COMPETENT CHILDREN AND THEIR TEACHERS

LEARNING ABOUT TRAJECTORIES AND OTHER SCHEMAS

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in association with

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A REPORT FROM THE ACTION RESEARCH
COMPONENT OF THE COMPETENT CHILDREN
LONGITUDINAL RESEARCH PROJECT

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CONTENTS

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NOTE

Single quotation marks throughout this report enclose items of schema; cognitive structures or forms of thought.

CHAPTER 1

INTRODUCTION

The Beginnings

This is the beginning of a long story. At this point in time, the researchers are unable to predict whether the story will be told in a trilogy of reports, or something more than that. Already an initial report has been published in the Pilot Study Report (Hendricks, Meade, & Wylie, 1993).

In January 1992, the Ministry of Education began funding this longitudinal study, to look at the effects of early childhood contexts on children's development. The first-stage funding allowed the research team to meet 2 objectives:

1. to undertake a pilot study for the main longitudinal project, and
2. to conduct an action research study of a small number of children to examine the effects of intervening in their curriculum for learning at home and in early childhood settings, by heightening adults' awareness of children's schema development.

The report based on the pilot study (objective 1) was published earlier (ibid). The basic design for both these studies is set out in Figure 1 on page 2.

The whole project is known as the *Competent Children* study[1], and the researchers are exploring the question, "What experiences influence the development of children's competencies?" The children in the main project began joining it in 1993 or early 1994 in their final pre-school year.

The main project is being conducted throughout the Wellington Region, and has 2 main components:

1. A qualitative study of over 300 children in chartered childcare centres, family day care schemes, kindergartens and playcentres. Up to 90 randomly-selected children in each service are participating. In addition, all children in the 4½- to 5-year-old age range from each chartered Pacific Island language group in the Wellington Region have been included in the sample - i.e. approximately 20 children;
2. A telephone survey of parents of another 800+ pre-schoolers attending chartered early childhood services, supplemented by information about their early childhood service at around 4½ years of age.

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[1] Stage 1 and 2 funding for the project has come from the Ministry of Education, with contributions from Victoria University of Wellington and the New Zealand Council for Educational Research.

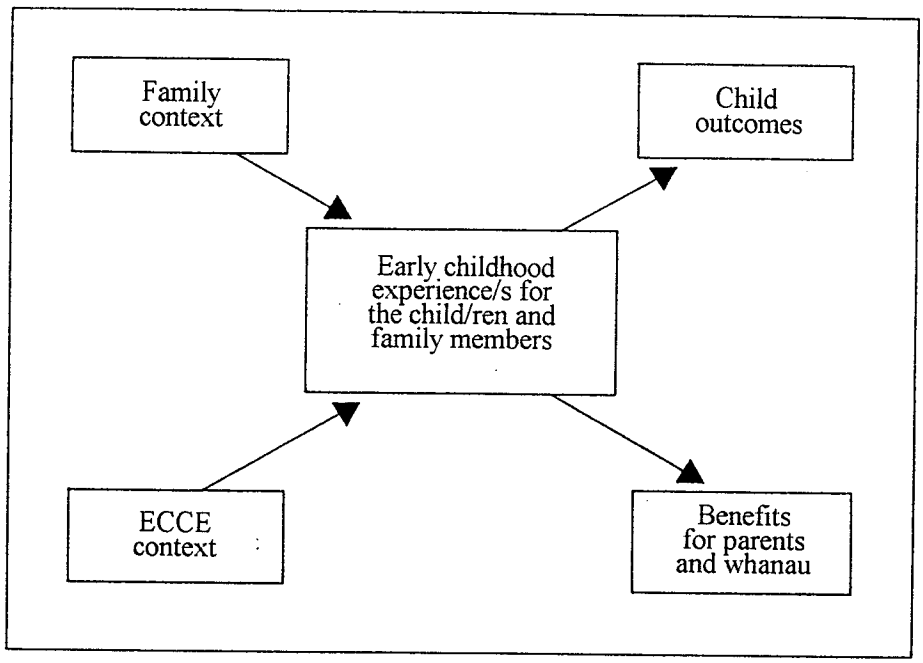
In the qualitative study, data were gathered about the children's early development, formal early childhood care and education, and family background, as well as about aspects of the early childhood service they were attending. Before they started school, an assessment of several competencies was made. More limited data were gathered in the second component, i.e., the telephone survey. For example, it was not possible for the researchers to assess some of the competencies without meeting the children, but as there was no face-to-face data collection with these 800+ children we could not do those assessments.

Subject to the availability of more funds in the future, it is intended to remain in contact with all 1,100+ children and their families and/or various teachers right through to the end of their schooling years, that is, until the year 2005 and beyond. When these children start secondary school, around the turn of the century, they will become the second cohort to be studied by the Smithfield team of researchers who are examining the impact of aspects of education policy on educational opportunity and school effectiveness. The first cohort in the Smithfield project entered secondary school in 1994 (Lauder & Hughes, 1994).

The teachers, parents and researchers participating in this substudy agreed to bring what we know about children's schema development into their curricula to enhance children's intellectual development. Schemas are cognitive structures or forms of thought. What is seen by the observer are patterns in children's behaviour, or in their drawings and paintings, which indicate common themes or threads (schemas) running through them.

Figure 1

Study Design



Who Is This Report About?

This report focuses on 10 children aged between 4½ and 5 years old who were fortunate to have their teachers (their parents and staff in their early childhood centres) tune in to their exploration and thinking about mathematical and science-related schemas[2].

The adults who participated in this substudy observed the way children represent their thinking about *static schemas* as simple, and yet complex, as 'vertical'. With some initial guidance, the parents and staff were able to see that children think about things like 'vertical' and want to know about the properties which define "vertical" - a schema that is very dominant in physical structures in our world. They were also tuning into children's more complex *action schema* such as dynamic horizontal, and other schema involving action, and to clusters of those schemas to understand about more complex concepts such as trajectories. The report also provides information about another 8 children who were chosen as comparison subjects. The 18 children attended 4 early childhood centres in the Wellington Region. All 18 children are also included in the total sample for the *Competent Children* project.

The 10 children in the centres where schema development was studied, and the 8 comparison children, will also be included in the analyses for the qualitative study. The schema group will be separately identified from time to time in later reports, both because the centres were not randomly selected, although the children were, and because we want to study the ongoing effects of the curriculum intervention focused on schemas as part of the larger longitudinal study.

Schemas

The focus on schema development, i.e., on the formation of cognitive structures by children, came as a result of a visit by Pamela Cubey to London in 1990 where she met the researcher and teacher who had worked together on the "Early Education Project" carried out during a 2-year teaching programme at The Froebel Institute in London (Athey, 1990). Anne Meade was also able to meet Chris Athey, the Froebel researcher, in late 1992.

There is considerable interest in schema theory and its implications for teaching and learning amongst pockets of early childhood professionals in England and in New Zealand. Using a small-scale intervention approach, Anne Meade and Pamela Cubey hoped to assist New Zealand parents and teachers to facilitate children's learning through the adults thinking about schemas the children may be working on.

During their early years, children are "coming to know" about different schemas until they can think about them, or clusters of schemas which form concepts, in the abstract. The 2 principal observable ways younger children "come to know" are by:

1. using symbolic representation (e.g., painting), and
2. their exploration through action.

The patterns in their creations and explorations indicate when children are working on or with particular schema. Athey (op.cit., p.69) states that,

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[2] Other schemas, and their clustering into concepts, could be studied, e.g., gender concepts. We have elected to limit this sub-study to schemas which are predominantly logico-mathematical.

> Although it may seem obvious that what a child thinks and knows at any given time must reflect what has gone before - both in terms of cognitive structure and the content of experience - it was rather startling to find out how specifically the thought-level observations were related to a child's previous representations.

And later (ibid., p. 138), she says,

> When children reach the 'thought' level, the earlier motor and representational stages, with all the contents of past experience, are 'brought forward' to provide the 'form' and 'stuff' of thinking. ... [W]ith all schemas, paucity or richness of experience becomes increasingly apparent with age.

If teachers value or, for that matter, society values the extension of children's thinking, the provision of rich experiences by parents and/or by early childhood teachers is very important. Hence, the interest of the *Competent Children* research team in the home as well as early childhood care and education experiences. Teachers also need to be aware of home experiences. Providing a wealth of experiences to supplement the home is one of the many challenges faced by early childhood teachers in their role as curriculum developers.

The Froebel Early Education Project team (Athey, op.cit.) found after observing 20 children daily for 2 years (from age 3 to age 5) that all those children made systematic advances in *forms of thought* (schemas or concepts). These advances were assisted by the adults creating more opportunities for the children to extend their range of experiences. One example from that study of adults nourishing thinking will suffice at this stage in the report. A child, Alistair, was pursuing the movement schema involving 'circular direction and rotation'. Records indicated his interest in this schema was strongly evident by the age of 3½. The Froebel teachers and his parents were keen to keep active and to nourish his demonstrated interest in 'rotation'. As you read the quotes about Alistair below, note the sort of experiences and questions provided by the adults. Note also the researcher's awareness of his earlier interest in a typist's swivel chair so that the adults instantly knew what was meant when he told them the seats on his model of a car would go round.

Motor level

Alistair (3:9[3]), on a visit to the Science Museum, could not be moved from a mechanical model of a man rotating a handle, which turned a large wooden handle screw in order to winch water from the well.

Symbolic representation

Alistair (3:9) ...[made] 'A car with wheels'. He made the wheels go round and said, "Look, they go round." He then pointed to square shapes on top (seats) and said, "And they go round." He had been absorbed by the typist's chair.

Functional dependency (between 'rotation' and another schema)

Alistair (4:9), following a visit to the railway, worked with Jack (4:9). They made a level crossing. They set up the railway track, intersected with a road ['grid' schema]. They closed the level-crossing gates by 'rotating' them so that they closed off the road. ... They made the train go along the tracks. They 'rotated' the gates back again and made the cars move across the railway line.

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[3] Figure *x*:figure *y* denotes age. In this case 3:9 represents 3 years 9 months of age.

Thought level

Alistair (3:6) noted the effect on wet clothes of 'turning' the handle of a mangle. His mother encouraged him by suggesting he reversed the direction.

[Later], Alistair started a conversation with his father about a fishing rod. He said, "You know a fishing rod? When you throw it out [he made an enactive gesture of casting the line] the string goes right out." His mother asked, "What happens when you reverse the rotation of the handle?" Alistair said, "The line gets shorter. (Athey, op.cit., pp. 139-141).

This excerpt also indicates that the adults associated with the Froebel Institute were deliberately using language which labelled schemas and/or enhanced children's understanding of schemas. This is a point we will return to later.

Objectives of the Intervention Substudy

The *Competent Children* research team described the schema substudy as the action research component. However, it should be noted that it did not follow many of the traditions of action research in education, and this may well be part of the explanation as to why the intervention was not fully implemented. We will comment further on the action research approach in Chapters 3 and 7.

The objectives of the intervention study were:

1. to introduce staff and parents of 10 children to the theory of schema development and the findings of the Froebel Early Education Project,
2. to provide them with resources about schemas,
3. to assist staff with, and foster observations of, children's work on schema evident in children's art and other representations, and children's talk, and children's actions,
4. to foster curriculum innovations by staff to facilitate children's development of schema, and
5. to document these children's development of competencies alongside that of peers in similar early childhood settings, and compared with all the children involved in the qualitative component of the *Competent Children* project at later stages of the longitudinal study.

The *Competent Children* team approached centres which had an interest in incorporating activities which would nurture children's schema development in their programmes. We explained that the research objectives were to assist staff and parents to attend more to children's actions and thinking about schemas and concepts, encourage curriculum changes which would support children's work on schemas, then assess the impact of the low-key interventions on children's competencies at the end of their time at the early childhood centre and in later years. The data collected about the children in the qualitative component of the main project were gathered about these children as well so that comparisons can be made in later years.

The staff devised curriculum innovations which they used flexibly to allow the children to construct their own learning. It was important that the centres continued to offer a rich and varied curriculum content so that the children could select from the experiences those aspects which would help develop their current forms of thought. Parents were also given information and asked to take part in "schema spotting" and share their observations with staff.

The *Competent Children* research team did not set out to replicate the Froebel Institute project where the London team focused on the continuities in the children's thinking as well as progressions evident as the children made advances in their knowledge and understanding of schema. This was not possible in the Wellington schema study where the children were observed for only 2 terms (that is, for about 6 months) in the year prior to starting school, rather than over 2 years. In Wellington, the researchers had resources only to undertake running-record observations monthly (not daily) to try and detect the schemas of current interest to the project children, and do time-interval observations for 3 sessions. We did ask the staff to do some quick observations (daily if possible) as well. In addition, parents were invited to fill out a form or talk to a researcher about their child's schemas.

Outline of This Report

In the second chapter, more information about constructivist pedagogy, and about schemas and their importance for young children's learning, is explored. Chapter 3 describes in greater detail the research methods employed in this component of the study. In Chapter 4 the centres and the project children are introduced. Chapter 5 contains case study material about the 10 schema children focusing on the schemas which were dominant in their artistic endeavours (representations), or action. The data on the project children in the two centres which changed their curriculum to follow the children's interest in schemas are compared with data on children in two comparison centres in Chapter 6. These data cover the children when they were rising-5. Chapter 7 contains a discussion of the findings, with reflections on the research experience.

The implications of these action research experiences of curriculum change are important given the current expectations that early childhood services will develop their own curriculum innovations based on the *Te Whaariki*, curriculum guidelines for early childhood services (New Zealand Ministry of Education, 1993).

CHAPTER 2

SCHEMA AND ADULTS CONNECTING TO YOUNG CHILDREN'S THINKING

Introduction

This chapter describes the theoretical underpinnings to the work carried out by Pamela Cubey and myself with the staff of the two schema centres. We have called the two centres "Ngaio-tree schema centre" and "Karaka-tree schema centre".

Included is theoretical material on how children learn. Over time, we have come to believe that it suits societies to portray early childhood teaching as unskilled work, in part because it is a female-dominated profession[4]. However, we have also come to believe that society is short-changing children (and therefore society in the next century) if it does not accept and value the intellectual work involved in early childhood teaching. Good teachers do analyse and think and plan their work. How many people in the community appreciate this intellectual component of the job?

Much of the onus for converting others' views of early childhood teaching to an appreciation of the intellectual core of the job rests with the teachers themselves. Teachers need to portray their work as facilitating learning. A powerful way to do this is for teachers to be fluent in describing how children learn and how teachers facilitate children's learning. Then they need to demonstrate how they bring the theory and practice together so that the community can see with their own eyes children's learning is enhanced because of the way teachers deepen children's learning experiences.

A key concept for teachers to emphasise is *planned learning*. It is planned learning which occurs when teachers bring theory and practice together. It occurs when the teacher has sufficient knowledge of individual children to orchestrate activities or processes "to take children a stage further forward from where they were" (Moyles, 1989, p. 15). For young children, effective planned learning does not occur when the curriculum is compartmentalised into subjects. As Nutbrown (1994, p. 2) reminds us,

> Children are complete and whole persons. They are not divided into parts which need to be educated, parts which need to be cared for and parts which need to be healthy. Ensuring their health, care and education requires a holistic approach. ... Children will explore science, learn about maths and develop language skills

[4] Why else would incentives to increase training and skills for early childhood staff be decreased at a time when the work force is being encouraged to upskill (as has been the case in New Zealand in the mid 1990s)?

through activities and experiences which are *planned* [my emphasis] to encompass these and many more elements of thinking and learning.

This substudy of the *Competent Children* project used recent advances in theory about how children learn to think. It focuses on intellectual play and on children's thinking about mathematical and science-related schemas. The researchers worked with teachers to describe this to parents. Then all the adults planned ways to facilitate and enhance the target children's learning, and thereby bring the theory and teaching practice together. Doing this was intellectually challenging for the adults, and the results indicate that their mental work flowed through into the children's mental work (cognition) with positive effects.

Children's Thinking

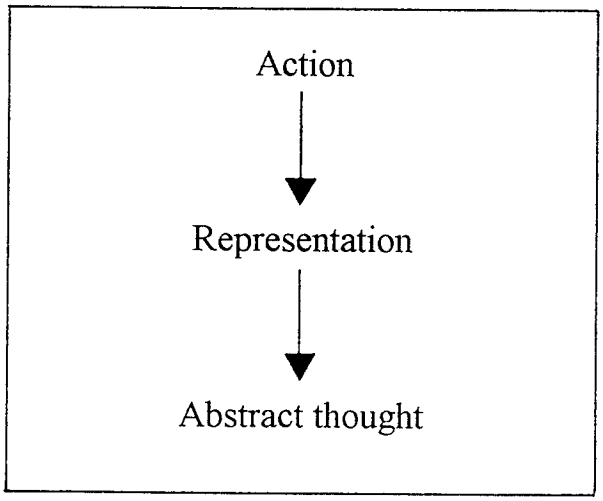
Catherwood (1993, p. 23) describes cognition as an "interplay of the processes of 'attention', 'encoding', 'representation' and 'memory', with the latter involving the establishment and activation of networks of information or knowledge within the brain or mind." These processes are used at all stages of human development.

Catherwood argues that the process of attention is important for concentrating learners' resources on to the most salient information, and "attentional persistence is likely to be affected by the child's interest in the available task or items," (ibid., p. 27). Children's interest is high when playing. In their earliest months and years attention-spans are usually relatively short with plenty of motor activity. 'Encoding' is ongoing. Encoding is the process whereby new input is fitted into patterns already observed. Representation in the form of first language usually starts being observable to adults in the later months of the first year of life but other forms of representation e.g. painting, develop later in the pre-school years.

Piaget (1926) and Bruner (1971) had noted the 3 broad levels - action, representation, and abstract thought - in their theories.

Figure 2

Levels of Cognitive Development



Athey wanted to know more about:

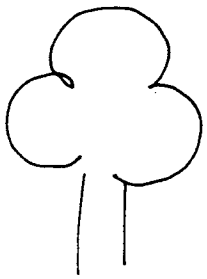
1. the development of symbolic representation,
2. developments in individual children's abstract thinking, and
3. how early childhood curricula contributed to young children's forms of thought, (ibid., p.vi).

It was these questions which motivated Athey to undertake 2 years of field work in the Froebel Institute, collect over 5,000 observations of young children, and then analyse and write up her findings. Her rewards came in the findings. The main findings were:

1. children are fascinated with patterns, some of which stem from their perceptions of the world, and some of which stem from actions,
2. "thoughts" develop as children cluster schemas,
3. adults working with children's schemas bring marked and lasting benefits for children.

First, in terms of symbolic representation, Athey uncovered the fascination young children have with particular patterns. Some of the patterns are figurative and may be about spatial order, such as 'grids' (*figurative schema*). Some of the patterns stem from and are about actions, such as 'going over and under' (*action schema*). Athey (1990) found *figurative* and/or *action* patterns represented in children's drawings, 'writing' (called mark-making), play, and language, and therefore in their thinking. She categorised symbolic representations into 3 sub-divisions:

1. *Graphic* representations of the *static* states of objects (configurational or ikonic);



"Tree"

2. *Action* representations of the *dynamic* aspect of objects and events;

"Sawing"

3. *Speech representations* of either static or dynamic aspects of the objects or events that accompanied representations of 1 and 2, (ibid.).

"Walnuts fall off the tree, . . . so do leaves."

Second, in terms of children's development of thinking, Athey confirmed that for each type of schema there is a sequential and systematic progression. For *action schemas* the sequence is from motor behaviour, through a symbolic representation level, to abstract thought in young children for each *action schema.* She created new knowledge from her observations. She found that prior to the abstract thought level, children spend time exploring 'functional dependency relationships'. In early education, says Athey,"functional dependency relationships" can be seen when "children observe the effects of actions on objects or material," (ibid., p70). An example is probably the best way of explaining "functional dependency". Athey observed Brenda (4 years 7 months) dancing around a maypole holding one of the ribbons, and reversing the direction of her dance from time to time. Brenda ran and fetched a teacher and said excitedly, "When I go round the string gets shorter," and demonstrated the truth of her observation. Then she danced in the opposite direction and shouted, "It gets longer." (ibid., p. 140). Here is the beginnings of a child being able to carry an operation and the transformation it produces entirely in her mind.

Athey also found that,

> [I]n everyday cognitive functioning, particularly as children become more mature and acquire more experience, 'thought' reflects clusters of schemas that contain a wide range of content. In brief, schemas become co-ordinated with each other and develop into systems of thought, (ibid., p. 160).

An example of a connection between early schemas and later coordinated concepts is the 'back and forth' schema seen in a toddler bringing items and dumping them in the lap of an adult. These may become coordinated during her period of absorption at age 3 years 6 months with 'going and coming', for example, between home and the early childhood centre. These two periods of exploring related schemas added together may form the foundation of map-reading which is developed in middle childhood. Athey makes the point that not much is known about how children build up coordinated schemas (ibid., p. 129) and, in personal communication, has indicated that she wants to undertake further work on how children develop an understanding of concepts from the coordination of different schemas.

Third, in terms of the contribution of curriculum to children's thinking, standardised test scores of the Froebel Institute children showed that "the experimental group made highly significant gains in test scores that were sustained during the first 2 years of primary education," (ibid., p.xi).

Fitting, Not Flitting

One of the insights we gained from Athey's research (1990) was that young children may be paying attention to a particular pattern, scientific principles, or even concepts, but the way they pay attention is not observable in the same way as is that of older children or adults' learning a concept.

Young children learn by putting together insights from diverse first-hand experiences. This is part of Vygotsky's theory (1978). He says that every piece of learning is based on earlier experiences - for young children they must be real life experiences.

When observing young children in an early childhood centre using a child-centred curriculum, adults often think that children are like a "butterfly", flitting from area to area, child to child. That may be the case at times. However, when integrated learning is happening, another metaphor might be more appropriate - that of a "bee" which gathers nectar to integrate it into something of significance. The way children focus their attention is to fit new experiences into patterns they have already stored in their memories. They develop schemas by behaving like honey bees; they move from experience to experience in order to gather further ingredients to encode and build a fuller understanding of that schema. In other words, children get hooked on certain patterns of behaviour because they are trying to make sense of the attributes of particular features of our environment, such as "vertical", by fitting them into existing cognitive structures.

