topics be treated in sufficient depth (Fleer, 1991c). Forman’s work advocates the use of drawing in science learning (Forman, 1989; Forman and Landry, 1992). Symington and Kirkwood (1995) propose that there are a range of teaching approaches that can effectively be used in science teaching. The video transcripts of the teacher helping children make their own games or plan the spider party, demonstrate an approach consistent with the scaffolding
approach supported strongly by Fleer (1990). The overall current view that science learning is achieved within a social constructivist framework coincides with the view of learning as a social construction held by the proponents of the emergent curriculum paradigm (Foreman and Landry, 1992; Rinaldi, 1993; Malaguzzi, 1993).

GENERAL DEVELOPMENTAL CURRICULUM.

These data revealed that this emergent science curriculum was not the only curriculum being pursued. There was a general developmental curriculum with children being encouraged to practice a broad range of motor, intellectual and social and emotional skills. These found expression through the science project as well as through the somewhat more tradition elements of the program discussed above.

IN CONCLUSION

The form that this project took was characterized by an interdependent model where processes were dependent on the players and the players were dependent on each other. It was evident that an emergent curriculum approach was being employed in this classroom. This approach is indeed an appropriate one for science learning in the preschool situation, as judged by the findings of this study.

.........the best outcome of all was that Angela, the teacher, overcame her fear spiders and the children knew it.
Author/s:
Smith, Ann C.

Title:
An investigation into early childhood science within an emergent curriculum framework

Date:
1997

Citation:

Publication Status:
Unpublished

Persistent Link:
http://hdl.handle.net/11343/39467

File Description:
p.1-83

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