Athey (ibid.), Nutbrown in the United Kingdom, and our research team have all demonstrated that indeed young children do show "attentional persistence" and "encode". Nutbrown describes this in terms of obsessions (1994, p. 12).

In talks given about the substudy and the theory underpinning it (e.g., Meade, 1994), Anne Meade has called the behaviour and thinking process associated with children being obsessed with particular forms of thought a process of "re-cognition". "Re-cognition" involves different kinds of information from new experiences or fresh insights being clustered in the mind and feeding existing cognitive structures. This is where the processes of "encoding" (taking in information) and "representation" (forming a cognitive impression of the information) make a contribution to cognition (Catherwood, op. cit, p. 23) because in order to cluster information some sort of categorisation process is used. "Memory" is also drawn on to build schemas.

In order to cluster different kinds of information, there needs to be a variety of sources of information available to children. John Brierley, a scholar who has advanced our understanding of children's brain growth and development, says that,

> The brain thrives on variety and stimulation. Monotony of surroundings, toys that only do one thing, a classroom display kept up for too long, are soon disregarded by the brain. (Brierley, 1987, p. 111)

Nutbrown (1994) believes that variety and stimulation must be complemented by children talking with adults for optimum advantage to children's thinking. They need to be able to ask questions to make sense of the world around them, and deserve answers which do just that - make sense. Nutbrown is critical of flippant or autocratic closed answers.

> To reply to a child's why question with an answer such as 'because it is' or even 'because I say so!' will not suffice because such responses are neither logical nor satisfactory in terms of their thinking, and do not do justice to children's capacity to think through what they encounter as they try to make sense of what they find. (ibid., pp.8-9).

There is another important reason for adults to talk with children about their experiences as they happen. It is likely that young children just do not know the words that go with their explorations. Suppose a child does not know the word 'grid'. It is likely to be far more effective if she hears the word in the context of discussing her own paintings than coming across it in later childhood in isolation. If she has not heard the word 'grid', then she won't say it. If she has neither heard it nor said it, how will she get on in middle childhood when she comes to read it?

Both these reasons for talking also imply that the teachers must be well informed so that their talk is of high quality. If children are exploring 'tessallation' as one of their space order schemas - and they

do - then teachers need to know about tessellation themselves.

Schemas - the Core of Young Children's Developing Minds[5]

Schemas is the term Piaget gave to cognitive structures which have been developed by individuals internalising their actions and from content in the environment. Piaget believed that "thought consists of internalised and co-ordinated action schemas," (Piaget, 1959, pp. 357-386).

Athey (1990, p. 37) defines a schema as "a pattern of repeatable behaviour into which experiences are assimilated and that are gradually coordinated". Nutbrown, when referring to schemas (1994, pp. 10-11), uses the terms "forms of thought", or patterns of behaviour which have "threads of thinking running through them". These behaviours may be physical actions, speech, representation, and/or thought.

Athey concluded that there are 2 types of representation evident in young children's schema-related behaviours:

1. Figural representations which have developmental links with early perception, and
2. Dynamic thought patterns, which have developmental links with early action.
   (1990., p.78).

Figural Representation Which Stems from Perception

Athey included children's drawings, paintings and three-dimensional construction in *figural or static representation.* She found that the marks made by children were generally:

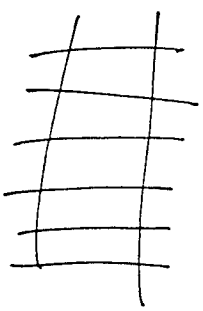
- lines,
- curves and
- space orders,
  (ibid., pp.79-80)

and space orders were "drawn" twice as often as either lines or curves.

Lines

When exploring lines, children between the ages of 2 and 5 years started with vertical scribbles and progressed through 13 other schema to drawing 2 right angles. Of these, the children were most likely to draw or paint vertical lines or a picture containing grids.

1. Vertical scribble (the effects of vertical action of the hand)
2. Horizontal scribble
3. Continuous horizontal and vertical scribble
4. Horizontal and vertical differentiated scribble
5. Open-continous triangle
6. Horizontal line



"A ladder"
('grid')

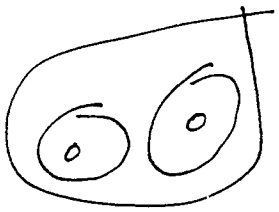
[5] Nutbrown, 1994, p. 35.

7. Vertical line
8. Straight parallel lines
9. Grid
10. Stripes
11. Triangle
12. Rectangle
13. Right angle
14. Two right angles.
    (ibid., p. 79)

Curves

When exploring curves, the children started with circular scribbles and worked on 10 schema in total in this cluster to finish with multiple loops (the most frequent representations being the circular scribble, then a circular enclosure or core and radial). The progression is usually as follows:

1. Circular scribble
2. Circular enclosure, or core and radial
3. Oval
4. Enclosed curve with or without corners
5. Closed semi-circle
6. Open semi-circle
7. Helix
8. Plane spiral
9. Concentric circles
10. Multiple loop.
    (ibid., p.80)



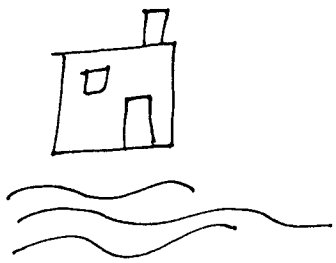
"A man"
('concentric circles')

If we reflect on the understanding that 4-year-olds must have developed in order to distinguish between a helix and a plane spiral, it is clear that work with these schemas is hard intellectual work.

Space order

Space order schema is where children start with exploring proximity between marks and progress through other space order schema to representing 'in front of' or 'behind', and finally the same figure in different positions. Athey's observations showed that the space order schema are systematically related to increases in age. The progression is usually as follows:

1. Proximity between marks
2. Vertical order of elements within figure
3. Horizontal order of elements within figure
4. Grid order within figure or within enclosure
5. Grid order inside and outside discrete figure
6. Proximity between figures but no order
7. Vertical order between figures
8. Horizontal order between figures
9. Grid order between figures



"A house by the river"
('behind')

10. Representing 'in front of' and 'behind'
11. Representation of figures in different positions (ibid.).

When working on space order schemas, children begin to think about the concepts of:

- proximity,
- enclosure,
- connection,
- separation, and
- horizontal and vertical coordinates.

These tend to be explored in this order. All are very complex abstract concepts.

Early childhood educators who have studied the curriculum offered in early childhood centres in Reggio Emilia, Italy (see, for example, Katz, 1990), will be recognising the way the Italian teachers are nourishing these forms of thought in young children. There are obvious similarities in what is being nourished.

Once any forms of thought (schemas) are identified by early childhood teachers' curriculum extensions can be planned by the teachers. The children will also extend the curriculum themselves, given a rich supply of materials and experiences.

When working with marks or building with blocks, young children are often not drawing, painting or building solely to represent content, which is what adults expect when they ask, "What is it?" Children are frequently drawing primarily to explore forms of thought or schemas. If they show a heightened consciousness of things in the environment which match the forms/schema dominating their thinking, it is possible that those objects are drawn or painted in the interests of exploring the schemas. Adults thinking about children's thinking are likely to cue into both possibilities.

Before moving to the next section about representations which stem from action, it is necessary to note that there is often no clear-cut distinction between *figurative schema* in drawings, paintings and models made by young children, and *action schema*. They may be dealing with both the static and dynamic aspects of an idea, e.g., a circle and a spinning wheel, simultaneously.

Dynamic Representation Which Stems from Action

Athey analysed the *action schema* she observed, and identified 8 categories. They were:

	Occurrences
1. Dynamic vertical	403
2. Dynamic back and forth, or side to side	357
3. Dynamic circular	280
4. Going over and under	204
5. Going around a boundary	133
6. Enveloping and containing	351
7. Going through a boundary	259
8. "Thought"	163

(Athey, 1990, p. 130).

Athey (1990) found that when advancing in their development of *action schemas*, the Froebel Institute children progressed from"motor" behaviour through "symbolic representation" to later "conceptual" thinking. Athey (ibid., p.69) found that, "The largest number of motor-level examples occurred at 3 years 1 month; symbolic representation at 4 years 1 month; and thought level at 4 years 5 months."

In other words she found that behaviour associated with each of the action schema showed continuity and progression. Motor-level examples of schema in individual children came before symbolic representations of schemes that were themselves antecedents to later coordinations of schemas at the thought level (ibid., p. 31). Examples might help explain the progression. In her discussion of 'vertical dynamic', Athey described an incident where Amanda was exploring the effect of weight changes on her ability to lift things up ("functional dependency relationship"):

> Amanda (3:6:6) put water into a balloon. She told the teacher that the balloon filled with water was heavy. Mrs B asked how she knew. Amanda said, demonstrating, "Look, I can't lift it. I can lift this." (lifting the one filled with air), (ibid., p. 133).

Seven months later, Amanda was thinking about vertical dynamic schema and the concept of 'down' entirely in the abstract.

> Amanda (4:1:25) "You know leaves? They fall off the tree on to the ground [pause] and acorns fall off the tree." (ibid.).

We have already cited Alistair's development of an understanding of 'circular direction and rotation' in Chapter 1. He was described at each level: first 'motor level', then 'symbolic representation', then 'functional dependency relationship' and, finally, 'thought level'. Those levels followed each other as Alistair grew older. First he tried 'rotation', then talked about it as he tried it, later he experimented with it and, finally, he could think in the abstract about 'rotation' as it transformed a length of material.

These examples from the Froebel project also serve to illustrate the difference between *form*, in this case 'circular direction and rotation' and *content*, in this case many and varied, ranging from handles on the winch on a well, level-crossing barrier arms, old-fashioned mangle, to fishing reels. We quoted passages demonstrating Alistair's interest in car wheels and the typist's swivel chair. His fascination with a particular *form of thought* (schema), in this case 'rotation', was nourished with worthwhile and varied *content*.

Nutbrown (ibid., p. 35) describes the links thus,

> Children's schemas provide opportunities for continuity in learning. Children's persistent threads of action and thought seem to be fundamental elements which link children's thought and action with process and content. This kind of continuity is that which children create in the process of exploring, thinking and learning. Viewed in this way, schemas can be considered the core of children's developing minds.

Athey's and Nutbrown's projects validate the theories that the 2 principal observable ways younger children "come to know" are indeed via their symbolic representations and their active exploration. The environment needs to feel safe and predictable for children to follow curiosity in these ways.

> Effective educational provision for young children needs to be consistent. Consistency can be considered in terms of three 'constants':

- adults and their behaviour,
- routines and information,
- experiences and materials.

... These three 'constants' help to create a consistency of curriculum which enables children to be *active* learners:

- Tackling new things because they feel safe in doing so and because they know that adults will help them.
- Planning what they will do when they arrive - for example deciding "When I get to nursery this afternoon I'm going to paint some wood and fix it together.
- Revisiting familiar materials to build on previous experiences.

Knowing that adults, space, time and materials will be 'constant', the same today as yesterday, helps young children to assume more responsibility for what they do and to follow their consistent threads of thinking and doing without unnecessary hindrance, (1994., pp. 31-33).

The methods used in the action research to assist teachers to become more skilled at spotting schemas and nourishing them, as well as the research methodolgy itself, are described in the next chapter.

Teacher planning, and parent involvement in helping children construct their knowledge and understanding, are very significant. Teachers and parents need to open up experiences for children to explore the world around them which are in tune with individual children's agenda, and provide opportunities for children to represent what is in their minds through drawing, painting, modelling, and talking. The challenge to the adults who want to nourish schemas is considerable if we accept Brierley's observation that "monotony of surroundings ... are soon disregarded by the brain," (1987, p. 111). Remember the mentions of visits to different settings in the notes about Alistair in chapter 1: a science museum, railway, fishing, as well as experiences in the home and early childhood centre. The Froebel Institute children went on weekly excursions!

Nutbrown (1994, p. 14) asks, "What do you do when you think you have identified a child's schema?" Her answer is,

It is not sufficient simply to identify a child's interest: early education needs to challenge children's thinking and extend their learning. When a child appears to be playing attention to a particular pattern, he or she needs to be provided with a range of interesting and stimulating experiences which extend thinking along that particular path. ... Extensions to children's schemas need to provide opportunities for further learning, for children to talk and for more nourishment for children's fertile minds, (ibid., p. 15).

As well as opening up experiences, opportunities for children to talk need to be extended. Athey (op.cit, p. 111) cites studies which show that children work longer and produce work on a higher development level when they talk about their experience with adults (e.g., Bruner, 1980).

The Competent Children Substudy on Children's Schema

The researchers came to this substudy of the *Competent Children* believing that adults can enhance the possibilities for, and from, children's active exploration of schemas or "threads of thinking" (Nutbrown, 1994). To do this, the teachers, with the help of the researchers, needed to:

1. identify, reflect on, plan for and talk about the children's schemas at staff programme-planning meetings,
2. during sessions, help children recall experiences that link into their current strand of thinking, talk about the representations of that schema evident in, say, the children's paintings in ways which would extend their language and thinking about that schema,
3. provide a rich environment for the children to explore, at the centre and on excursions into the community, and
4. talk to parents so that they too could provide opportunities for further learning following the same "thread of thought".

We believed that both adults and children would become more skilled at connecting different areas of content which weave into children's schemas, if consciousness of children's thinking was raised in the adults. However, the steps outlined above cannot occur if the adults have difficulty in spotting the pattern/s in each child's learning. The action researcher's journal provides some insights into the difficulties of schema spotting.

> It was much more difficult to spot the schema than I had imagined. Although I observed the children closely and carried out running records on my visits, and staff made independent observations, conclusions about schema could be only tentative for many weeks. 'Enclosure', 'enveloping', and 'connecting' [action] schema seemed easier to identify than some others. It is difficult in a session to pick out repeated patterns of behaviour for several children. It was only [after about 3 months] when the observations had accumulated, that there was some confidence in associating certain schema with the children, (December, 1993).

We want to emphasise that we were not encouraging, and are not arguing for, teacher-imposed themes; chances are they would not fulfil the children's need for continuing their own threads of thinking.

We would also like to emphasise that we were not making a case for **lots** of change in early childhood centre environments for the children, only for variations in content over time, and more adult-child talk, in keeping with the need to nourish individual children's schema learning. Our approach was to support the position that Nutbrown (1994) made for constants.

The methods used in the action research to assist teachers to become more skilled at spotting schemas and nourishing them, as well as the research methodology itself, are described in the next chapter.

CHAPTER 3

CURRICULUM CHANGE AND RESEARCH METHODOLOGY

Action Research Methodology

This substudy of the *Competent Children* project has been described as the action research component. It was designed so that the teachers (and the researchers) "could learn from their own experience and make this experience accessible to others," (McTaggart, 1989, p. 1). Features of action research present in this substudy included,

- the teachers (and the researchers) were committed to improvement and,
- those affected by the hoped-for changes had primary responsibility for making the decisions about what changes to make which were likely to lead to improvement.
  (ibid.)

Where we differed from some other action research studies was:

- the changes did not start from the early childhood teachers perceiving a practical issue that could be resolved by a process of collecting data and developing a theoretical analysis of the experiences they had;
- the participants in the research - the teachers, parents and children - had little say about the way the substudy was conceptualised and carried out, except that the 2 sets of adults had reasonable control over the ways they observed and recorded children's behaviour;
- those participating the most in this study, the teachers in the schema centres, were not asked to evaluate the results of what they tried out in the way of curriculum changes for research purposes.

The *Competent Children* team initiated the research. They identified 2 centres which met the selection criteria and knew too that staff had a little knowledge of schema theory from an in-service course. These centres have been called Ngaio-tree centre and Karaka-tree centre for the purposes of this report. The team asked key staff whether they would like to take part in a curriculum innovation, revolving around schema development, which was likely to improve the benefits the children gained from their early childhood education. The staff were interested, consulted internally, then consented. Group decision-making is another important feature of action research and there was a considerable

amount in this study.

The design of the substudy and instruments for collecting data were mostly already decided by the research team by the time consent was given. However, almost all changes to the curriculum were in the hands of the early childhood teachers. It was suggested to them that change would be necessary if they were to extend the children's thinking once a child's interest in particular schema was spotted. The teachers were left with the primary responsibility for making the decisions about what changes to make.

Some staff adopted the aim of nourishing children's schemas more than others did. In part, the level of motivation to make changes to the curriculum seemed to be related to the level of satisfaction with the existing curriculum in each centre.

Other than an informal debriefing at the end of the field work, staff were not asked to evaluate the curriculum innovations they had implemented. It was seen as inappropriate to ask them to undertake an evaluation within any formal analytical framework. Elliott (1991) describes how theoretical analysis comes into play in action research as teachers use a repertoire of cases which they reflect on.

> Practical wisdom as the form of the practitioner's professional knowledge is not stored in the mind as sets of theoretical propositions, but as a reflectively processed repertoire of cases. Theoretical understandings are encapsulated in such cases, but it is the latter which are primarily utilized in attempts to understand current circumstances, (ibid., p. 53)

Action research places some responsibility on the researchers to reflect on their practice as well. In the final chapter, we do just that, and note that we too were caught up in dominant ways of thinking about curriculum which affected the data we selected for recording.

Preparation for Including Schema Theory into the Curricula

The action researcher ran workshops for staff at the Ngaio-tree and Karaka-tree centres, explaining Athey's research findings about schemas, and describing different types of schemas. She showed an amateur video of two children, one of whom was absorbed with exploring 'enveloping' and the other was fascinated with an *action schema*. His fascination began with a specific *trajectory action* - squirting water - and became more intense as he noticed the trajectory altered as the water level changed.

Written materials were handed out with examples of children's work on schemas to help them spot schema in children's drawings, paintings and models with 3-dimensional material (*figurative schema*).

About 10 days later, the researcher returned to do some running record observations of the 5 target children in Ngaio-tree centre and the other 5 children in Karaka-tree centre and to talk to staff about any schemas they had detected. Tentative signs that the reseacher or staff had observed were discussed. After another 10 days, the action researcher ran a workshop for all parents of the target children with some staff in attendance. The parents were immediately able to identify with some of the examples of schemas. They too were given written material to assist their recognition of a range of schemas and asked to take note of further examples of their children working on any schemas.

After 6 weeks, staff from both schema centres were invited for a follow-up workshop based on the schemas being explored by the children in their respective centres and sharing methods for recording profiles of the children. Descriptions of extension experiences and materials were shared, although the records on language extensions were not sufficiently detailed to share. As well, the teachers did

not "write themselves" into their observational notes. We will return to the topics of a paucity of language extensions, and teachers overlooking themselves when keeping records, in later chapters.

Curriculum Innovations

Curriculum innovation can occur in either *curriculum* content or *curriculum* processes or both. In the opening chapter, we quoted Athey's conclusions that the richness or paucity of experiences for young children makes a big difference for children's thinking with and about schemas and development of conceptual understanding. One way early childhood centre staff can extend the range of children's experiences is to take them on excursions. The Froebel Institute did this quite frequently.

In the New Zealand centres, we noticed that excursions were not organised very often. There are structural regulatory reasons for this, especially in the Karaka-tree schema centre which had a 1:15 ratio of adults to children. The regulatory requirements are that this ratio must be maintained for the balance of the children even if a few children go on a visit into the community. Thus, for the most part, the extensions which were offered to children once 'their' schemas were tentatively identified consisted of within-centre enrichment of language and materials associated with the children's patterns of behaviour. Support of children's initiatives in their play and artistic endeavours was a strong element in the cultures of both centres.

Some examples will make the approaches adopted by staff clearer. In one centre, Paul was fascinated by 'containing', 'going through' and 'going around'. Staff provided a range of lengths of different materials to work with. With this enrichment of resources, he 'contained' and 'went around' his wrists with some sewing tape; he passed streamers through several doorways ('going through' boundaries) and tied them ('going around') to furniture in each room; and he wrapped parcels with string. Staff exchanged anecdotes about Paul working on this schema with whichever parent picked him up from the centre.

In the other centre, the teachers had noticed that several children were also exploring 'containment' in that they were frequently filling buckets of sand, or gathering fallen leaves into a bucket. One teacher offered soup-making as an extension activity (with nutritional benefits as well) and the target child, who was fascinated by 'containment', helped to peel and cut a carrot and she put it inside the pot for cooking the soup ingredients. The researcher noted that the adults supported the schema learning by reflecting back any language about "inside the pot", "inside the soup", and so on.

Most teachers will say there is nothing particularly innovative about these curriculum approaches. This is true. What was happening was that the researchers and teachers were sharpening their observation skills so that they could get inside children's thinking. This in itself is a radical development. Once they were more aware of the patterns of children's thinking and doing (the children's schemas), they planned additional content experiences to nourish them, but within an environment characterised by consistent routines of regular adults..

By now the reader may have noticed the focus on *content*. The minimal focus on *curriculum processes*, described earlier, was not identified until the analysis of the data was undertaken. The final chapters take up this point in greater degree.

Methodology Used in This Study

The data were collected in a way which had ecological validity: the staff reflections about what was happening for the children were holistic, and in touch with reality. The range of data collection methods are summarised in Figure 3.

Figure 3
Data Collection Methods

	Schema centres		*Comparison centres*	
	Ngaio-tree	*Karaka-tree*	*Matai-tree*	*Rimu-tree*
Main project				
Child interviews, observations and assessments.	*	*	*	*
Centre ratings, and profiles	*	*	*	*
Main caregiver interviews	*	*	*	*
Action research				
Staff observations of children	*	*		
Profile books about children	*	*		
Parent observations of children	*	*		
Action researcher observations of children	*	*		
Teachers' curriculum innovations	Incidental notes			

Schema Data Collection

Three sets of people were involved in observing the children to try and ascertain schemas which might be dominant in their exploration and thinking during the 2 terms' participation in the action research:

- the staff at the centres,
- the researcher,
- the parents of the children in the research project.

The *staff* were asked to help in 2 ways. First, to maintain a wall chart about the children, "posting" a brief record of actions, representations or language which illustrated particular schema. This type of observation is called "event recording" (McMillan & Meade, 1985). The mechanism used in the *Competent Children* project was for staff to jot a brief note on a "yellow sticky" and to attach it to the chart. Before long, in one centre, staff had identified a few schema which seemed to be interesting their children at around age 4½. They structured the wall chart with the children's names across the top, and the dominant schemas down the vertical axis (see Figure 2). After a period of time, the chart began to resemble a graph. The frequency of schemas and for different children was visible.

Figure 4
Staff Records of Schemas

	Child	*Child*	*Child*	*Child*
Vertical dynamic	**			
Trajectory			**	****
Connecting		***	*	**
Going around a boundary			***	
Etc.				

Secondly, staff were asked to compile some sort of record of each research child's work, including a focus on schemas. These records were to fit, as far as possible, with current practice for recording in order to not add too much extra work for the teachers. A folder or book which included pictures of the children's representations in their creative work, with notes from staff observations of schemas, was suggested. One centre already had a system of taking photos of the children on a regular basis and recording observations in an exercise book which was sent home from time to time for parents to read and include some of their own observations. They began to include material about schemas in those books. The other centre had a system of making big books for each child; these books were large enough to include some paintings. They adapted this system of record keeping for the research project. Both could be described as forms of "anecdotal recording" (McMillan & Meade, op.cit.).

The *researcher* who undertook the action research field work visited each centre at least once per month in order to discuss progress on spotting schemas and ideas on nourishing schemas. Her data collection comprised "running records". Each child was observed for 2 to 3 times for 15-20 minute-intervals on each visit, and the researcher carefully described what the child was doing, adding some notes about the context as appropriate. At a later stage, she annotated the written notes from the

observations on each child, coding the *graphic* and *action representations*, or the language which indicated a particular schema. This researcher also added some discussion about schemas to each interview with the parents, and took some notes about parents' perceptions of schema development.

The *parents* were invited to keep some record of schemas they spotted in their child in the home setting at the time the action researcher conducted the Main Caregiver interview. As well, a simple chart was given to them via centre staff after a couple of weeks, and they were requested to jot down any events where schemas were noticed as they happened. Only one parent actively did this. In hindsight, some system for collecting them in on a regular basis could have been tried in order to motivate the parents to be more active participants in the data collection. The parents in the centre which operated the "home book" policy were able to read about the schemas noted by the staff in those books from time to time, and could reply. No parent did continue the dialogue in any of those books.

The action *researcher* collated all available data, by child, at the end of the period when all the children had left the centre and started school using a coding system based on the schemas located and described by Athey in the Froebel project and outlined in Chapter 2.

Regular Data Collection

All data collected about all children in the qualitative study in the main project were also collected about the children targeted for the intervention component. Thus, three types of data were gathered.

1. Data about the children: 15 time-interval observations (5 observations at each of 3 sessions), assessments of some competencies gathered by interviewing and assessing each child in the month before each turned 5 years of age, and adults' perceptions of other competencies exhibited by children at the same age, (in this substudy both a parent and a key staff member were interviewed);

2. Data about the centres: a profile of each centre was supplied by the supervisor/head teacher, and the researcher rated centre quality on 4 cluster variables at the end of every session when the time-interval observational data were collected;

3. Data about the families: demographic, early childhood service use, and family life experiences, gathered by an interview with the Main Caregiver/s.

All these data were collected for the 10 children in the schema centres, as well as for 7 of the 8 children in the comparison centres. (A complete data set was not gathered for the eighth comparison child who moved from the region.) Field workers for the main project gathered these data, except in the case of the two interviews with parents/care-givers (see 1 and 3 above). These interviews were conducted by the action researcher in order to establish and continue the dialogue about schemas between herself and the parents.

The data from the regular data collection were coded by the field staff collecting the data, checked by one of the main project team members, and entered on to the computer. This report uses only a selection of the potential analyses which could be undertaken because of the hundreds of variables in the data. Findings from these analyses are presented in Chapters 4 and 5.

CHAPTER 4

THE CENTRES, AND THE 18 CHILDREN

The Centres[6]

Two centres were chosen for the intervention component of the *Competent Children* project - Ngaio-tree centre and Karaka-tree centre. Neither they, nor the two centres chosen as comparison centres, were randomly selected. As the intention was to work with the staff and parents on a curriculum innovation, it was important the centres made a conscious decision to opt into the intervention aspect of the research. As well, the research team agreed that some minimum criteria for inclusion were necessary. They included:

1. the centres were to have a charter;

2. at least 5 children were to be in the age scope for the main study - that is, aged 4¼ to 5 years - and would be at the centre for 6 months;

3. the parents of the children understood enough English or Samoan (the two languages on our pamphlets and consent forms at that stage) to read and understand the material about the research so that the teachers and researchers felt confident that parents had given their informed consent;

4. at least 2 staff in each centre with Diploma qualifications in early childhood care and education, or a recognised equivalent;

5. the majority of staff had at least 3 years' experience as early childhood teachers;

6. the staff group were stable, and individuals were unlikely to change their employment during the course of the intervention study.

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[6] Centres is used as a generic term. In the context of this report, it may refer to a childcare centre or a kindergarten.

These criteria were necessary to achieve some consistency over time and between centres. They had the effect of excluding playcentres from the list of possible centres. It was decided to include one all-day childcare centre and one kindergarten sessional group as the schema centres, and to select another all-day childcare centre and another kindergarten sessional group as the comparison centres. We have called these Matai-tree centre and Rimu-tree centre. The comparison centres were to have similar staffing profiles and have families on their roll with similar socioeconomic backgrounds to the families attending the schema centres. In the event, the childcare centre which was initially chosen as the comparison centre, because its staffing profile was similar and it was located not far from the schema childcare centre, turned out to have families with markedly different backgrounds. The team decided not to proceed with data collection there, and chose another comparison childcare centre where staff and families were a better match.

The research team consulted with association staff of the kindergarten movement and of a grouping of childcare centres, and sought advice from a staff member of the Early Childhood Development Unit, to obtain a list of centres which met the criteria for selection. Some centres were also known to some members of the research team. The final selection was made by the research team, based on which centres best met the criteria.

Inevitably (it would seem from other research experience), soon after access had been negotiated, consent had been signed by the randomly chosen families attending the centres, and one or two interviews done, a staffing change did occur in one schema centre because of illness. We felt we were too involved to change to another centre.

Once the selection was made, the principal researcher contacted appropriate management and senior staff members to inform them of the centres chosen, and the negotiation process was set in train, using procedures appropriate to the type of centre, to obtain permission to do the research in the centres. When approval was given, the researchers, together with a senior staff member, used the centre's roll to draw a random list of 5 children aged at least 4¼ years and who did not turn 5 for another 6 months. By that time, 1 comparison centre had only 4 children who met the sample criteria. A letter, a pamphlet about the *Competent Children* project, and a consent form[7] to sign were sent home to the parents of all 19 sample children. All but 1 child who was approached came into the study. Another child was withdrawn after some of the data had been collected, and it was too late for a replacement child to be sought and studied in the time frame.

Thus, 1 month after the study started, 3 changes had occurred, and all criteria were no longer fully met. One other staffing change occurred in a schema centre, and influenza affected regular staff attendance to a noticeable extent in the other schema centre. This reflects the reality of undertaking research over time in the field.

Figure 4

The Centres

	Action	*Comparison*
Childcare Centres	Ngaio-tree	Matai-tree
Kindergartens	Karaka-tree	Rimu-tree

[7] The consent form allowed parents to withdraw their child at any point .

Each centre is described below in order to provide a picture of the early childhood care and education contexts for the children the researchers worked with during this component of the study.

Ngaio-tree Schema Centre

The centre is cooperatively managed by a parent:staff committee, and fits into the category of employer-assisted centres. This assistance comes in the form of minimal rental for the physical facilities. Maintenance costs were shared by the employer and the parent-cooperative.

The families were described as mainly middle-class, and mainly Pakeha[8]. Parents paid $27 per day, or $133 per week, in fees.

Ngaio-tree centre had 40 children aged over 2 years of age at the time of the research. The children were not separated into age groups. However, there was a key caregiver arrangement which meant that the key caregiver staff member paid particular attention to 'her' children (undertook observations of these children, focused on their individual curriculum needs, maintained their home-centre book, liaised with their parents, and so on).

Staff described the roll at Ngaio-tree centre as very stable; thus, most children started at age 2 and left to start school. However, the roll fluctuated each week because many parents worked in jobs with rotating rosters, and school holidays brought other kinds of fluctuations. The centre was open from 7.30am to 6.00pm daily, and children arrived and left at different times of the day.

To cover the long day, there were 5 full-time staff and 1 part-time staff working in Ngaio-tree centre. Staffing was relatively stable with less than one-third turnover in the previous year, but there were a number of absences because of illness. The staff have a collective employment contract, fitting under the Consenting Parties umbrella. The highest salary is around $37,000 per annum.

Half the staff had the equivalent of a Diploma of Teaching (Early Childhood Education), and 2 others were part-way to it. Half the staff were currently upgrading their early childhood qualifications. All were attending work-related continuing education short courses from time to time. These courses ranged from Maori, music, and language development, to First Aid. Four of the staff had worked in early childhood centres for 3 years or more, and all had at least 1 year's experience.

Programme planning occurred at 2 levels: the primary (key) caregiver was responsible for picking up individual children's learning needs and planning their individual curriculum; and the group of staff attempted to plan the overall programme. The supervisor felt that key caregiver planning was satisfactory because of the skills of the staff, but there was variable success with planning and running the overall programme. Some aspects were rated by the staff as going well; for example, the puzzles, blocks and reading areas, as well as transforming meal and snack times into learning times, and improving the routine for children going off to sleep. Both types of planning suffered because of too little staff non-contact time, and the rostered attendance of staff (as well as the fluctuating attendance of the children). The Education Review Office had recommended more formal programme planning.

Assessment of, and record-keeping about, the children revolved around the home-centre books, and folders of art. Key caregiver staff tried to undertake running record observations of children on a regular basis. These were written up as a commentary in the book, adding photos of the child at the centre or during excursions. The check-list method had been stopped because of parent reaction to the tacit labelling which emerged. Regularity of observation times and recording in the books was a problem, because of staff illness and fluctuating attendance of children.

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[8] A term used in New Zealand to describe settlers of European origin and their descendants.

The links between planning and assessment are made continuously, as staff are constantly discussing the effects of their work on children. Individual staff find they reflect on the children's achievements when recording in the books.

The Ngaio-tree centre supervisor reported that there had been one discussion focused on the charter with parents during the previous year but no formal discussion with staff.

There is one principal rule for children - do not harm people physically or mentally. Another rule (secondary) is: do not harm property.

Karaka-tree Schema Centre

The Karaka-tree centre is managed by a parent committee under the auspices of a regional association. No rental costs are borne by the centre. A considerable amount of the administrative load is undertaken by association personnel.

The families were described as mainly having lower-middle incomes, with a mixed ethnic profile: nearly half the children were Maori, with a similar proportion Pakeha, and the balance came from other cultural groups. The cost to families (voluntary) was $5 per week.

Karaka-tree centre had a roll of 45 children in the group in the research project. All children were aged between 4 years 2 months and 5 years. The group attended for 3 hours every day. (Another group of 45 children, younger in age, attended on 3 afternoons per week.) There was a fairly continuous turnover of children - on average more than 1 child per week started school.

There were 3 full-time staff members working with both groups. A relieving supervisor took on that responsibility at the time the research started, but generally there was little turnover of staff. The staff were covered by a collective employment contract, common to all centres of that type. Leave provisions were far more extensive than for staff in Ngaio-tree centre, but illness still affected attendance. The highest salary was approximately $28,000.

All staff had a Diploma of Teaching (Early Childhood Education) or its equivalent. Two of the staff were currently upgrading their early childhood qualifications. All were attending work-related continuing education courses from time to time. These courses included art curriculum, human relations, flax weaving, sexual abuse, and effective communication. All staff had worked in early childhood centres for 2 years or more.

The closing paragraph in Karaka-tree centre's philosophy statement in its charter provides the learning theory underpinning the curriculum in the centre:

> The key to the early childhood curriculum is to observe, support and extend children. All learning is based on personal knowledge through discovery, and discovery is based on first-hand experiences.

Programme planning starts with a term plan which has broad goals. This developed further in the fortnightly plans which focus on the children's interests. As staff have shared non-contact time they are able to do their planning together. Objectives are worked out which focus on the staff (e.g., language use), on curriculum areas (e.g., science and mathematics), and on the children (learning outcomes).

Assessment of children involves a range of methods to form a profile: some running record and time-sampling observations, art work, and photographs. From the initial profile, objectives are set. Achievement of these objectives is evaluated once per term and the objectives reviewed. In each group, 2 children's profiles are developed each fortnight, the frequency being dictated in large measure by the fact that a new child enters the group at the average rate of one per week. Objectives for

individual children are referred to during the development of the fortnightly plans.

The links between planning and assessment for individual children is done on a cycle, and records are kept, but the roll numbers and turnover preclude each child being the focus more than a couple of times. In the period prior to starting school, the staff ensure they complete an evaluation-against-objectives record involving parents.

Karaka-tree centre philosophy is articulated in a 3 page handout for parents, presented on sheets bordered with a Maori design. It starts with a statement that "Your child's early childhood years are a period of life in its own right." Later it says, "Through their time at [Karaka-tree centre], each child should experience and develop some degree of competence and pleasure in every activity."

The stated aims about children's learning include:

- to provide experiences that meet children's needs and stimulate their learning in ALL developmental areas: social, physical, emotional and intellectual;
- to prepare the environment for children to learn through active exploration, interaction with adults, other children and materials;
- for the teachers "to move among groups and individuals to facilitate children's involvement with materials and activities";
- to provide a language-rich environment;
- to see how reading and writing skills are useful;
- to provide a warm and loving environment with mutual respect.

The philosophy statement also includes a number of statements about working in partnership. They include:

- Teachers have a broad knowledge of children; parents have an intimate knowledge of their own child. Your child will benefit from us working together;
- New Zealand has a Treaty between Maori and Pakeha. We, as teachers, have a commitment to this partnership. Children will benefit from learning to appreciate our dual heritage;
- We value each child's heritage taking into account differing value systems and customs;
- It is important for teachers and parents to work in *partnership* so we can build a mutual understanding and a greater consistency for your child.

When asked about behaviour rules for the children, Karaka-tree staff provided guidelines comprising a 9-point code for *adult* behaviour when disciplining children, including no corporal punishment, frequent positive reinforcement, inappropriate behaviour should not be reinforced, and "setting safety limits positively (for example, rather than 'no running inside', it can be 'walk inside')."

The teachers use a 20-point checklist as part of their assessment procedures during each child's last month at the centre. It covers early literacy and mathematics competencies (e.g., own name recognition and writing, understanding concepts like '10', schema like 'over' and 'under', and shapes), social skills (e.g., asking for help when needed, sharing and turn-taking), language skills (e.g., speech is clearly understood, and expressing views well), motor skills (e.g., using scissors, ball skills, confident on a range of outdoor equipment), self-care competencies (e.g., toileting), and music appreciation.

This checklist validates the competency variables used by the researchers. The competencies on the Karaka-tree centre checklist are remarkably similar to the researchers' competencies list!

Matai-tree Comparison Centre

This centre, like Ngaio-tree centre, is a non-profit cooperatively managed centre, with parents and staff handling management responsibilities. It fits into the category of employer-assisted centre because initial capital for the facility came from employers. The families were described as mainly middle class, and mainly Pakeha. Parents paid $130 per week per child in fees.

Matai-tree centre had 29 children on the roll at the time of the study, and there were some vacancies. The children ranged in age from 6 months to 5 years. Most children attended for 3 - 4 years.

The children were grouped into an under-2s group (10 children), and an over-2s group (17 children). There was less weekly and daily fluctuation of attendance than at the other full-day centre discussed in this report.

There were 8 staff employed by management at Matai-tree centre, 2 of whom were part-time. Staff turnover was low, with less than one-third having changed in the past year. The staff have a collective employment contract, under the Consenting Parties contract. The highest salary is around $36,500 per annum.

Three staff had a Diploma of Teaching (Early Childhood Education), 1 of whom had an advanced diploma, and 3 others were partly trained. All of the latter were actively working on gaining an early childhood qualification. Another 2 staff were undertaking courses of study, such as on children with special needs.

The supervisor had worked in early childhood services for 15 years, 2 others had at least 5 years' experience, and the others averaged just under 3 years' service. Half the staff were Maori or from a Pacific Island country, and the others described themselves as Pakeha. Languages other than English were spoken to the children at times during the course of the day.

Programme planning for the group programmes is done by the staff as a group, although it was acknowledged that the senior staff mostly did the writing. Programme planning is based around 9 basic activities:

* listening to stories,
* basic physical skills,
* painting,
* drawing,
* blocks,
* outdoor play,
* language communication (rhymes, songs, conversations),
* puzzles,
* dough,

and consciousness of:

* social interaction,
* stages of play.

A recent development, since the preparation of the charter for Matai-tree centre, is the evaluation of the programme's effectiveness. This has entailed an appraisal of all activity areas to decide which

activities the children need more or less of. The appraisal is done 6-monthly, and a record is kept of the assessment results.

For individual children, a programme is planned with components for the home as well as for the centre. This is done on a 6-monthly cycle following an assessment of each child's development, and a discussion of results at a staff meeting; and parents are invited in to discuss the children's development and future programme. Assessment of the children is based on developmental checklists, adapted from Sheridan (1975). These are set out by age (6 months, 12 months, 18 months, and so on). Records are kept of the results of the assessments. If there is a problem at any time, staff will do event sampling observations and discuss at a staff meeting. If warranted, more in-depth assessments are carried out.

In summary, the planning cycle is assessment, discussion at staff meetings, and then planning.

The basic philosophy of the centre was summarised for the researchers as: "non-sexist, non-violent, culturally sensitive, non-sectarian, non-competitive [education and care]." The guiding principles are set out in detail on a 1 page handout for parents. The principles relate to:

* *The Child-*

"meeting the overall needs for education and care", "enhancing the development of the child", "promoting the physical, social, emotional, creative, cultural and cognitive development of young children";

* *Parents and Family -*

parents and family ... shall play a major role in any decision-making concerning their child", "the programme shall be designed ... to support the family", "providing an atmosphere which is warm, accepting and welcoming;

* *Curriculum -*

The early childhood curriculum shall be defined as the sum total of the children's direct and indirect learning experiences in early childhood services", opportunities for learning through play which promote ... development in an overall way will be provided", "care and education will be integrated in the curriculum, and the development of self-esteem, confidence, independence and interest in learning for young children and infants will be facilitated at all times;

* *Equity-*

Fair practices will be reflected in the administration and operation of the centre.

The main rules at Matai-tree centre are: no hitting, no-one is allowed outside the gate without an adult also outside the gate, sit down while eating, be respectful to adults (without fawning), if elect to have a sleep then sleep, wash hands after going to the toilet, and put own tissues in the rubbish.

Disciplinary practices include using peaceful means to resolve conflict, giving the other person a hug if anyone has caused physical or emotional discomfort, and time-out (as a last resort).

The competencies expected of a rising-5 year old mesh with those adopted for the *Competent Children* project even though we did not spell out ours explicitly to the staff:

* communication skills,
* [aptitude for] learning,
* early literacy,
* early mathematics,
* puzzle problem-solving,
* human relations problem-solving,

* physical ability and dexterity, and
* doing things like flushing the toilet and beginning to tie own shoe-laces.

The staff also said that it would be good if all children were partly bilingual (i.e., they wanted the children to have some understanding of another language). For some competencies, a quite extensive list of indicators was provided. For example, maths was elaborated thus:

* know about basic shapes - circles, squares,
* have some understanding of measurement - eg, cubic measurement in 3-D shape with the help of a block,
* be able to do a mosaic puzzle,
* build a castle with a moat in the sand-pit,
* steer a trolley,
* construct a house with junk material and a sheet, and
* know about floating/sinking, and heavy/light.

The researchers noted that the indicators provided by the supervisor would make very useful "authentic" assessment items.

Rimu-tree Comparison Centre

Rimu-tree centre is managed by a parent committee under the auspices of the same regional association as the Karaka-tree centre. No rental costs are borne by the centre. Here also, a considerable amount of the administrative load is undertaken by association personnel.

The families were described as mainly low income and/or on benefits. This was related to a relatively high turnover of children on the roll. As children were able to attend for nearly 18 months before starting school the rate of nearly one per week was more to do with family factors than with waiting list pressures. The families' ethnic profile was mixed, with a large majority being from Pacific Island communities (50 percent) or Maori (30 percent). The "fee" to families was voluntary, with the suggested donation being $3 per week.

There were 38 children on the roll of the group in the research project, with their age range being about 2½ to 5 years. The group attended 3 hours daily. Another group attended into the afternoon. They were not included in the research.

There were 3 full-time staff members working with both groups at Rimu-tree centre. There had been 1 staff change in the previous 12 months. The staff were covered by a collective employment contract. The highest salary was approximately $34,500 per annum.

All staff had a Diploma of Teaching (Early Childhood Education) or its equivalent. The senior staff member also had completed a degree, and 2 additional teaching diplomas (1 relating to children with special educational needs). Two of the staff had more than 4 years' experience, while the third had completed her first year as an early childhood teacher. She was able to attend a First-Year Teachers' course. All the teachers were involved in on-going professional development activities, mostly together. These included bicultural support, and special education. Short courses included: Te Hangi Kaura, First Aid, Physical Education, and Working with Parents.

The staff team had 4 principles explicitly relating to learning theory in their philosophy statement,

* children learn best through experience,
* children learn best when they choose their own activity,
* children should be able to extend their learning at their own pace with support from adults and other children,
* it is equally important for children to learn to work with others and to learn to work independently.

The Rimu-tree centre's statement of philosophy also contained principles about the environment and equal educational opportunities, such as,

* all children need to learn to understand, appreciate and be confident in their own culture, the culture of the Tangata Whenua and the culture of Aotearoa/New Zealand.

Programme planning is set in a framework. The staff set goals for the year, then for each term, and then fortnightly. Once per fortnight the planning focuses on individual children (objectives, plus evaluations), and once per fortnight, the planning focuses on the programme. This planning involves staff discussion.

There is regular monitoring of children's development via the completion of at least one anecdotal record and two running record observations of each child every 3 months. If parents have concerns additional specific observations are conducted. In the final month before leaving, staff do time-sampling observations covering all areas of play curriculum, language development, and cooperative and individual play.

A record profiling each child is kept. The 4 headings used are: social, emotional, physical, and intellectual. Observation notes are included, as are examples of work. The objectives for each child are recorded, and looked at when doing evaluations.

When asked about children's behaviour, the supervisor provided the following rules,

* use equipment appropriately,
* use equipment where they find it - in the right place,
* use language to resolve disputes,
* no kicking, biting, hitting,
* wait their turn to use something,
* stay inside the fence.

The competencies expected of the children before they turn 5 were:

- communication:
  * able to communicate in own first language,
  * explain ideas, needs, wants,
  * hold a proper conversation, keeping to the topic;

- social skills:
  * able to work cooperatively with at least one child,
  * able to work alone,
  * able to take turns;

- learning:
  * make an attempt to solve problems,
  * persevere with tasks they find difficult,
  * try out experiences they are not confident at,
  * interested in normal environment, ask questions,
  * show knowledge,
  * ask for help if needed,
  * get everything they need before they start;

- early literacy:
  * know some things about books; e.g., right way up,
  * know that pictures give information,
  * can tell a simple story by looking at the pictures,
  * listen to short stories,
  * recognise own name when written;

- early maths:
  * able to recite at least up to 5,
  * able to match shapes and colours,
  * able to match small number of objects one-to-one;

- logical reasoning/puzzles:
  * know effective ways of solving puzzles; e.g., turn shape around, try other pieces,
  * ask for help if needed, either adult or child;

- physical ability:
  * able to walk, run, climb, jump, throw and catch a ball, swing themselves, dig, slide, balance on a plank;

- physical dexterity:
  * hold and use pens, brushes, scissors appropriately,
  * able to coordinate hand-eye movements - cutting, etc;

- music:
  * sing simple songs in own language,
  * know how to use a simple musical instrument,
  * take part in adult-led music/dance activity.

Again, the team felt that their research instruments had been validated by the high level of agreement between teachers and researchers about indicators of competencies in the different domains.

Centre Ratings

Each time the researcher visited a centre to collect the time-interval observational data on the children, she rated the centre quality on 4 variables:

* staff-child interactions,
* the fostering of children's self esteem,
* programme focus, and
* physical environment, resources and safety.

The results of these ratings are provided as additional information about the contexts experienced by the schema and comparison children.

The schema and comparison centres were remarkably similar in their total mean percentage scores[9]; see Table 1 below. However, there was some variation on 2 variables: the schema centres had higher mean scores for staff-child interactions, and the comparison centres had higher mean scores for fostering the children's self esteem.

Table 1

Centre Rating Scores

	Maximum score	*Schema*	*Comparison*
Staff-child interactions	25	20.23	18.18
Self esteem	25	17.46	20.46
Programme focus	30	23.31	22.55
Environment, resources & safety	25	21.15	20.91
Mean Total		82.15	82.10

Later we will show other data to validate the finding that adult-child interactions in the schema centres were better than in the comparison centres. Thus, although most of the quality indicators in the data indicate that there were few differences between the schema and comparison centres (this was intended in our centre sample design), staff behaviour on a few measures was different in ways that brought benefits to children.

[9] The percentage is of the centre scores against the total possible. Adjustments to the total possible were made on days when the weather precluded an outdoor programme occurring.

The Children

The target children met the selection criteria in age (4¼ to 5 years of age, with at least 6 months' formal early education experience prior to starting school). Twelve girls and 8 boys were initially randomly selected from those eligible. In one centre, all children who met the criteria were needed to have 5 target children per centre, but parents of one of these children did not give consent. Another child moved from the district just after the data collection started. Of the 18 children who did finally participate, half were described as European/English, 3 as Maori and English, 3 identified as Maori, and the remaining 3 were from Pacific Island countries. Twelve (66 percent) came from two-parent families, 4 came from single-parent families, and 2 from reconstituted families.

Earlier, we said that the children in the centres selected for study were described as middle class (1 schema and 1 comparison centre) or lower-middle, or lower class (the other 2 centres). When we looked at the target family data, we noted that 30 percent of the schema children and 43 percent of the comparison children were from average/below-average income households; two households in both groups were high income earners; and the balance were a little above average.

Differences Between Schema and Comparison Children

Using the interviews with the main caregivers, checks were made to see whether the children in the schema centres were markedly different from the children in the comparison centres. The few differences which emerged were mainly in the children's health, their activities and skills, and the families' socioeconomic status.[10]

Children's Health

* 4 comparison children and only 1 schema child were reported to be unsettled at the time of the interview because of stress at home, or concerns about starting school, although only one was described as not coping well;
* 1 comparison child was in poor health; all others were currently in good or excellent health;
* 3 schema children had been to see a medical specialist, all others had not;
* 2 schema children and 1 comparison child had hearing problems.

Children's Activities

* When asked by the researcher what the mothers did often with their children, mothers of comparison children were far more likely to say "explore/go to special places or events" (86 percent, compared with 40 percent);
* 40 percent of schema children watched 4+ hours of television per day, and more at the weekend. Comparison children watched fewer hours of television.

Children's Skills

* More comparison children (71 percent) were described as having a wider range of numeracy skills than schema children (50 percent), and these derived from a greater range of sources.

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[10] It should be noted that as we are discussing only 10 schema children and 8 comparison children (i.e., total of 18 children) percentages reflect small numbers and must be treated with caution.

Families' Socioeconomic Status

* 80 percent of the schema children's mothers were in paid employment compared with 57 percent of the comparison children, with half or more being in part-time jobs. However, more schema children's mothers had irregular work hours;

* A greater proportion of schema children's mothers were home during the day (60 percent) than comparison children (43 percent);

* The mothers of all the comparison children had spent time in senior secondary school. Only 70 percent of the schema children had spent time in secondary school. However, about half of each group of mothers had been awarded higher school certificate or bursary passes;

* 60 percent of the mothers of the schema children and 71 percent of mothers of the comparison children had attained a post-school qualification (degree or diploma, such as a Diploma of Teaching);[11]

* 70 percent of the fathers of schema children and all the fathers of comparison children had attained a post-school certificate or diploma;

* 50 percent of all the mothers of schema children were in professional or semiprofessional jobs. 42 percent of comparison children had mothers in higher status jobs (Levels 1, 2, 3, on the Elley-Irving scale, 1985);

* 30 percent of the fathers of schema children were in professional or semiprofessional jobs, and 66 percent of comparison children had fathers in higher status jobs.

Family Composition

* Another difference was that 2 comparison children and 1 schema child lived in single-parent households.

Similarities of the Schema and Comparison Children

There were a number of similarities between the schema and comparison children. These can be categorised under the following headings:

Children's Health

* Similar numbers (3) had birth difficulties;

* An equal proportion of the children (30 percent) had been in hospital.

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[11]This is high compared with the whole female population, and can be the strongest indicator of children's scholastic achievement (Kalmun, 1994).

Children's Activities/Skills

* All children were read to, with a similar frequency (mostly once per day);

* All children could recognise their own name in print and a similar high proportion could actually write their own name;

* All children could write or pretend to write lists;

* All children counted out loud and recounted their ages;

* A majority of children in both groups watched between 1 and 3 hours of television daily.

Other Similarities

* Both groups had similar changes in their lives to date (moved house, changed household composition, an absent parent);

* About equal proportions (50 percent) had attended more than one early childhood centre at one time - mostly for parent-related reasons;

* All had English as their main language, with about 20 percent of both groups knowing some phrases in another language (2 comparison children knew a little in a third language).

Families' Socioeconomic Status

* 85-90 percent of both groups received their income from wages or salaries;

* A similar very high proportion of households had major consumer items, including about 50 percent having home computers.

Summary and Comment

It can be seen that there were no stark differences between the 2 groups of children and their family backgrounds. It is possible that some of the differences would cancel out; for example, while fewer schema families had low incomes, more of them spent a higher proportion of income on housing; more mothers of schema children had paid jobs, but they worked irregular hours and were more likely to be home during the day; and fewer comparison children had mothers in professional or semi-professional jobs, but more of their fathers were in professional occupations. From other studies (eg, Kalmun, 1994) any difference in children's achievement is likely to favour the group whose parents' (particularly mothers') occupations are high status (and those whose mothers' education and fathers' education is greatest). Given that there is little difference between the groups with regard to mothers' occupational status, there could be some influence from the comparison children's mothers' higher educational qualifications.

The Children in Context

Some data taken from the child observations provides a more detailed picture of what was happening around and for these children during the period of the research. About a quarter of the observations were done when the target children were in a mixed age group with some infants and toddlers present - this reflects the roll and arrangements at Matai-tree comparison centre. Nearly two-thirds of the observations located the children indoors, which is to be expected given weather constraints and the proportion of time children spend indoors for snacks and meals, and to engage in a range of activities.

The target children averaged 10 percent of their time alone (mostly engaged in active solitary play), and 90 percent of their time with other children. Forty four percent of their time was spent with one or more teachers - over half of which was with one adult close by. Interaction with the researcher happened during another 4 percent of the observations. The children initiated contact with the teachers during only 6 percent of the observations. The most common child to adult interaction was a short verbal exchange (one-third), and other forms of interaction such as a cuddle, request for help, and a conversation occurred with slightly less frequency. For the most part (90 percent of the time), the adults did not initiate contact. When they did, most adult-child interactions were simple or elaborated somewhat. A negative tone of voice was practically never heard (2 percent of the observations).

There was minimal aimless wandering (1 percent), and 4 percent of time was spent as an onlooker, observing what others were doing.

In observing the social skills of the target children with other children, we found that the dominant social interaction was Simple Interactive (45 percent of the observations). Howes (1989), who developed the scale, regards this form of social interaction as less complex than role reversal play or pretend play. We observed only 7 percent of the former, and 16 percent of the latter. Aggression (physical and verbal) was seldom observed (2 percent in total).

Problem solving was not a common phenomenon. Verbal problem solving by the children was noted during 6 percent of the observations, and exploring material to solve a problem occurred 14 percent of the time. A related finding was that the teachers were seen to be providing cognitive language extension during only 7 percent of the observations.

In the next chapter, qualitative data are presented to illustrate schema development in some of the target children. The subsequent chapter contains quantitative data which indicate that positive benefits do accrue to children when teachers identify, support, and nourish schemas that children are working on.

CHAPTER 5

SCHEMA DEVELOPMENT IN THE 10 CHILDREN

Introduction

Cathy Nutbrown (1994) has continued the work of Chris Athey in Great Britain. Nutbrown brought the perspective of an early childhood teacher and adviser to her research. Her aim was "to provide evidence of children's thinking about, and learning about, their world. ... to think more deeply about children's action and a voyage of discovery into the riches of children's minds," (p. x). Nutbrown devotes a whole chapter in her book to three case studies of children, drawn from a study of 40 children, to demonstrate "Schemas as Consistent Patterns of Behaviour". Her purpose was "to identify ways in which theory about patterns of development and schemas might be useful in practice" (p. 40).

In this substudy of the *Competent Children* project, the New Zealand research team was also motivated to carry out research on patterns of development and schemas which might be useful in practice. By adopting an action research approach, we felt that the 2 schema centres involved in the study would definitely learn more about schema theory and its application. Their experiences could throw light on how early childhood teachers can think more about children's thinking. We believed that there would be positive spin-offs for children and adults at the centre. However, there was some tension inherent in the study in that the *Competent Children* project is primarily an outcomes study. This meant that our observations were designed more to help explain any differences in results between the schema children and the comparison children than they were to provide steps for teachers to use in their work with young children and/or to get detailed data to advance the theory developed by Athey (1990)[12]. Notwithstanding our different aim, we believe that this chapter, and the last two, contain plenty of material about schemas for practitioners to use.

Multiple Observations

"Schema spotting" in centres with many children and lots happening is not easy. The schemas could be confirmed when the different sets of observations were read in conjunction with one another. Thus,

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[12] For example, Athey says more research needs to be done to find out how schema are coordinated in children's thinking for the development of concepts. This would require far more detailed observations than the *Competent Children* researchers had the resources to gather.

schema spotting is probably easier when a range of observational techniques is used. Different observational techniques were used by different participants in the substudy. The researchers used the techniques of running record, time-interval observations using categories, and a brief running record to accompany it. Teachers used anecdotal records (as and when they thought they identified schema work), and running records. Parents told us anecdotes.

The observation records written down by the teachers, parents and researchers about schemas proved to be not as detailed as the research team hoped or needed for some types of analysis. The reasons for this were probably both pragmatic and motivational. However, the multiplicity of observations of the same children was useful in identifying the schemas the children were absorbed with during the two terms of the action research. For example, if the teachers doing anecdotal records were unsure whether they were seeing a repeated pattern of action, often it could be confirmed by the action researcher's running record observations of the child. At the analysis stage, further confirmation was evident in the other researcher's time-interval observational records (but this was too late to be useful for the teachers).

Combing through the multiple observational records revealed how much theoretical detail needs to be absorbed to make full use of schema theory in observation of children and in curriculum practice. Teacher educators and researchers could help practitioners by improving the presentation of the theory, for example, by drawing attention to the fact that children work on *figurative schemas* which are static as well as on dynamic *action schemas*, and highlighting the way children progress in their thinking better when adults notice and support thought-level work on schemas.

Case Studies of Children Working on Schemas

In this chapter, case studies of the schema children are provided to explain how their activities and learning experiences demonstrated periods of absorbtion with *figurative schema* (based on the children's perceptions) and/or *action schema* (based on the children's actions).

Figure 5
Types of Schemas

Figurative	*Action*
Lines	Dynamic lines
Curves	Dynamic circular
Space orders	Going over, under, through
	Enveloping, containing

The first set of case studies include examples of *figurative schemas*, and the remaining case studies focus only on *action schemas*. As many of the children were working on both types of schemas some children feature in both sections of the chapter. In the case of Paul, his work on figurative schemas was so interwoven with his action schemas that we provide all his data together in one section.

Figurative Schemas

Figurative schemas are static representations of the way children perceive the world.

Bob[13]

'Lines', 'Space Orders'

Bob was the second in a family of 3 and a half children (his mother was pregnant at the time of the study). His attendance at the centre was not regular because of transport difficulties and the number of young children in the family. His mother was interested in the project and its focus on schemas. When we asked him what he liked best at the centre, he replied "Being at kindy."

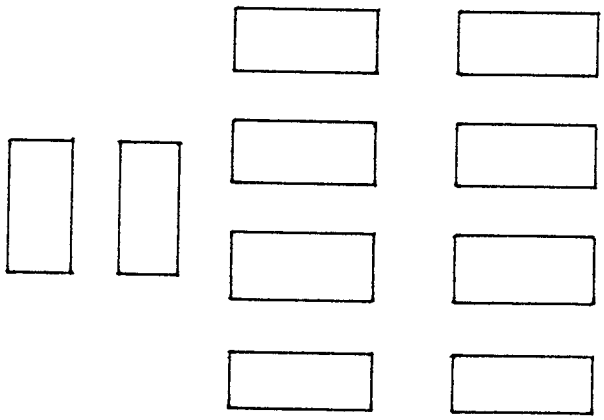
Bob's mother told the researcher that he had been focusing on 'lines' and both the 'vertical' and 'horizontal order between objects `off and on' for over a year. She knew Bob exhibited this pattern of behaviour at the centre as well as at home. She said that he placed his cars neatly in line ('horizontal order') and balanced his skateboards on top of each other ('vertical order'). Her mention of more than one skateboard also sent a signal of his interest in 'dynamic horizontal', a possible *action schema* extension of his *figurative schema* to do with lines. We will take that up in a later section in this chapter. Bob also seemed to be absorbed with 'enveloping' action schema, but other children are used as case studies for illuminating how children explore 'enveloping'.

The teachers also felt that Bob was working on the 'spatial order of lines' and on 'dynamic horizontal' (more on this schema later). They pasted a painting into his profile book when he was 4:8 which was covered with blue, orange, and some black, vertical, and horizontal lines.

The action researcher was able to capture more examples of Bob working on *figurative schema* to do with horizontal and vertical lines or space order.

Figure 6

Bob's Line up of Cartons



[13] The names in the report are not the children's real names.

Bob (4:7), with 2 boys, was loading small vehicles on the flat roof of a toy garage. Bob told the boys where to park them until all the garage area is full. ('proximity' and 'horizontal order between items')

Bob took about 30 minutes to make 2 caterpillars by painting egg cartons and lining up those he had painted on the floor. Again he was exploring `horizontal order between items or lines'.

Bob (4:8) was painting egg cartons with cotton buds and pallet paints, with a friend. Bob lined up the finished product on the floor in a careful neat arrangement. He had been working there for 20 minutes already. He drew on a carton with a pencil before he painted it. Again, he aligned the finished carton with the others, precisely. He took one back to the table. 'I need a tail on it, I've got 2 caterpillars.' [After a conversation with his friend,] Bob returned to painting another carton, different colours down each side. He went to look at what the girls were doing 3 times, then returned to his work. He had lined up 10 cartons.

He took one back and painted its "feet" carefully and thoroughly with yellow, then said, 'I am going outside now.'

The time-interval observations of Bob confirm that there were patterns of behaviour related to 'lines', 'dynamic horizontal', and 'dynamic vertical' in that 10 of the 15 one-minute observations included mentions of these schema - not that the researcher collecting the regular data was watching out for schemas! Some examples from her observation notes include,

Bob (4:8) stood painting at an easel. ... He drew flowing long lines ('Stripes') and large circles (curves).

And later that day,

Bob walked to the art table. He got some scissors and some wool. He cut off pieces of wool ('lines') and put them in a yoghurt pot (curves).

Anita

'Lines'

Anita had 3 schemas she was exploring - 'lines', 'enveloping' and 'dynamic horizontal'. We will focus on the latter schema (an *action schema*) later in the chapter. Anita had been to the same centre since a toddler. She is an only child. Her mother told the researchers about her 'enveloping' and 'enclosure' activities, but the details in the notes are minimal. The teachers noted her interest in 'lines'.

Anita (4:5) was sitting on the floor with 2 girls pushing a truck along a track. She helped to rebuild the track, fitting the pieces together competently ('horizontal line').

A month later, the staff records describe Anita drawing on "the blackboard with a piece of chalk in each hand, side to side, horizontal marks, then vertical, making a grid" ('lines').

Emma

'Horizontal lines' and 'Vertical lines'

Emma comes from a family of 4 people, and her brother is older than she. She attends a variety of early childhood services each week - kindergarten, childcare centre, and care in a private home a few hours per week. She was described as a quiet, happy child, who was equally content to work on her

own as with a group of children. She described family play when asked about her favourite activity at the centre.

Emma's mother said to the researcher that she thought that Emma was working on several schemas, but felt that 'enveloping' was dominant at that time. The researcher's notes confirmed both points. (We will use Emma again to illustrate 'enveloping' schema.)

The paintings which were mounted in her profile book indicate that Emma was interested in kowhaiwhai patterns, usually a series of vertical patterns. At age 4:8, the researcher provides a running record observation of Emma at the easel with a teacher close by.

> The teacher asked her whether she would like to do another kowhaiwhai painting. Emma said, "Ae" [yes]. The teacher suggested, "You could do a pattern like the picture you have just finished, where you went up and down, up and down, and go right across the page." Emma replied, "I went like this," demonstrating vertical lines with her finger. She began to paint the picture. The teacher reflected Emma's actions in words. "You're using white paint, red paint, and white paint again. The shapes look like triangles. Your brush is going up and down, up, up." Emma laughed.

This was one of the rare occurrences where a researcher observed a teacher providing language support for a child working on a schema. The researcher's field work journal, however, noted that this teacher increasingly reflected children's schema with appropriate language.

The other observation captures Emma exploring `dynamic vertical' by using the static horizontal lines of ladders.

> Emma (4:7) was outside. She climbed the ladder on to the cable reel, talked to a boy, then climbed down the ladder and straightened the mat. She climbed the ladder, jumped across the space between the cable reels ('dynamic horizontal') and climbed down on to the mat. She repeated this four times ('dynamic vertical').

It could be said that Emma was also exploring grid patterns by her repeated actions. Some functional dependency calculations relating to momentum were probably also occurring.

Valerie

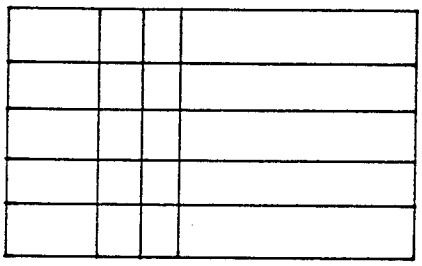
'Ordering'

Valerie has a younger sister, and lives in a family of four. She attended family day care from age 6 months until she was able to start at the centre, which she has attended for several half days per week for a couple of years. Neither researcher achieved a full set of observations because her attendance was not regular. She was mostly observed engaged in physical activity or pretend play. In her interview, she told the researcher that what she liked to do most of all at the centre was play with dolls.

Valerie's mother was intrigued by her daughter's fascination with collecting things and putting them into piles or different pockets [according to category].

The staff notes indicated that her art work also showed a fascination with 'ordering' as well as with 'lines' and 'curves'. At age 4:10, Valerie's art work was dominated by radials and rainbows ('curves'), 'verticals' and 'grids', and dabs. Unfortunately, we obtained only one sample of her drawing, or painting. At 4:11 she drew a 'grid' with different coloured felt pens, and said it was, "A coloured trap". (This was the only piece of art work we found.)

Figure 7
Valerie's Coloured Trap



(different coloured felt pens were used)

A week later, she painted an oblong and filled it with dabs, saying, "We'll just put these dots in the middle of here" ('enclosure, space order').

Jan and **Sam**
'Connecting'

Jan and Sam attended the same schema centre. Jan's mother was very quick to appreciate schema development when it was described to her. When the theory and the dominant schemas were described to her, she immediately gave several examples of Jan's 'connecting' schema.

Jan (4:9) tied all the laces from shoes between or to chairs all over the house.

Jan (4:10) was very interested in a TV programme on trains and asked how they were all stuck together. Soon after he joined cushions together on the floor and joined pegs together in long chains.

Jan (4:10) arranged video cassettes on the floor all in a row, touching.

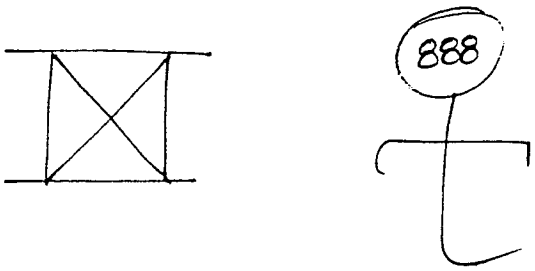
Several weeks later, when she was interviewed prior to Jan starting school, she said that Jan seemed to have lost interest in this schema, and no other schema were dominating his behaviour.

The staff and action researcher had difficulty in identifying any repeated pattern of exploration, and little shows up in the time-interval observation records, except that on 2 of the 3 observation days Jan was observed on the obstacle course 2 feet above the ground walking across the planks and ladders which 'connected' the "separate" boxes and cable reels.

Two undated pieces of art work in Jan's art portfolio demonstrate an interest in 'connection'.

Figure 8

Jan's Art



Sam's mother also responded immediately with descriptions of his obsession with connecting through space. She said he was "into tying chairs together". We observed Sam in one of 2 early childhood settings he attends. In that centre, like Jan, Sam also spent time in and around planks which 'connect' boxes, and on making trains which were 'connected'.

> Sam (4:11) was sitting on the sofa watching 4 children balancing and walking across a plank balanced across 2 boxes like a bridge ('topological space, connection'). A parent helper was standing in the door talking to the children on the plank. She then turned and walked away. Sam jumped off the sofa and jumped across the plank in front of 1 of the boys. The boy said, "Hey; I'm walking." Sam looked at him and smiled. He lay underneath the plank and tried to lift it as the boys walked over it. One of the boys said, "I'll tread on you." Sam laughed and carried on pushing his arms up to try and lift the plank ('functional dependency, going over, connection').

Sam's trying to lift the plank while children were on it gave him functional dependency information that a connection may be made stronger when there is a weight factor.

There were 2 days about a week apart when Sam was observed pulling trains around a room.

> Sam (4:11) was sitting on a mat with another boy with the Duplo blocks and trains. He had a train with 4 carriages behind, pulling it along the mat going "ummm, ummm, ummm". Sam pulled it behind the boy who sat and watched him. He pushed it hard into a pile of bricks and it broke up. Sam said, "Oh, no." ('connection', then 'separation').

> Sam (4:11) had 7 little carriages ('connection'), part of a train set. He pushed this around the floor and headed into another room" ('dynamic horizontal').

Later that day, one of Sam's teachers helped him with making physical connections by fixing his rod and line. A few minutes later, he asked her how to make a fish. She used language to do with tying (to connect) in response to his questions about making fish, demonstrating that she understood that what Sam was asking was about joining a 'fish' to the line. This was the only occasion we recorded any conversation between Sam and an adult.

> Sam (4:11) was pretending to catch a fish. His fishing rod fell apart ('separation') and the teacher fixed it [without using any 'connection' language]. Sam took his rod and line to another area and pretended to catch' ('connect with') a fish. The other child said, "That cannot be a fish." Sam asked the teacher how to make a fish, and she explained what was needed.

Half an hour later, Sam was up in the tree fort with 1 other child. They had fishing rods made of sticks and wool. Now there was a block of wood tied to the end of the wool (that is, his "fish" was 'connected').

The teachers' records capture an event where Sam was exploring 'connection' mechanisms. This was when he was younger.

> Sam (4:7) carried some rope outside with Raymond. They linked 2 trolleys together with the rope. The rope fell off so there was some joint problem solving as to how to attach ('connect') the rope to the trolleys. In the end, Sam sat on the back of one of the trolleys holding the rope link to the other.

A lot of Sam's behaviour was disruptive or aimless wandering. However, we noted that he was able to stay on-task for quite a length of time when absorbed with 'connection' schema behaviours.

Figurative and Action Schema, Interwoven

A number of children explored the static and the dynamic variations of schemas at the same time. One child provided striking examples of this pattern.

Paul
'Circular enclosure, and core and radial'
'Dynamic circular'

Paul was the youngest of the schema children, and was still falling asleep at the centre some days. He came from a family of four. His sister was older than he.

As with Bob, the researchers and teachers thought that Paul was working with several schemas at the time of the field work - for example, 'circular enclosures', 'connecting' and 'enveloping'. However, as he was the only schema child who could provide a case study of 'circular enclosure, and core and radial', and 'dynamic circular', this is the focus of his case study. Because there seemed to be a very close link (within minutes sometimes) between Paul working on 'circular enclosure' (a *figurative schema*) and 'dynamic circular' (an *action schema*), we will present Paul's data all together here.

The time-interval observations indicate Paul using 'circular enclosure' in 5 of the 15 observation periods. He chose the sandpit which is encircled by a tractor tyre in preference to the oblong-shaped sand-pit. When 4:8, Paul spent over 5 minutes one morning, examining first one and then another roll of sellotape. At the end of that week, Paul combined his interests in 'circular enclosure' and 'connecting' by taking advantage of the teachers' supply of connecting material. He tied a cord around one wrist, thus enclosing it. This took a considerable amount of time and effort. He then got the other end of the cord, and with help from an adult, tied that end of the cord around his other wrist (another 'circular enclosure') which resulted in one part of his body being 'connected' to another. This proved to be a powerful learning experience about the state of connectedness. Another day, Paul (4:10) walked around with a cardboard tube and tried to fit it over a variety of items or fit things into it ('circular enclosure').

In the case of Paul, it was the action researcher, who was consciously trying to spot schema, who noted many examples of Paul's interest in 'circularity'.

> Paul (4:4) was following [supervisor], helping to tidy the centre. He keeps moving his hand in and out of a towelling elastic hair ring ('circular enclosure'). He found a wheel ('circle') and gave it to [supervisor].

Paul (4:5) moved to the sand trough in the other room, poured sand on to the water wheel ('core and radials' and 'dynamic circular'). He had the wheel turning well. [Another child] put a handful of sand on the wheel. Paul said, "No, don't help me." He stopped it turning, got the container [for pouring] and refilled it. The wheel became clogged, so he put his finger in and unblocked it ('dynamic circular, functional dependency').

Paul's immediate move to the source of the blockage for the wheel's rotation demonstrated his understanding of the function of the 'core' of the wheel - in this apparatus the inner rod had a circular enclosure to which the radials were fitted. Sand or water poured on those radials caused the wheel to turn provided that the 2 inner circles were not restrained by friction. He got rid of the source of the friction when the wheel clogged.

Paul (4:6) and two other children were playing chasing. He had some string tied around him ('circular enclosure').

Paul (4:7) was twirled a lasso ('dynamic circular').

And on the same day,

Paul [at the collage table] made a crown and placed it over 2 yoghurt cartons joined together ('circular enclosure'). After sellotaping strips of card to larger card, he moved into another room and twirls his lasso ('dynamic circular').

Ten minutes later,

Paul "juggled" a ball ('dynamic circular'), then tied a scarf around his head ('circular enclosure') and lay down and "slept" on a cushion.

Nearly an hour later, when the researcher returned to observing Paul after spending time observing 2 other schema children, she found him still working with his lasso.

Paul was attempting to lasso a tree. He threw it around the tree several times, rotating it before throwing it ('dynamic circular, functional dependency'). He threw it on top of the fort, then on to the verandah railing.

In his work with this *trajectory schema*- an *action schema* where an object moves through space - Paul had observed through his own actions or from watching television, that rotating a lasso before sending it to "catch" another object helped its speed and/or distance. This schema or coordination of schemas were still fascinating him a month later.

Paul (4:8) was swinging a rope around, attempting to throw it over the branch of a tree ('dynamic circular, trajectory').

Later that day, the action researcher became involved in another of his experiments with the 'dynamic circular' schema. She supported and nourished his schema.

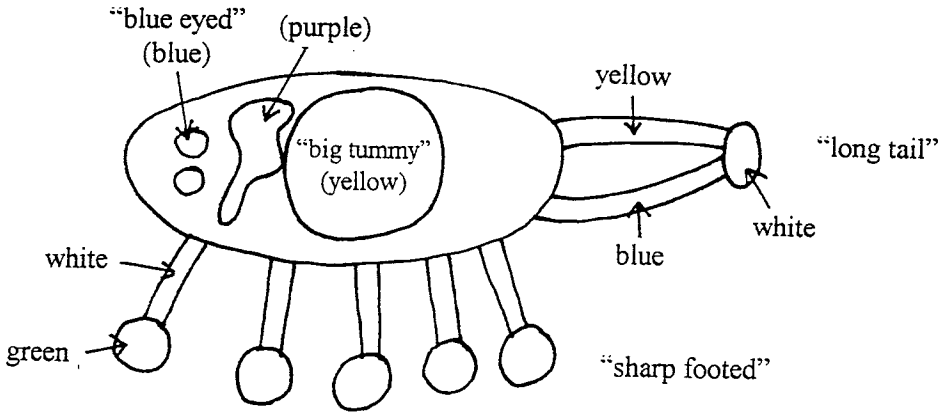
Paul took a length of wood and returned to the outside playground. He tied the rope to the wood and I helped secure it to a tree. He swung back and forth, then side to side, then round and round ('dynamic circular'). I used words to describe his movements to him.

Paul's parents completed some observational records for a few days about that time, when Paul was 4 years, 7½ months of age. On the first day, they noted he had drawn "a painting with circular shapes - said it was a fire hose". A day later, they recorded that Paul had built a "pin wheel special machine out of a shoe box, with pins [forming] a circular protrusion out the side and stuck out the top" ('circular').

The teachers' anecdotal observations were also littered with examples of Paul's fascination with "circles" and with "dynamic circular". As their notes are very brief, we cannot report the detail of what occurred in many instances. At age 4:4, on 2 separate days, they noted 'enclosure' on the schema chart. At 4:5, they kept a painting of his for the researchers which used a 'circle and radials'.

Figure 9

Paul's Smiling Funny Creature

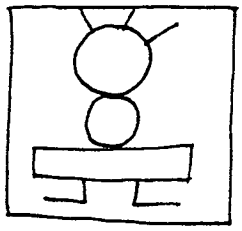


('enclosures', 'radials')

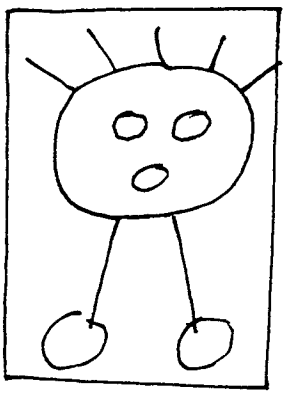
About the same time, the staff noted on the schema chart that Paul had spend a period of time "holding a cape in his right hand, whipping it around and around". Two days later, they recorded, "twirling a poi in his right hand". The supervisor wrote in Paul's profile book (which was shared with his parents) that his art work was mostly 'enclosures' and dabs. Paul was then aged 4:3. When Paul was about 4:8, the supervisor wrote, "He has a fascination with things that go around - spirals and pieces of string that he can twirl around" ('circular dynamic'). The staff, aware of this fascination (as well as with 'connection'), provided Paul with additional suitable material to use - rope, sewing tape, string - in order to facilitate his learning around these schemas. They also took sketches of his art during this period, and noted the repeated patterns or *figurative schema* of 'circular enclosure' and 'core and radials', as well as 'grid order outside of a discrete figure'.

Figure 10

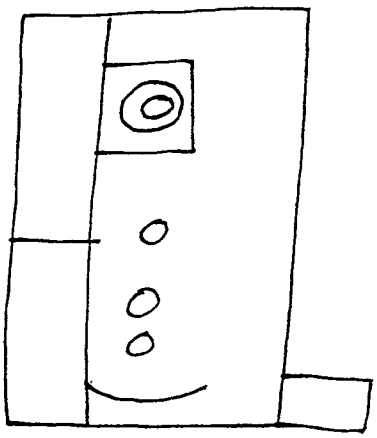
Paul's Dad Paintings Approximately 1 Month Apart



May



June



July

During the last interview carried out before Paul turned 5, Paul's mother described his on-going interest in circles and radials, "In his drawings I have seen semi-circles, radials and connection". She also said that he makes things "using bottle tops to "turn things on" such as radios" ('dynamic circular, functional dependency').

These schema explorations were an enduring pattern over months. No-one captured records of Paul at thought level with the *action schema* associated with 'circles', but that could be to do with the adults' concentrating on concrete actions and drawings in their observation notes. It could also be because he seldom had close contact and conversations with any adult at the centre - only 2/15 time-interval observations found him within a metre of a teacher (once when he got sand in his eye, and the other time when a teacher was trying to persuade him to go inside for a drink and snack).

The sand clogging the water wheel and Paul's rapid solution to the problem suggests that he had arrived at the thought level, but as there are no records of any conversation in the abstract we cannot confirm this hunch.

We were left with the impression that Paul did not feel a need for social interaction with the staff and yet his language and intellectual development were likely to have been enhanced if his work on these schema had been nourished by adult talk related to his thinking.

Action schema

Action schemas are also described as operational systems of knowledge by Athey (1990), and she points out that they involve more conceptual thought than *figurative* knowledge. Generally, children go through a progression of stages when working with *action schemas.* There is a motor level (our data often focus on this stage), a symbolic representation level, a functional dependency relationship exploration level, and finally the thought level evident in talk about something in the abstract.

Bob

'Dynamic vertical' and 'Dynamic horizontal'

Earlier in this chapter, we described some of the things Bob was doing with 'vertical' and 'horizontal' in his figurative work. We noted that he was also interested in these schema in their dynamic forms. His mother was the first to signal this to the researchers when she told us of his interest in skateboards - he had not one, but two skateboards! More than one skateboard would provide scope for comparisons between the two and relating the differences to size and weight and wheel qualities - in other words, exploring functional dependency relationships. Other equipment extended these forms of thinking. When Bob was 4:7, the teachers' running record of him captured him "on a bike, going forward and back in small spurts".

Bob was also working with and thinking about 'horizontal vertical'.

> Bob (4:8) was sitting on a see-saw in the garden, in the middle holding on. One other child was on the end. Both were laughing and rocking. The other child said, 'Let's do it high, eh?' Bob smiled, moved off the see-saw and got back on at the other end, knelt, and said, 'Yes, really high'. ('Vertical dynamic', functional dependency). Both began to rock and chant together, 'Waay, waay, waay'.

In this action, Bob demonstrated that he had thought that he could go higher on the see-saw if he knelt on the end, rather than sitting.

> Bob (4:9) pulled a truck toward towards a tree ('dynamic horizontal') and tried to fit the truck through the gap between the sandpit and the tree. It got stuck so he pushed it back, lined it up (functional dependency relationship) and pulled the truck through the gap and smiled.

And later on the same day,

> Bob was sitting on the mat building with the blocks, placing one on top of another. Another group of children were building an elaborate tower next to him. Bob stood up and pushed their building over ('dynamic vertical'), and smiled.

In the final example from the time-interval observations, Bob connected two lines - the tie on the hood of his jacket and a piece of wool - to a piece of wood and experimented with pulling these items ('connection') along the ground. Again he seemed to be at the functional dependency stage of working on 'dynamic horizontal', figuring out that the length of the ties might contribute to the difficulty he was having in 'transporting' the piece of wood over a rough horizontal surface. There are lots of variables in this experiment.

Bob (4:10) tied a piece of wool which was attached to a nail in a block of wood on to the tie from his hood. He tried to pull the wood along by walking backwards but the block of wood kept turning over on the sandy soil and getting stuck, so he held the wool about 18 inches from the wood and pulled it until he reached the concrete path. He then let go of the wool and walked backwards, letting the hood tie pull both the wool and the block, gradually walking faster as the block slid easily over the concrete.

This observational record was one of the last collected about Bob. We think it indicates that he was coming close to the thought level in his work with 'dynamic horizontal' schema. We did not capture any anecdotes of him working on these schema entirely in the abstract, but that may have been because there were fewer opportunities for children to engage adults in conversations as Bob attended the centre with over 40 others on the roll, and 3 teachers.

Anita

'Dynamic horizontal'

Anita's intellectual fascination with 'dynamic horizontal' mostly showed up in the action researcher's notes, although the teachers had also noted the pattern of behaviour on the schema chart. A few examples from the researcher's field notes provides more examples of the way children explore 'dynamic horizontal' schema.

Anita (4:6) was inside. She scooped sand from the trough on to the floor ('dynamic vertical, trajectory'). She crawls on the floor, stands and dances, scraping her feet along the sandy floor. She fills a funnel with sand, moves around the room allowing the sand to flow on to the floor. She said, 'Everybody', shuffling rapidly, 'Everybody'. She ran in a circle, shuffling.

About 15 minutes later, the researcher found her still experimenting with sand on a horizontal surface - a table.

Anita vigorously swept the table free of sand with a wide arm movements. She tipped another container of sand on to the cleared table and swept it thoroughly again. She fetched a broom and swept the sand on the floor with a broom, back and forth. Then she got a dust pan and brush and swept the sand with that brush for another 5 minutes ('dynamic horizontal').

The following week, the researcher's notes showed that Anita spent 15 minutes with another schema child trying to push a large wooden train up slopes and along paths on the outside playground area.

Anita quite often used her own body to explore 'dynamic horizontal' schema.

Anita (4:9) fitted one cardboard carton inside another and walked around with it balanced on her head.

Anita (4:11) was walking around with her feet in beakers.

In both the examples above, she was moving objects horizontally by wearing them. In the next example, the teachers provided materials for her to gain tactile experience of 'dynamic horizontal'.

Anita (4:11) was finger painting - reluctant to begin with, but soon very involved - moving her hands very energetically on the table.

Looking over these notes, we reflected on the value of free-form materials for Anita's exploration of 'dynamic horizontal'.

Susan

'Boundaries', 'Going Between' and `Maps'

Susan's mother alerted us to her intellectual interest in 'maps', and made reference to 'boundaries'. Although the researchers' observations showed hardly any examples, the teachers' records confirmed Susan's interest in maps. At 4:2, the profile book says "Susan continues to draw pictures of maps and machines - works with care and concentration." About the same time, the staff observed,

She has shown an interest in following the boundary of the centre fence line, and on walks follows lots of different tracks ... often interweaving.

Small groups going on walks in nearby park land was part of the regular routine of this centre. The numerous different tracks had allowed Susan to explore the foot traffic routes and the notion of 'going between'. Soon after, she started making paper darts and throwing them ('going between'). The staff records told us that Susan was painting maps and tracks at age 4:6.

Two girls from different centres, as well as Susan introduced above, were particularly absorbed in learning more about the schemas to do with 'enveloping' or 'containing'. These schemas were also evident in other children's patterns of behaviour; and seems common around the age of the target children in the study. Athey (1990) found that they came after children's interest in *trajectories*. She noted that these schemas have received a good deal of attention in the literature, and gives the example of Donaldson (1978) finding her research subjects being fascinated with 'fullness' and 'emptiness'; and cites Brown's (1973) finding that when children were exploring the notion of 'inside', they wanted to discuss topics to do with containers such as waste-paper baskets, boxes, pots, and so on (ibid., pp. 149-50).

Susan, Stephanie, Chris, and **Emma**

'Containing' and 'Enveloping'

Both the staff and the action researcher noted that Susan was doing quite a lot of wrapping ('enveloping') when she was about 4:8. Susan wrapped blocks in tissue as presents for children who were pretending to be asleep in beds ('enveloped') on the floor, and put these under their pillows. She also wrapped all her art up in parcels.

Our first example of containing will be very familiar to all who know children of this age.

Susan (4:10) spent quite some time filling different containers with sand, first a pot, then an ice-cream container. She told Darryl, "Don't put it [sand] in - it's mine."

On another day when we were observing her, Susan was intellectually fascinated by changes to different objects when they were immersed ('enveloped') in water.

Susan (4:11) was with 2 other children by a basin of water. Susan had a sponge and pushed it in, then pulled it out and squeezed it, twice.

An hour later she had returned to the basin, this time with a flower.

Susan was in the shed with another child experimenting with flowers in the basin of water. She selected one, turned it upside down and then pushed it up and down in the water, watching the changes to the petals. 'These are octopuses, eh?'

Stephanie was an interesting child in the range of explorations she was engaged in. Her mother said, "She seems to be into everything at the same time." More than most other children in the study she engaged in complex pretend play at the centre. By definition, this involves drawing on a large range of past experiences and cumulative knowledge to carry out. Susan was also frequently involved in these pretend play activities. They shared an absorption in the same schemas and probably enhanced each other's understanding of 'enveloping' and 'containment'. Given the amount of pretend play, it is likely that these children were also working on social schemas (not explored in this study) such as gender.

Stephanie comes from a family of 4, and has an older brother. Her mother tipped us off to her interest in 'enveloping', saying that there was a lot of wrapping things, and putting things into beds and covering them up. This was seen at the centre as well. The teachers were equally aware of the 'enveloping' schema. They described her as fascinated with parcels, wrapped and stuck with sellotape.

Stephanie (4:6) announced, "We are going on a picnic. That's a nice spot." She carried 2 plastic bowls and 3 chocolates (in reality, blocks) and a container of pipe cleaners to Susan on the couch. They wrapped the blocks in paper ('enveloping') and then hopped around the room, "We're rabbits." Stephanie lifted the inverted plastic container and hid the parcels underneath ('enveloping/ containment'). Three other girls pretended to go to sleep. Stephanie and Susan hopped to them pretending to be Easter Bunnies and hid the parcels under their pillows ('enveloping'). The girls woke up and "ate" their "chocolates". This play was repeated and sustained for 30 minutes.

Ten days later, the action researcher was visiting again. Every 45 minutes when she did a running record observation of Stephanie she noted wrapping ('enveloping') going on.

Stephanie (4:6) folded a piece of paper into a parcel and sealed it with 6 strips of sellotape.

Stephanie joined 2 girls in decorating me. After a few minutes, she went and folded a piece of paper, taping it together with a generous amount of sellotape. Next she found a milk bottle top and covered a bottle with it, taping it on.

Stephanie made several firmly sellotaped parcels of "fish and chips" for the "bird" (another child).

When the action researcher next visited, a month later, she was again subjected to being 'enveloped' in decorations by Stephanie, Susan and another girl.

Stephanie (4:7), Susan and Barbara decided to decorate me as I sit observing them. They made necklaces, decorations, wings, and presents which they draped over me.

Stephanie was sitting with another child on a chair. Both were putting fabric on to soft toys and covering them.

Outdoor play also presented opportunities to trying 'enveloping' using natural materials.

A group of children were pretending to be a family working in their garden. Stephanie (4:8) brought pieces of shrub she had broken off, poked a hole in the ground and "planted" the pieces, patting the soil around the plants ('enveloping' the bottom half).

This action was repeated and lasted for more than 20 minutes.

The next event we describe probably held many excitements for Stephanie, because it was a science experiment with novel, attention-grabbing results. It was adult initiated, but would have added to Stephanie's experiences which enhanced her thinking about 'enveloping' and 'containment'.

Stephanie (4:8) joined a teacher and other children in the kitchen. They sat at a table. Each child was given a teaspoon of baking soda to put in a cup. A jug of vinegar was passed around, and children poured it over the baking soda ('enveloping'). There was much comment from the children about the resultant fizz, and questions were asked about why the bubbles in some cups came half-way up, whereas in others they filled the cup ('containment'). Stephanie added more vinegar when her mixture went flat, and asked for a spoon to stir her mixture (exploring 'functional dependency' possibilities).

Stephanie's exploration of floating/sinking an object in water described below (where she started to explore a more complex concept putting together her understanding of 'enveloping' and other schema) provided an example of an opportunity lost by a teacher. The event started with Stephanie engaged in pretend play with Susan and 2 other children where a small stone was the "baby" in a "family" of stones.

Stephanie (4:10) said, "This is the baby stone," then moved out of fantasy play, and commented that another stone was heavier. She went to a teacher and said, "Can we get some water to float this one?" The teacher agreed. Stephanie fetched a bowl ('container') and put water in it. She tried to see if the 'baby' stone would float, and found it sunk like the heavier stones ('enveloped/contained'). The teacher did not join the group to provide language which could enhance their thinking.

Later that morning, Stephanie used her own body and senses to explore 'envelopment/ containment'.

Stephanie was having afternoon tea in the kitchen. Rather than eating her plum, she put it into her mouth and felt it, and pushed it out. She repeated this action several times.

Containment came to the fore as Stephanie grew older. By this time, Susan had left the centre and started school. Stephanie was using containers twice when the action researcher carried out running record observations one morning.

Stephanie (4:11) and 3 girls are in the bookshelves playing with dolls. They have 'lollies' in cups.

Stephanie and Barbara are sitting listening to a story. Their 'babies' are in a large green box with a fitted lid. Stephanie puts the box into a larger yellow tub, then takes it out.

The researchers asked the staff if they could read the profile book which was sent home to Stephanie's parents from time to time. This book captured some additional explorations of 'containment'. The teachers opened their commentary (age 4:7) with a list of the schema they thought Stephanie was working on. The list was mostly *figurative schema* observed in her many creations - drawing, painting and construction: semi-circles, radials, verticals, horizontals, crosses, grids, 1:1 correspondence. They also noted 'connection' and 'containment/enclosures' (*action schema*). Their commentary continued,

> Stephanie is very interested in copying what she sees. Susan painted a picture of a teapot, then Stephanie painted an almost identical one (*figurative representation* of a container), but she added a handle and a spout.

A teapot in a painting was noted again in a later entry by a teacher in her profile book (undated). The teacher then went on to describe other 'containment' behaviours.

> Stephanie has painted another teapot - a "happy" one with a smiley face and even brown tea coming out of the spout ('trajectory' as well as representing what had been enveloped in the container). She has done a series of 'envelopings' with embellishments: folded paper and card sellotaped as a parcel, with flags and fringes. One is amazing - a flat, decorated, cardboard container which has been decorated with many pieces of work folded and stored inside ('enveloping/containing').

Just as Stephanie and Susan shared an interest in this pair of schemas in their centre, so too did Chris and Emma in the other centre. However, they were less often seen working together and enriching each other's understanding.

Chris was reported to be aggressive at home, where there had been family problems, but she played quietly at the early childhood centre. The action researcher first noted a pattern of behaviours to do with 'containing', all in one morning.

> Chris (4:7) was lying in the bottom shelf of the storage cabinet with another girl. They were chatting to each other.
>
> Chris is now matching and fitting shapes in a form board ('enclosing/containing').
>
> Chris tips blocks on to a table and then puts them back into the container.

A month later, her concentrated work was more focused on 'enveloping'.

> Chris (4:8) stood at the trough. She selected a plastic duck, scooped water and poured it over the duck ('enveloping'). As the duck floated away, she threw water further ("functional dependency"). She retrieved the duck and poured water gently over it. Next she used the duck as a scoop and filled a small container, balancing this in her left hand and gazing at it, filling it until it overflowed ('enveloping'). She repeated this action several times.
>
> Chris reached for the puzzle. She quickly completed it correctly. Then she muddled it. She sat down and turned pieces over, hiding the people on it, and invited me to guess what the pieces would be ('enveloping?').

A month later, she was still playing with a variation of this.

Chris (4:9) was playing a card game with Emma called Memory. They were turning the cards over and trying to remember where the matching cards were hidden ('enveloped').

Emma showed in a series of observations that she too was focusing on 'containing/enveloping' in her explorations. For example, she was Chris's partner in the card game described above. The teachers had captured her interest in their records. A teacher's observational record in her profile book described her at 4:7 first using a small bottle to fill a large bottle with water, "I'm putting some petrol in" ('containment'). Then, she went on to make a cup of tea (similarly, 'containment'). She moved to the collage table, and wrapped up a parcel ('enveloping/ containing'). A week later another record in her profile book described her as making a Marmite and alfalfa sprouts sandwich and eating it ('enveloping' twice over), before going to do a painting of a big blue patch surrounded by 3 pink and purple patches and an orange patch.

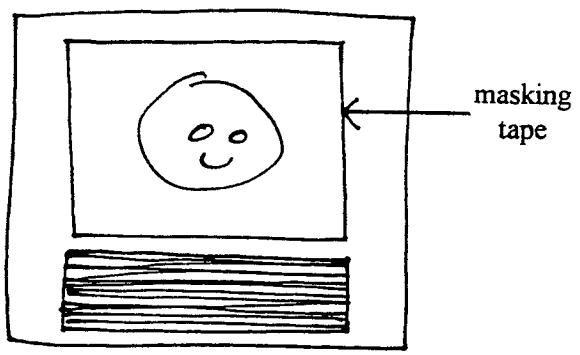
The action researcher captured a whole sequence of activities to do with 'enclosure or enveloping' in the space of 45 minutes.

Emma (4:10) was at the creativity table, sellotaping a folded piece of paper ('enveloping'). She then made and fastened a watch strap around her wrist ('enclosure'). Next Emma cut up some straws and put them into a plastic container ('containment'). Emma moved to the painting easel and painted a picture ('enclosures' dominate, although there are other schemas evident).

Figure 11

Emma's Painting

(she used masking tape as the frame for the TV picture)



Emma moved outside and sat in a cart ('containment'). Then got out and with another child pushed a third child in the cart.

This particular schema is a common one for children in the age range of 3 to 5 years to be exploring. Schema research using observations of 40 children in this age group in England (Nutbrown, 1994) found that children in this age range showed a similar fascination with 'enveloping, enclosure, and containment'. The 2 other major schemas found by Nutbrown were 'dynamic vertical' and 'dynamic circular' (ibid., p. 63). Her analysis revealed a relationship between these dominant schemas and ideas or concepts:

* The 'dynamic vertical' schema was evident where some children were involved in activities and ideas concerned with height;
* Dynamic circular schema was evident where some children were exploring aspects of rotation and roundness;
* Containing/enveloping schemas were evident where instances of capacity were observed, (ibid., p. 64).

These data from another schema research project are likely to prove useful to New Zealand early childhood teachers.

Discussion

Children's intellectual obsession with one or some schemas is observable when adults use their knowledge and understanding of schema development in young children. The adults involved in this substudy of the *Competent Children* project employed a number of observation techniques to identify the repeated patterns of behaviour. Parents used anecdotes, as did the teachers in a more systematic and recorded way, keeping some records in the form of schema charts as well. One researcher was carrying out running records throughout a half day period once per month. Staff also tried to do something similar for the profile records they kept of the children. Another researcher visited on 3 half-days to collect time-interval observation data, using an observation schedule containing pre-coded categories, (see Appendix 1).

No one observation technique proved more useful than the others. For some children, one technique illuminated their schemas clearly, whereas for others, a combination was valuable for confirming patterns of behaviour associated with children thinking about particular schema. Thus, the best advice we can offer practitioners wanting to enhance their observations of schema development is to try a combination approach.

Staff in the centre operating a key caregiver arrangement appeared to find it easier to identify their children. Good communication about schemas with parents was also important. In initial meetings, parents proved yet again that they are the experts about their own children. It is possible that it was the parents of these children who provided more of the language enrichment to enhance schema development, because the teachers were seldom recorded doing this. Teachers were more likely to provide materials enrichment. This is easier to accomplish when the group size is large and/or the ratio is poor.

The 10 schema children made rich use of the wide array of curriculum materials readily available in the 2 centres to nourish their current schemas. They explored the materials and created with them to construct their own learning. If the children had to wait passively for adults to provide all the activities for exploring schemas, they would have experienced far fewer opportunities to experiment with and think about 'vertical' or 'circles' or 'containment' and so on. It is very doubtful that adults could be so creative if they were solely responsible for shaping children's learning. The children's powers of inventiveness, visible in their patterns of behaviour, seemed to be boundless.

There is a noticeable difference between our case studies, and the observation notes provided by Athey (1990). Athey recorded many occasions when the Froebel Institute children went on excursions. These excursions served to trigger new threads of thinking in children, or were planned to nourish several children's schemas. The New Zealand children were taken on fewer excursions. In one of the schema centres, it was a very rare occurrence indeed. The other centre mostly only took children on walks in the nieghbourhood. Part of the explanation for the scarcity of excursions relates to the Early

Childhood Regulations, and another part relates to organisational policy. Some review of these regulatory inhibitors merits consideration, so long as children's safety is not compromised. It is also possible that excursions were limited to make the research easier.

In the schemas centre themselves there was also a difference in the amount of language enrichment provided when we compared our running records with those provided in Athey's book. A review of the observation notes from the New Zealand schema centres - those quoted in this report, and the others not included - indicates a paucity of conversations between adults and children on any topic whatsoever[14]. The language interactions were more likely to be about "house-keeping" topics, such as putting things back on shelves, sitting while eating, and so on.

One teacher did show consistent skill in, and dedication to, reflecting the patterns of children's behaviour (schemas) back to them in the language she used. She did not have much time with the target children because of the large group size. Notwithstanding this, she demonstrated that a shift in teacher behaviour is possible even where structural variables make it harder to do so. Most other staff thought intermittently to use language related to schemas the children were exploring.

The researchers checked whether the low level of language enrichment was because the teachers and/or action researcher were missing out language in their observational records. (This in itself would have been worrying because it would have implied that language was not seen as part of learning experiences worth recording.) However, it would appear that the records were not missing the language which occurs. When we examined the time-interval observational data, we found that adult-child conversations occurred during only 8 percent of the observations. This is a finding of considerable concern. Providing language to help the children represent their thinking was the exception, not the norm.

Reading through the qualitative data from the Froebel Institute research (Athey, 1990), we were left with the impression that there was far more teacher talk with the children, about their art, and about their *forms of thought* (schemas). At times, it was very explicitly instructional and, in our view, helpful to the children's learning.

> Gary (4:2:16) asked the teacher if he could 'read' to her. After they settled he said, "Look!" and swivelled a pencil. The teacher expressed interest and said, "You made that turn around didn't you? You made it 'rotate'." Much later Gary showed the teacher a picture of a concrete mixer in a book. The teacher said, "That's interesting, you have found something else that goes round, that rotates. Can you think of anything else that 'rotates'?" After a pause Gary replied, "Yes, a candy floss maker", (ibid., p. 140).

The Froebel Institute teacher remembered Gary's interest in the 'dynamic circular' schema and supplied appropriate language to nourish it. More than that, she asked him to use his memory and recall other things that "rotated". He did.

What emerges from the New Zealand data is a picture of a higher level of staff reliance on materials enrichment to nourish children's schema, and a lower level of staff interaction. To lighten any concerns, it would appear that the range of equipment and materials, and access to the outdoors, in New Zealand centres may have been greater than the Froebel Institute. For example, the New Zealand children were observed working on the representation of lines by using string and ribbon and other materials of that type whereas the Froebel children's art seemed to be the main medium for exploration. Outdoor materials provided many more opportunities for the New Zealand children to

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[14] This finding is consistent with other research, see for example, Meade (1985).

explore, for example, 'enveloping' and 'containment' schemas. This does not excuse teachers' paucity of language enrichment however. Without language interactions, how could the children consolidate their thoughts about either *figurative* or *action schemas*? Were conversations with their peers sufficient? We doubt it. Hopefully, parents were filling this gap, because this level of work on schemas is likely to be significant for children to progress to understanding concepts.

It was a challenge for the teachers to keep the programme operating in much the same way but give special attention to the target children. Many people have questioned how it would be possible to do this for all children at a centre. We noted that the one teacher who performed well on language enrichment for the target children did so for all children. What is more, she taught in the centre with the largest roll (45 in the group). Here we have a paradox: she accomplished the language enrichment for some by doing it for **all** 45 children. Perhaps this was easier than remembering, "This is a target child in the research; I should be providing language to help her schema development." It is also worth reflecting on the possibility that, in the process of her thinking more about children's thinking so that she could provide the appropriate language for the schema children, she was likely to have been spotting schema in far more children than those in this substudy.

This reflection about the exceptional teacher may also demonstrate that the curriculum intervention could have been handled in a different way. We suggested that the teachers observed and "spot schemas", then undertake curriculum interventions (including language interactions). Moving straight to language enrichment interactions, and reflecting on the children's thinking evident in their talking as it occurs, may be an effective alternative option with which teachers can experiment.

Figure 12

Enrichment Options

Our suggestion	*One teacher's practice*
Observe	Talk to enrich
Spot schema/s	Think
Think	Observe
Enrich schema/s by talk (and materials and experiences)	Spot schemas
	Enrich

Materials enrichment for all teachers was not too much extra work. Note that materials enrichment was provided for all children in the centre, although its introduction was directly related to particular children's schema exploration, especially *action schemas*.

In the next chapter, we will see what effects the approaches of the teachers and parents in the schema centres had on the children's development of competencies related to cognition.

CHAPTER 6

OUTCOMES FOR SCHEMA AND COMPARISON CHILDREN

Introduction

The *Competent Children* research team decided to assess 9 competencies rather than use a single outcome variable such as an IQ score. We do not subscribe to the view that children are either competent or not. Like adults, young children have strengths and weaknesses in different areas of their development. This approach was common to the main project and this substudy.

The researchers did not go as far as calling these areas intelligences and using the theory of multiple intelligences as propounded by Howard Gardner (1993). There were 2 main reasons for this. The first was that we had agreed from the outset that we were interested in a range of behaviours which demonstrated competence rather than intelligence only. The concept of competence is a far more socially and educationally acceptable focus for research on educational outcomes in New Zealand than is intelligence/s. The second was that measures of IQ are generally narrowly conceived and the results are notoriously unstable for young children. There were strong suspicions about the ecological validity of IQ tests amongst early childhood teachers and experts in New Zealand, in large part because of the way Urie Bronfenbrenner's theory of the ecology of human development (1979) has been embraced in this country. Assessment measures for young children for the 7 intelligences, which followed principles relating to ecological validity, were being devised overseas at the time we began our study (Krechevsky & Gardner, 1990) but had not penetrated the literature for us to learn about their existence. In any event, it is likely that our focus would have remained on competencies.

Not surprisingly, there are some overlaps between Gardner's 7 intelligences and the competencies we have focused on in the *Competent Children* project. As stated earlier, we were conscious that we could have added some other areas of competencies if we had found, or developed, measures for assessing them. A comparison based on Vialle's (1994) summary of multiple intelligences from Hatch and Gardner (1988) and our own description of the 9 competencies we are studying is depicted in Figure 13 on the following page.

When the range of competencies we studied are set alongside Gardner's intelligences a remarkable overlap of areas is visible. The intelligence which we did not tap is musical intelligence; this was beyond the measures for young children's competencies accessible to us. One of the intelligences (interpersonal) is more or less captured by 2 competencies: social problem-solving, and socio-emotional. (This could have led us to clustering these 2 variables in the statistical analysis of the larger

data sets for the *Competent Children* study, except that one is a scaled measure and the other is not.)

Figure 13
Gardner's Multiple Intelligences and Our Competencies

	Intelligences	Competencies
Linguistic	*	*
Logical-mathematical	*	½
Spatial	*	*
Musical	*	
Bodily-kinaesthetic	*	½
Intrapersonal	*	½
Interpersonal		*
- social problem-solving		*
- socio-emotional		*
Exploration		*
Early literacy		*

Three of the competencies are labelled with a ½ value, because we did not conceive of those competencies as fully as Hatch and Gardner (1988) have. (This may provide an explanation for an a-typical result in the case of mathematical competence which we will return to later in this chapter.) *Logical-mathematical* intelligence is defined as "the ability to explore patterns, categories and relationships by manipulating objects or symbols, and to experiment in a controlled orderly way," (Vialle, 1994, p. 30). The measure of early mathematical ability used by the *Competent Children* team[15] is predominantly about the recognition of patterns and categories, about a sense of number, not their manipulation. *Bodily-kinaesthetic* intelligence is defined as "the ability to use fine and gross motor skills in sports, the performing arts, or arts and craft production," (ibid., p. 31). The measure of fine and gross motor (body) skills used by the *Competent Children* team had no connection with kinaesthetics, although some Pacific Island communities have requested that we examine performing arts ability at later ages, because of the high value accorded these abilities in their cultures. *Intrapersonal* intelligence is "the ability to gain access to and understand one's inner feelings, dreams and ideas," (ibid., p. 31). The measure used by the *Competent Children* team did not tap into dreams, nor consciously measure feelings although feelings were often manifest in the target children's complex pretend play (the indicator used).

Competencies

The 9 competencies we worked with have been placed in 3 general categories:

[15] The team replicated the use of the student interview for the Beginning School Mathematics Evaluation (New Zealand Ministry of Education, 1995), which incorporated the Schools Entry Numeracy Skills (SENS) assessment developed by Jenny Young-Loveridge (1991).

* "be-ing" competencies,
* "doing" competencies,
* "intrapersonal" competency.

We needed to categorise competencies for both philosophic and pragmatic reasons, e.g., to devise different types of instruments to assess the children's competencies. It should be noted that the distinctions are somewhat artificial in that children are themselves and do things at the same time.

"Be-ing" Competencies

The first set of 3 competencies included is:

* social-emotional (akin to an aspect of Gardner's interpersonal area),
* communication (akin to Gardner's linguistic area)
* exploration.

These have been explicitly drawn from the aims in *Te Whaariki*, the New Zealand draft curriculum guidelines for early childhood services, although we had to collapse 2 curriculum goals ("belonging", and "contribution") together under the heading of "social-emotional" as it proved too hard to find separate research measures for these 2 curriculum goals. We also grouped these 3 competencies together because they are about a child's "be-ing", rather than about what a child can "do".

None of these "be-ing" competencies can be measured at one point in time by a relative stranger. For this reason, the research team chose to approach assessing this set of competencies by interviewing a significant adult in the preschoolers' lives and asking them about these competencies. Assessing the children based on these curriculum goals is philosophically difficult. As well, using interviews and rating scales is not without its technical difficulties; e.g., how could we know the reliability of ratings from different adults who had never sat down together and worked out shared definitions? Our trials and pilot study did provide reassurance, however, about the reliability and validity of our measures - there was remarkable agreement amongst 2 significant adults who knew individual children well when they provided independent ratings of the same child.

"Doing" Competencies

Another 5 competencies are about what children can *do*. They are:

* social problem solving (akin to another aspect of Gardner's interpersonal area),
* early literacy,
* early mathematics,
* logical reasoning (eg, solving puzzles) (akin to Gardner's spatial area)
* motor (bodily) skills.

This set of competencies was assessed in the context of an interview with the children about 1 month before they started school (in New Zealand children start school on their fifth birthday).

Intrapersonal Competency

The final competency is qualitatively different again. The label our research team used was Complex Pretend Play. Tina Bruce (1991) uses the label "free-flow play". She describes the type of play as an integrating type of play which "involves meta-cognition," ... "brings together everything we learn, know, feel and understand", and "is sustained ... [using] technical prowess, mastery and competence we have previously developed," (ibid., p. 60). There is considerable agreement between this definition and Garner's intrapersonal intelligence.

Some Findings

With a few exceptions, the outcomes for children were more positive for the children in Ngaio-tree and Karaka-tree schema centres. There appears to be an association between the results and the schema children having more interactions with adults and more opportunities for exploring materials in the schema centres.

About Interactions

In our analyses of the time-interval observations of the children, we found that the most common child-initiated adult interaction was a short verbal exchange (one-third), and other forms of interaction such as a cuddle, request for help, and a conversation occurred with slightly less frequency (for definitions, see Appendix 2).

There was minimal aimless wandering (1 percent of the observation intervals), and another 4 percent of time was spent as an onlooker, observing what others were doing. Aggression (physical and verbal) was seldom observed (2 percent of the total observations in all four centres).

For the most part (90 percent of the time intervals), the adults did not initiate contact. Most adult-initiated child interactions were simple greetings or a question and answer, or an elaborated comment without it becoming an extended conversation. A negative tone of voice was practically never heard (2 percent of the observations).

In observing the social skills of the target children, we found that the dominant social interaction was in the category called Simple Interactive[16] (45 percent of the observations). Howes (1989), who developed the scale for assessing social skills, regards this form of social interaction as less complex than the Role Reversal Play or Pretend Play categories. Of the time intervals observed, the target children spent only 7 percent of them in Role Reversal Play, and 16 percent engaged in Pretend Play.

There was a difference between the schema children and comparison children - in the schema centres, there was more Pretend Play (19 percent of the observations, compared with 11 percent in the comparison centres). Note, however, that schema children were about twice as likely to be engaged in Parallel Play as their peers in the comparison centres.

In child-initiated adult interactions, there was a trend for the schema children to engage in more Conversations with their teachers (9 percent, compared with 5 percent), and to Request Help (6 percent, compared with 3 percent). This is likely to contribute to the better scores of the schema children. It is reassuring that the teachers may have adjusted their language behaviour and openness to children as part of their curriculum innovations for the action research. However, the fact that

[16] The definitions of the different categories of social skills are described in Appendix 1.

teachers still spent a low percentage of time in Conversations with children is of some concern.

Exploration of Materials

Problem solving was not a common phenomenon across all centres. Exploration with Materials to solve a problem occurred 14 percent of the time, and Verbal Problem Solving by the children was noted during 6 percent of the observations. However, Exploration with Materials was far more prevalent in the schema centres (28 percent of the observations, compared with 13 percent in the comparison centres). This validates the finding in the analyses of the qualitative data shared in the last chapter, where we commented that the curriculum innovations introduced by the teachers in response to the children's schema were dominated by additions of materials and equipment. The time-interval observational data show no difference for Verbal Problem Solving rates between schema and comparison children.

Cognitive Extension

The differences in these data sets indicate that children in the schema centres were spending more time on activities with cognitive extension possibilities. There were few other notable differences found in the time-interval observations of the children.

About Outcomes

The results about the 3 "be-ing" competencies indicate differences between children attending the schema and comparison centres. The differences between means for different competencies are, in part, due to there being variations in the number of sub-scales making up the scores for different competencies. Thus, it is not appropriate to compare the variable scores for, say, the schema children and interpret that they are better at, for example, Communication than Socio-emotional. The higher scores simply reflect that a higher maximum score was possible.

Table 2

Mean scores for Children's "Be-ing" Competencies, by Centre Type

	Schema centres	Comparison centres
Social emotional		
Social skills (peers)	10.05	9.43
Social skills (adults)	12.50	11.43
Selfcare	12.40	12.86
Communication		
Receptive language	19.75	18.43
Expressive language	16.50	14.71
Exploration		
Curiosity	16.35	14.00
Perseverance	18.95	15.57

Higher scores in any group of children indicate that early childhood teachers rate children to be mostly or always exhibiting these competencies. Thus, the higher mean scores for children in the schema centres indicate they were perceived to have greater strengths in these sorts of competencies than children in the comparison centres. The results showed more positive mean scores for children in the schema centres for each competency than was the case for children in the comparison centres, except on 1 sub-scale - Self Care. An examination of the range of scores for each variable demonstrated no consistent patterns *vis-ā-vis* the schema and comparison children, except that the range was bigger for schema children than comparison on 1 variable in a cluster and the reverse occurred on the other variable in the cluster, e.g., the ranges for Exploration were:

Table 3

Exploration Competence - range of scores

Curiosity	
Schema children:	13.00 to 19.00 (Range = 6.00)
Comparison children:	11.00 to 19.00 (Range = 8.00)
Perserverance	
Schema children:	14.00 to 23.00 (Range = 9.00)
Comparison children:	13.00 to 20.00 (Range = 7.00)

The reversals in ranges within clusters were present all through these data.

When examining the results of the "doing" competencies, more positive outcomes for children in the schema centres than for children in the comparison centres were also found on the 2 competencies

associated with cognition: Early Literacy, and Logical Reasoning.

Table 4

Mean Scores for Children's "Doing" Competencies, by Centre Type

	Schema Centres	Comparison Centres
Early Literacy	16.33	7.86
Early Numeracy[17]	15.20	14.70
Spatial Logical Reasoning (Ravens Coloured Matrices)	6.13	4.00

Here again, the differences between means for different competencies are, in part, due to there being variations in scoring approaches and maximums for different competencies. It is not appropriate to compare the schema (or comparison) children's Early Numeracy with their Spatial Logical Reasoning scores. There is no similarity or relationship between the two measures.

We asked ourselves whether there could be a connection between children's spatial logical reasoning and the level of *action schemas* they were working on. However, we could find no apparent association between higher scores on this instrument and children working on *action schemas* at the "functional dependency relationship" or "thought" levels, but this may be because there were few records of children operating at the "thought" level.

Complex Pretend Play, indicating intrapersonal competency, is the final competency we associated with cognition. It was observed by the researchers during 7 percent of the time intervals in schema centres and 4 percent in comparison centres.

Table 5

Frequencies for Children's Intrapersonal Competency, by Centre Type

	Schema Centres	Comparison Centres
	% of time-intervals	
Intrapersonal competency	7	4

Here again, something different was occurring in the schema centres.

[17] These scores were derived by using the student interview in the Beginning School Mathematics Evaluation (New Zealand Ministry of Education, 1995) which included (SENS) assessment developed by Jenny Young-Loveridge, 1991).

In summary, with a few exceptions, the scores for children in schema centres were better than the scores for children in the comparison centres. Tests of significance have not been used because of small cell sizes. It would appear that the intervention was having an impact on outcomes in terms of the competencies we measured, except Self-Care. Early literacy was the most marked. The outcomes where some impact showed up in the data were most of the competencies with a cognitive component.

Interpreting the Early Numeracy Data

The data on early numeracy from the schema centres and comparison centres were puzzling. Comparison centre children scored closer to the level of schema children. Why? Three possible explanations are put forward for consideration. The first is to do with the parents' background of the comparison children. The second is to do with numeracy (and literacy) socialisation in the home. The third is related to the instrument we chose to measure early numeracy achievements.

First, in Chapter 4, when we compared the family background of the schema and comparison children, we commented that, on the basis of other research which indicates the importance of the mother's educational background on their children's school achievements, the comparison children were likely to do better. The pattern in our findings runs counter to this. However, it is possible that the comparison children's mother's educational levels were influential on one variable, namely, the early numeracy scores. This begs the question, why did this not also flow through to early literacy scores (another measure similar to school achievement measures)? Our data suggest it is to do with home experiences, but there may not be any flow through from the parents' educational backgrounds. In other words, this explanation does not seem to be a strong one.

Second, socialisation of numeracy (and literacy) in the home is likely to be influential. We checked the data we had from the main caregiver interviews about "What?" and "How?" children engaged with reading, writing and number. The data for both groups of children were very similar, with schema children's parents less likely to teach their youngsters about any of the 3 sets of knowledge. However, at home, more of the comparison children did numeracy-related activities like counting, singing counting songs, using numbers in cooking, and learning to tell the time. The array of extra things done by the comparison children was also bigger (6 categories, whereas the schema children did 4). Parents of comparison children told us about different activities such as games/puzzles, using phone numbers, adding and subtracting, answering questions involving numbers, handling money, and recognising number symbols. Schema children did the first 3, plus understanding patterns. These data suggest that there were a few more number experiences in the home for comparison children, and it could have been enough to show in the assessments.

For writing, the trend was in the same direction - comparison children did more writing of their own name, friend/family names, and other words. However, as we did not assess writing skills we cannot examine writing outcomes data against the home socialisation hypothesis.

Examining the set of data about reading in the home, there are many similarities between the 2 groups of children, but we noted that a wider range of people read to schema children, and more of these children read signs and brand names in the community and looked at stories. The not surprising conclusion is that directly-related home experiences - usually not explicitly instructional for the children - were important for children's numeracy and literacy scores (see also McNaughton *et al.*, 1990). For numeracy, the home experiences may have been more effective in socialising the comparison children into a stronger sense of number.

Third, the instrument chosen probably did not tap the children's *logical-mathematical* intelligence. As stated earlier in this chapter, the instrument chosen focused on children's number sense, on the children being able to identify patterns and categories. It covered: forming sets, numeral identification, pattern recognition, rote counting, sequence forwards, enumeration, sorting, shape sorting and linear patterning. As you can tell, these are not measures that connect much with children's work on schemas.

The instrument chosen for collecting information on early numeracy for the main project proved to be unhelpful for this substudy - it did not produce data on children's ability to understand features of, for example, lines, circles and trajectories. It did not capture whether children could work out mathematical relationships or undertake controlled experiments with objects and schema (Hatch & Gardner, 1988). The qualitative data described in Chapter 5 reveal that the schema children were working out *functional dependency relationships* with the *action schemas* they were absorbed with, and these children were often working with schemas in ways akin to trial and error experiments (albeit seldom using adults' ways of experimenting). Our chosen instrument did not connect with these behaviours.

Our conclusion is that the second and third explanations are worthy of further investigation.

It would appear that children's work on schemas - as well as literacy socialisation - does assist their literacy skills, e.g., they understand that mark-making represents other things, they have worked on 'lines' and 'curves', and they appreciate connected versus separate (which is important for identifying what a word is).

Discussion

The explanations for the better scores for children can only be speculative with this small sample. As well, in Ngaio-tree and Karaka-tree schema centres, the patterns in the findings could be regarded as surprising given the imperfect understanding of schema theory by most of us involved and the many constraints on the teachers putting the theory into practice.

Constructivist learning theory and research (e.g., Elliott, 1991; DeVries & Kohlberg, 1987) suggests that there are a number of conditions and teaching approaches which improve young children's learning. We have summarised these under 6 headings: Context, Content, and Coordination with Parents, and the cognitive processes of Recognition, Recall and Coordination. (With some linguistic playfulness - with an underlying seriousness - it is possible to start each heading with a '**C**'.)

Teachers need to:

* provide a child-centred *Context* without too much structure so that children can explore and experiment to construct their own learning,
* have a good grasp of the *Content* of schemas as well as the concepts that are formed by children as a result of their explorations of clusters of schemas, and
* *Coordinate* with parents to discuss the threads in children's thinking and learning.

The teaching processes involve adult-child interaction, which is where the better staff-child interaction ratings in the schema centres (reported in Chapter 4) could be significant. These interactions are important for:

* the nourishment of *re-Cognition*, for example, by reflecting back in words to children what they are doing,
* assisting children to *re-Call* other experiences which relate to their current thinking and thereby sustain continuity in threads of behaviour and thinking,
* helping children to *Coordinate* their ideas to develop meaning.

All these assume that teachers include children's intellectual development in their goals.

We have argued that all 6 of these elements are important to develop cognitively-competent children. We think they are for optimum development. However, we found that not all of them need to occur in the early childhood setting for benefits to accrue to the children. What we found was that the presence of some of these elements in the centre setting seemed to be sufficient to produce enhanced scores on a range of competencies. We simply do not know if other elements were provided by parents. A summary of the data described under the different elements is provided next to show the strengths in the way the teachers implemented their curricula. It also identifies some gaps.

Context

The centres' philosophy statements, and other qualitative data, have indicated that all the centres - schema and comparison centres - were operating child-centred curricula. The opportunities for children to explore the schemas which were fascinating them were numerous and varied, although we have noted that excursions, which can provide extension studies of existing schemas or trigger an interest in new schemas, were a rare event in the New Zealand centres. The children could create a rich diet of experiences for themselves from the materials and experiences provided within the centres, however. Moreover, as the adults seldom interrupted the children, especially in the kindergarten, the children were able to pursue their interest in their schemas.

Content

There are 2 aspects to do with content: curriculum content and teachers' content knowledge base. Data were not collected on the adults' content knowledge of the content of children's thinking. In retrospect, we wished we had recorded more details of staff actions and speech to find out whether teachers used materials and equipment, in part, as a shield from having to talk knowledgeably about content, especially when children were thinking about the coordination of schemas to give insight into scientific concepts.

If the children pursue their thinking about schemas through to the level of scientific concepts, such as the concepts of lever and piston action or of trees branching (all concepts which can be developed by exploring "connecting" schema), then the adults themselves need to have a content understanding of those scientific concepts or, at least, be prepared to learn it fast.

Coordination with Parents

The staff in both schema centres were transferring knowledge about the children's schemas to parents. This was intermittent, and included conversations as children were delivered or picked up from the centres, parents reading the wall charts about children's schemas, and comments in the home books which went home with the children attending Ngaio-tree centre from time to time. Parents also told staff about schemas they noticed, especially at the initial workshops run by the action researcher. Parents' interest in their children's schemas was given a boost when the researchers interviewed them.

Re-Cognition

Earlier in this report, we talked about young children "coming to know". Elsewhere, Anne Meade has called these processes, re-Cognition processes (Meade, 1994). Each time a child sees a schema a little differently, she is re-Cogniting. The qualitative data and the time-interval data indicate that the teachers made numerous adjustments to materials for the schema children to recognise further patterns related to their schemas. A more structured curriculum approach than that which we observed in any of the 4 centres may have limited children's opportunities to re-work their understanding; that is, limited their opportunities for re-Cognition. Access to a rich array of materials and equipment is a definite contributor to the benefits derived from early childhood education.

We noted that the adults in schema centres did spend more time in conversation with the children than adults in the comparison centres. However, the teachers' use of language to enhance re-Cognition was still minimal - the qualitative data seldom included adults in conversation with the children, and we captured only a couple of episodes where the adults talked about what the children were **thinking about** (the *form of their thoughts* as opposed to talking about the *subject* of their art and constructions (Athey, op.cit.). All too often the language interactions were about superficial matters, such as keeping an area tidy.

Recall

The High/Scope curriculum (Schweinhart and Weikart, 1986), which is being franchised in an increasing number of countries because of the effectiveness of the results, is based on a child-centred approach, such as we have described for all 4 centres in this substudy. It also incorporates a particular cognitive process into the daily programme - recall. The children are expected to come along each day with a plan for a special activity, and at the end of the session appropriately-sized groups of children sit with an adult and recall how their special activity progressed. (No progress is an acceptable answer.) Our data contain few examples where the teachers deliberately asked the children to recall either content or schemas. Perhaps parents provided more opportunities for children to use their memory?

Coordination

Exploration of schemas, and encoding and coordinating processes (Catherwood, 1994), help children to shape concepts in their minds. These processes and thought structures are necessary for more advanced abstract thinking. To provide an example, as children are exploring the 'containing' schema, their understanding of 'capacity', 'volume', 'space', 'inside', and 'inclusion' can come together in their heads. It was very worrying that the teachers did not appear to be assisting children develop this higher level of working with schemas. We count on the fingers of one hand the examples of teachers and children talking → thinking → talking we recorded. We can only speculate that parents did talk in the abstract with their children. Other research indicates that they do (Tizard, 1985).

These processes - re-cognition, recall and coordination - are important curriculum processes. In the next chapter we express concerns that more could be done in planning, implementing and monitoring curriculum processes.

Why did the Schema Children Perform Better?

It would appear that the explanation for their better performance as a consequence of centre

curriculum changes rests on the metaphorical shoulders of Context, and opportunities for re-Cognition. Child-centred programmes with children having ready access to materials is important. Children can construct a lot of knowledge about schemas for themselves in these contexts, and they did. For example, the teachers did little to alter the regular curriculum for Stephanie and Susan, and yet they found many, many ways to discover more about 'containing' from within that curriculum.

However, as the context in the schema centres was little different from the comparison centres the explanation for the differences in the schema centres appears not to rest with the child-centred approach. The materials enrichment, giving the children more opportunities for "coming to know" their schemas, does appear to be a significant factor. Remember that the additional materials were carefully chosen to fit the children's intellectual fascinations. They were not chosen because they were attractive to adults.

The second explanatory factor is probably to do with the subtle and small changes to adult-child interactions because the teachers were targeting these children for special observations and curriculum innovation at the individual level. The 10 children were more prominent in the teachers' consciousness during the 6 - 8 months the researchers and staff were studying these children's schema development.

In addition, the teachers' efforts to co-ordinate with parents, and the likelihood of the parents providing re-call, re-cognition and co-ordination-of-thoughts experiences relating to schemas probably contributed to the differences. A common theme in outcomes studies is that where parents have been involved in their children's early childhood education the children benefit more (see, e.g., Lazar, 1983). The dynamics are not well understood, but we believe that the nature of the parent-child relationship changes when parents understand more about how young children learn.

Just stop for a moment and think of the effect of changing a parent's perspective about Sam tying the chairs together. The switch from seeing this as being naughty to seeing this as a child learning about 'connection' and starting to think about the physics of tension (amongst other things) would be beneficial.

What is the Role of Parallel Play in Cognitive Development?

The greater proportion of time spent by the schema children in parallel play raises interesting questions about the role of this type of play in cognitive development. It is probable that children who engage in interactive play associated with particular schemas will advance their thinking on those schemas. Certainly, we picked up that some children consistently played with friends and, as was evident in some friendship pairs reported in Chapter 5, some of these friendship pairs were absorbed with the same particular schemas. The most obvious example was Stephanie and Susan in working on 'enveloping' and 'containment' schemas and, to a lesser extent, Chris and Emma in the other schema centre (who demonstrated an absorption with the same schemas). Jan and Sam may have been partners in exploring 'connecting', but unfortunately the field notes don't name the play partners of each target child.

Does parallel play contribute to the development of competencies? And is it in any way related to children's work on schemas? We cannot answer these questions from these data. Vygotsky (1978, p. 87) talks about a zone between what children can do alone and what they need help to come to next. Perhaps parallel play helps children find ways to cross such zones? Or the association may simply be one of chance.

CHAPTER 7

PROFESSIONAL LEARNING: IMPLICATIONS FOR CURRICULUM DEVELOPMENT AND INNOVATION IN EARLY CHILDHOOD SERVICES

Curriculum Change

The action research substudy of the *Competent Children* project was a study of curriculum change involving teacher development (staff and parents) based on the intellectual development of both adults and children. We selected centres which had the structural features usually associated with quality early education which produce higher outcome scores for children (although the group size in the kindergartens was higher than those advised by research). The centres had adequate or more than adequate ratios, the teachers were trained and qualified at the level the profession and bodies such as the Teacher Registration Board in New Zealand regard as the benchmark, the staff were experienced and the turnover of staff within the centres was mostly stable, and the physical environments were well equipped and safe. Thus, we would have expected to find good outcomes for the children in both the schema and the comparison centres regardless of any curriculum intervention. We believed, however, that outcomes - in terms of scores and activities - could be improved further.

We started with the premise that the day-to-day experiences of children in early childhood centres are important for children's development. We believe that most centres in New Zealand are providing an adequate, developmentally-appropriate curriculum for children's social development (with reservations about the cultural appropriateness in some cases). Notwithstanding the positive aspects of early education in New Zealand, we felt concerned about the adequacy of the curriculum in many centres in New Zealand in 2 curriculum areas: language; and exploration, thinking and reasoning.

Inspired by the research and teaching of a cluster of people in England (Athey, 1990; Bruce, 1991; and Nutbrown, 1994), we decided to use their theory and practice to foster a curriculum innovation which was designed to enhance children's development and learning in the intellectual domain. We trialled this in 2 centres which we have called the schema centres.

To re-frame our focus in terms of the curriculum aims for children contained in *Te Whaariki* (1993), we decided to assume that the aims of Well-being, Belonging, and Contribution were being catered for in the centres chosen for the substudy, and we concentrated on the aims of Communication, and Exploration, with particular attention being paid to the Goals 1, 3 and 4 for the Exploration aim:

Children will experience an environment in which:

Goal 1
their play is valued as meaningful learning and the importance of spontaneous play is recognised;

Goal 3
they learn strategies for active exploration, thinking, and reasoning;

Goal 4
they develop working theories for making sense of the living, physical, and material worlds.
[*Te Whaariki* poster, 1993]

There are 18 goals set out in *Te Whaariki*. Schema theory and practice led us to connect with 3 of them. Our motivation was similar to Lilian Katz's when she said, "I wish to encourage adults working with young children to do more than just keep them busy and happy or even excited," (1994, p. 202) after stating that young children have a "real need to feel intellectually engaged and respected," (ibid.).

One of the key things which happened in the schema centres as a result of the action research was the adults (teachers and researchers) became far more conscious of children being "absorbed" or "fascinated", and they did respect their "intellectual engagement". The observational aspect of the research explicitly fostered a consciousness of children's absorption, and the teachers and researchers deepened their respect for what was going on in children's minds in association with repeated patterns of behaviour. These attitudes were passed on to the parents. We gathered evidence that the effects of these changes in the adults (in behaviour and attitudes) were significant for the children.

Curriculum change can involve change in content and/or process. The action researchers left the teachers in control of the content and the process of how they implemented curriculum change to nourish children's schema development - with one exception. Part of the process of curriculum implementation is evaluation of how the curriculum is working for the children themselves. In working with young children, an appropriate tool for curriculum evaluations is observation of children. As we did ask the staff in the schema centres to undertake observations of children looking for schemas and to make running and anecdotal records of what they observed, this would have had an impact on the 2 centres' curricula. We encouraged them to make some adjustment in content and processes to nourish the children's schemas but empowered them to make their own decisions with these aspects of the curriculum in their centre.

In one of the schema centres, the supervisor had been sick when the action researcher ran the workshop for staff about schema theory and practice and, despite assurances from staff that they would share the plan with her, there was communication breakdown. She never fully understood, or engaged in, the action component of the research. It was not until the end of the field work that we found out that she had been doing the schema observations, recording them in the profile books sent home with the children, and discussing children's schemas without realising that the researchers had also wanted her to extend children's schema development by making curriculum changes specifically around them. In the event, her professionalism meant that she had made adjustments to curriculum content anyway. She did this not because of the research, but because she was responsive to children's learning needs which she had identified through the observations. This demonstrated to the researchers the importance of their using a variety of means to communicate the material and the process of curriculum change. Our assistance was probably too minimal.

Curriculum Content

The data demonstrate that once the teachers had identified children's schemas, through observation and sharing what they seen with each other and with the action researcher, they thought about *content* associated with those *forms of thinking* (schemas). This was evident in the supply of new, additional materials for children to explore different aspects of the schemas that were absorbing their attention. This was a very positive change. It increased the opportunities for the children to work with and think about their schemas. At the same time, it empowered the children to continue to take the initiative in how they would explore those schemas. Moreover, it is highly likely that these new materials may have triggered other children's intellectual curiosity about the same schema.

The rich array of materials and equipment in centres is cause for celebration. In most instances, what satisfied the children's intellectual needs was not flash or costly equipment, but natural materials or simple additional goods such as sewing tape, a cot blanket or cooking ingredients. Often they were used by the children in ways that adults would not have thought of. Remember Jan and Sam, exploring 'connection'? (see Chapter 5). A list of what they used to work on this schema included:

* shoe laces,
* television programme on trains,
* pegs,
* video cases,
* planks and ladders in the outdoor area,
* Duplo train,
* building blocks,
* rod and line (made of sticks and wool), and
* rope.

When Paul was exploring and learning about 'circular enclosure', 'core and radial', and 'dynamic circular' schemas (see Chapter 5), according to the observation records, the things he used in the centre included:

* tractor tyre,
* roll of Sellotape,
* length of cord tied around his wrist,
* cardboard tube,
* towelling hair ring,
* wheel from a toy vehicle,
* water wheel,
* lasso,
* string tied around his waist,
* ball,
* scarf,
* a swing he made himself, upon which he went round and round,
* cape,
* pois,
* paintings,

* drawings, and
* collage constructions.

The depth of Paul's understanding of these schema was probably greater as a result of his experimentation with so many different materials. Most of these materials were available daily at the centre, although the teachers did supply additional cord, string and rope for Paul once they spotted his fascination with tying things about his body (e.g., his wrist or his waist) to experience enclosure. Brand-name equipment, on its own, may not have kept Paul's interest for so long, nor have been so intellectually satisfying.

The equipment and materials used by the children exploring the 'containing/enveloping' schemas also included natural and collage materials as well as lots of different kinds of containers as was to be expected. The materials and activities invented by the children included:

* blocks and other objects wrapped in tissues/paper,
* paintings and other art folded into a parcel with sellotape,
* children tucked in beds,
* parcels ("presents") under pillows,
* sand in a variety of containers,
* a variety of objects (e.g., flowers, sponge) immersed in water,
* packets of "fish'n'chips",
* adults with decorations stuck all over them,
* covering soft toys with fabric,
* planting "plants" in the soil outside,
* soda in vinegar in a cup,
* a plum in child's mouth,
* children climbing inside items of furniture,
* "babies" (dolls) inside covered boxes,
* drawings and paintings of containers, including of a teapot with brown tea coming out of the spout,
* fitting shapes into a form board,
* covers for bottles of liquid,
* pouring water over a toy duck,
* filling containers with water until they overflow and the water envelopes them,
* tipping out and putting back blocks in a container,
* card games where the pictures are hidden face down,
* putting the filling inside of sandwiches, and
* sitting in a cart.

After drawing up these lists for some schemas, we were left marvelling at the ingenuity of children in using material and equipment in so many different ways to nourish their understanding of the schemas. And we have addressed only a handful of schemas.

The conclusion we made is that if adults were to structure the programme more, or limit the supply of or access to equipment and materials, then the exploration by children would be more limited. By structuring we mean when adults introduce limits on the times, spaces and materials available for children to play with and explore. For example, group time to do an adult's prepared activity brings

in all of these limitations. We believe more limited opportunities to explore with materials would affect children's learning. Wagner & Stevenson's research (1982) validates this view. They concluded that learning involves knowledge being transferred from experience to experience, and from a wide rather than a restricted range of experiences.

The lists of things used by the children also reinforce the importance of access to natural materials and creative medium which can be used in a multitude of different ways. Early childhood centres can provide more than is often possible or allowed at home.

Time to explore the rich array of materials and equipment with few adult restrictions was also cause for celebration, as was the ready access to the outdoors where there were plentiful supplies of additional and natural materials as well as opportunities to explore the topography of the playground. Ngaio-tree schema centre had reduced the times when this ready access to the outdoors was permitted between earlier visits and later visits for reasons related to supervision. This constraint was regrettable.

While we were impressed with what was provided in the way of appropriate additional materials and equipment, at the same time we were concerned about the focus on *curriculum content* with little change occurring in *curriculum processes.* This is not a criticism of the schema centres only, it is a criticism of New Zealand early childhood centres in general. It could well be a criticism of New Zealand teachers in general (Renwick, 1995).

Why do teachers focus on change in content? There is a tendency for people - be they teachers, or the general public - to think about subjects when the word "curriculum" is mentioned. They think about mathematics, science, English, and so on - in other words, they focus on knowledge, on *content.* Moreover, they fragment knowledge into subjects, because that is how educational institutions for older children and students organise their teaching and learning. It is hard to help the general public to think think that curriculum is about skills and attitudes, as well as about knowledge, even though curriculum documents in New Zealand since 1987 (Department of Education, 1987) have stressed this. It is hard for many educators to accept that teaching does not have to be organised in such fragments called subjects, especially when the curriculum is organised in subjects, and there have been few formal attempts to assist teachers to offer an integrated curriculum, or to think much about curriculum processes. Some change is underway to heighten aware of process. The politics of education make it harder to change the common organisational patterns away from organising teaching and learning by subject.

Early childhood educators have been successful in resisting these organisational arrangements in their teaching, and curricula developers have resisted presenting early childhood curricula by subjects as well (Ministry of Education, 1993; Heaslip *et al,* 1992). They know young children learn the foundations of later knowledge, skills and attitudes through experiencing the world primarily through play, albeit with enrichment and clarification by adult involvement. To quote the U.K. Early Childhood Curriculum Group:

> In the early years, the child's knowledge is not naturally separated into subject groupings. When children are cooking, for instance, they may be learning science, maths, health education, about how to collaborate and share while extending their vocabulary and language skills, (Heaslip *et al,* op.cit., p. 19).

Early childhood teachers may have resisted the pressures in the wider world to think "curriculum = subjects"[18], but they have, we believe, succumbed to the pressures to think "curriculum = knowledge" only, and hence the focus on *content* when asked to make changes to the curriculum.

Why is a change in content not enough? Obviously because it misses out on the skills and attitudes goals of curricula. In addition, it emphasises a specific approach to learning and teaching, and views the teacher and child in special roles. Generally it is a top-down model of learning and de-emphasises the importance of children learning from their peers, and children learning from adults.

Curriculum Processes - Children Learning from their Peers

The freedom of the children to learn from materials and equipment alongside and by interacting with their peers was notable. The schema children were seldom alone or passive in relation to their peers - zero interaction with children was noted during only 11 percent of the time-interval observations. Sometimes the children were working parallel to one another but, more often, there was direct interaction. Thus, it is highly likely that other children were instrumental in the schema children advancing their communication skills, and in "learning strategies for active exploration, thinking, and reasoning," (Goal 3 for the Exploration aim of *Te Whaariki*) (*Te Whaariki* poster, 1993). It is also probable that other children were proposing or modelling "working theories for making sense of the living, physical, and material world," (Goal 4 of the Exploration aim of *Te Whaariki*) (ibid.).

Curriculum Processes - Children Learning from Adults

Curriculum processes - including planning children's interactions with each other - tend to drop out of teachers' consciousness when planning, implementing and evaluating their curriculum. This seems to be true in relation to adults' interactions with children as well. We detected evidence of this when we noted that adult-child interactions were not recorded in the profile books, nor in the action researcher's notes. Either adult-child interaction was seldom happening, or it did not rate a mention in records. Either reason is of concern. Our time-interval observations, which did require the regular researcher to note adult-interactions, captured interactions between teachers and target child in 28 percent of the observation periods. Most of this interaction was fleeting. Because of the large group size in the schema kindergarten (on a par with many kindergartens since the mid-1980s), which stacks the statistical odds against individual children receiving attention, we decided to separate the child observation for the two schema centres. The results were that the target children in the schema kindergarten were seen to interact with a teacher in only 14 percent of the observation periods. Target children in the schema childcare centre interacted with their teachers 44 percent of the observation periods. The better ratio, and the centre's organisation, contributed to these results.

If teachers are to provide effective support for children's learning and development, they can do this via curriculum *content* (discussed above), and via *processes* such as modelling attitudes and actions, and engaging in language interactions when implementing the curriculum. In addition, teachers need to be cognisant of processes as well as content when evaluating the effectiveness of their programmes.

The contacts between adults and children described above included a mix of children making a request and receiving an answer, exchanging hugs, and conversations. The staff all modelled positive attitudes toward children learning through play and exploration. The centre statements of philosophy, outlined in Chapter 4, all emphasised the importance of giving children opportunities for learning and

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[18] As have junior teachers to some extent.

the value of play, and staff attitudes and actions observed during the study indicated that the centre philosophies were implemented daily. Goal 1 for the Exploration aim in *Te Whaariki* was being actively pursued, even though there was little consciousness of the content of *Te Whaariki* in late 1993; (it was launched only toward the end of the field work for this substudy). Our data indicate that *Te Whaariki* has formalised what was happening in practice.

It is in the area of language that the data signal the need for improvement. In earlier chapters, we reported that conversations were rarely seen during the time-interval observations. As well, all the qualitative data about the children's schemas indicated that few conversations about schemas took place. Thus, the teachers were not often helping individual children develop their verbal communication skills. In kindergartens with their larger group size, the teachers could not give much time to any one child. They did model language in group situations and enthused children about language by reading stories. However, the occasions when they helped children, via discussions, with Goal 4 for the Exploration aim in *Te Whaariki* (1993) - "children will ... develop working theories for making sense of the living, physical, and material worlds" - were few and far between. Across all 4 centres, cognitive language extension was recorded in only 7 percent of the observation intervals.

Positive differences were noted in the schema centres - the researchers had rated the schema centres more highly for adult-child interactions when undertaking observations in the centres. We found when observing the children that the schema children engaged in more conversations with their teachers (9 percent, compared with 5 percent for the comparison children), and requested help more often (6 percent, compared with 3 percent). We have interpreted these results as indicating that the teachers in the schema centres had adjusted their responsiveness to children, and their language behaviour as a result of their attention to children's schemas. However, the conversations were still foo few, and the low percentages do need to be treated with caution. (The differences may be chance ones). We have chosen to believe that curriculum change was occurring.

Schema Development

In this substudy of the *Competent Children* project, it has been argued by the research team that schemas, and the concepts which form from the coordination of schemas, are integral to the way that children develop "working theories for making sense of the living, physical, and material worlds," (ibid.). However, none of us did as much as we could have to help the schema children advance those theories.

Why do we say, "None of us"?

We have reported on the paucity of discussions and conversations between teachers and children. It was a little better in schema centres, but still not at a level that most people involved with early childhood education would consider sufficient. Discussion and conversations with children seldom occurred, which meant that children's working theories were seldom advanced by teachers talking with children.

In Chapter 5, where we described individual children's work on schemas, we began signalling that Paul and others clearly were developing or had "working theories" in relation to *action schemas*. Susan, for example, was developing a "working theory" or concepts in relation to floating, sinking, and water pressure, and to porousness, when experimenting with 'enveloping' living and other materials in water. First she tried pushing a sponge into the water and pulling it out and squeezing it. Then later on the same day she watched with fascination the transformation of a flower when she pushed it up

and down in another container of water. There was some continuity in content, with water experimentation, but the main continuity was *continuity of thought.*

One example of a child demonstrating the existence of a sophisticated "working theory" was displayed when Paul moved immediately to get rid of the sand which was creating friction in the core of a wheel, thus stopping its rotation. Another example was Bob pulling a block of wood across different surfaces by two ties - he shortened the length of the wool when the rough sandy surface kept causing the piece of wood to turn over or get stuck, thus improving the tautness of the length of wool.

Our point is that adults did too little to help children construct a better understanding of what they were experiencing, because they did not engage with these children's thinking.

A startling example of adults not fulfilling their responsibilities to foster learning was apparent when Paul worked for over a month to refine his "working theory" about 'trajectories' by using a lasso at varying speeds to "catch" different objects across different distances (see Chapter 6). While we were watching these repeated patterns of behaviour no teacher spoke to him to help him make sense of his experiments. The evidence was there that Paul was capable of abstract thought about concepts (a cluster of schemas), but the adults did not afford him opportunities to talk his thoughts out loud and test his theories against what adults know about these matters.

If you look back to the description of Stephanie participating in the science experiment with baking soda and vinegar, described in Chapter 5, you will note that there were many comments made by the children as they tried to understand the chemical reaction. However, the notes indicate that the teacher did not ask many "Why do you think?" questions to stimulate theory development, nor did she offer much in the way of theoretical explanation herself. We were not regular enough attendees at the centre to know whether that or related experiments - e.g., cooking cakes - were conducted, with explanations discussed, to help the children develop a "working theory" about chemical reactions in rising agents. Many commentators have noted the lack of such conversations which they attribute to teachers' feelings of inadequacy in relation to mathematics and scientific knowledge.

The staff in the Ngaio-tree and Karaka-tree schema centres made an important shift to attending to the *form of children's thinking* - schemas - which puts them ahead of most teachers in focusing on processes of children's thinking. Notwithstanding the above, more attention should be paid to *progressions in children's thinking.*

Progression in Thought

There was development of teachers' and parents' theoretical knowledge which led to profound insights into the children's development. They grasped the opportunities created by the action research to broaden and deepen their understanding of intellectual development.

By the time children are approaching 5 years of age (the age we studied them), they are often experimenting with "transformations" and "functional dependency" in relation to *action schemas*, whereas their work on these schemas when they were younger was at the motor level or in representing the schemas symbolically. Children thinking in the abstract about the schemas which are fascinating them is very probable by age 5. They are also making connections between schemas to form new ideas, i.e., to form concepts.

We observed little which indicated that teachers were observing these progressions and nourishing the children's more advanced levels of work with *action schemas.* It appeared to us that teachers were not consciously fostering children moving to higher levels of intellectual development.

Part of the reason for the teachers not extending children's thinking in the abstract about schemas and concepts could have been the limitations of **our** focus. We concentrated on the *forms of children's thinking*. When reviewing our workshop material and guidelines for the observational data we sought from teachers (and ourselves), it becomes evident that we too were not attending to *progressions* in children's work with *action schemas*. For example, we asked only for isolated examples of specific schemas, not for a series of examples showing progress through the levels of working and understanding those schemas. Thus, all of us had "lost the plot" in relation to children progressing, and did not do as much as we could have to help the schema children advance their theories and abstract thinking. In hindsight, we realise that more sharing of main research data during the course of curriculum intervention could have been useful to the teachers. An interchange was all to do with schema data.

Lilian Katz (1994, p201) has proposed that quality programmes must be judged in part on the children's subjective experience of the programme. One of the questions she poses for and on behalf of the child is:

> Do I find most of my experiences satisfying rather than frustrating or confusing? (ibid.).

Our point here is that without discussions/conversations with adults about their more advanced levels of work on schemas, children are likely to answer, "No, I am feeling confused." Helping to overcome confusion is only part of the adults' role. Teachers are there as well to help children to move to what they may next be able to do. At the higher levels of schema development, this has to involve discussion.

Cathy Nutbrown summarises Vygotsky's arguments for adult involvement in simple language.

> According to Vygotsky every piece of learning had a history, a base on which it was built, beginning before formal education and based on real-life experiences. This kind of learning occurs when children spend time with adults, working on real situations such as baking, filling the washing machine, gardening. Vygotsky regarded the match between a child's learning and his or her developmental level as all important. He suggested that children had two developmental levels, their actual developmental level, what they could actually do independently, and a higher level, that which they may next be able to do. Vygotsky identified the interchange between these two levels as the "'one of proximal development", the difference between what children can do alone and what they can do with help, support and guidance. He argues: "what a child can do with assistance today she will be able to do by herself tomorrow" (Vygotsky, 1978, p. 87). This notion emphasises the important role of the adult in fostering progression in children's thinking: helping children to move forward in, and develop their ideas through, positive and interactive learning encounters between children and adults," (Nutbrown, 1994, pp. 38-39). Teachers who do foster children's thinking are likely to feel greater job satisfaction. They will "experience the thrill of planning and facilitating the children's excitement about new revolutionary cognitive discoveries", (Burns, 1995).

The researchers have been considering how teachers might be able to find time to spot schemas and "help, support and guide" children's progress in thinking. There are logistical bariers to this increased level of assistance. A policy change towards smaller group sizes in kindergartens would help, as would an operational shift to a key worker approach (Goldschmied & Jackson, 1994). Generally, the case for key workers/caregivers is based on young children's emotional needs for a special relationship with an adult they can rely on who sets aside times when the children feel they are getting her undivided attention. We want to add to that case the point that such relationships given time and space, are essential for optimising children's power of speech, and hooking into children's deep

learning (their intellectual discoveries).

Curriculum Change

Early childhood teachers help children move forward in their social skills. We have a considerable amount of data which demonstrate that the teachers are quite comfortable about helping children progress in their social competence. Earlier we described many brief exchanges between teachers and children as being "superficial" exchanges about centre rules. That description masks and belittles the nature of those interactions. Their intended (and actual?) effect is to help children become more skilled socially. Why do we do less, even in simple quantifiable terms, to help children to progress intellectually? (There were far fewer interactions which extended children's minds.) In Chapter 2, we offered a theoretical explanation about why the early childhood sector has evaded focusing on children's intellectual development, and why society has not supported giving attention to intellectual component of early childhood teaching. It has suited society to regard early childhood teaching as unskilled work.

But society and the sector has shifted in the 1990s - as is evident in the acceptance of Goals 3 and 4 for the Exploration aim in *Te Whaariki*. Teachers have been empowered to include a focus on children's intellectual work. Here is a window of opportunity. The challenge now is for teachers to effect those changes. This reports indicates that focusing on children's schema development is one way to do so.

The teachers in the schema centres found that including an additional focus on schemas into their observations and profile records of children and making some *curriculum content* adjustments quite enough of a challenge. It was not easy to spot the schema to begin with, until the adults "shifted gear" to watch for continuities in children's thinking. Parents were a great help in identifying the intellectual interests which were dominating their children's behaviour. A variety of different recording methods can help teachers confirm what parents indicate and their own professional intuition and reflection suggest.

We have commented that teachers need to go further in terms of adjusting their *curriculum processes*, and in terms of attending to progressions in children's learning. There is an unmistakable tendency for teachers to write themselves out of curriculum processes, when in fact they need to do the opposite. This is not to be seen as an argument for teacher control. The children themselves must continue to be empowered to construct their own learning from a rich array of materials and experiences, but with more intellectually satisfying discussion with adults.

Achieving more talk connected to children's thinking may be hard to effect in the early stages of implementation, especially when the observational and curriculum content changes are being consolidated. However, the results are likely to be more beneficial than the ones outlined in this report. As stated earlier, many "more areas of change in terms of adult-child interaction could occur, and if they did lasting benefits to children (e.g., as was found in the Froebel Institute, described in Chapter 1) would be more likely.

The schema centres say that when it all came together for them it was great for the children, and very satisfying professionally.

Learning From Action Research

We said in Chapter 3 that action research methodology places some responsibility on the researchers to reflect on their practice as well. What did we learn from conducting this research on curriculum change?

The principal insight we had about our own behaviour was that we were also somewhat blinkered - our focus was also more on *curriculum content* than on *curriculum processes*. There were 2 main manifestations of this. First, our field notes concentrated mostly on the children and what they did with materials and equipment, and overlooked detailing what the adults did. Second, in the design of the workshop programme and what we would ask teachers to do for the research project, we focused on getting the teachers to record children's schemas as they spotted them, but did not ask the teachers to record what they did in response. The wall chart recording the children and their particular schemas was a powerful motivator for teachers to zero in on curriculum enrichment related to those schemas which were observed a lot. If we had asked the teachers to extend that chart and record what they had actually done in response to the data on the children, another drive for improvement would have been created. Moreover, it would have made a fuller evaluation possible. All too often, teachers working with young children miss out the evaluation step in the curriculum cycle:

plan → implement → monitor → review → plan

If we had asked teachers to gather more data about their actions, and about themselves interacting with the children, they would have been placed in a better position to reflect on their role in the curriculum, while still empowered to organise the programmes to suit their children and their families. It would have been quite simple to ask the teachers to extend their wall chart (see Figure 4) by adding "yellow stickies" with notes about what they did in the way of curriculum content and/or process for each of the schemas. Parents would have been able to read it for ideas for extensions they could try at home. Moreover, a content versus process analysis could be carried out by staff after a couple of weeks to enhance their reflective processes.

Thinking teachers are more likely to shape "a curriculum for thinking children"[19].

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[19] Nutbrown, 1994, p. 119.

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APPENDIX 1

Child Observation - Guidelines

Target Child's Competency Behaviour: observe all behaviour that occurs during the minute. At the end of the minute, circle the **most complex** behaviour seen, in *either* Section 11 *or* Section 12. **However,** if the most complex behaviour occurs only very briefly during the minute, then code the **predominant** behaviour. For example, if a child spends most of the minute wandering aimlessly, but there are a few seconds where s/he bumps into someone and says "Sorry," the most complex behaviour would be coded as "Aimless wandering".

11. Alone

(a) Solitary play - child plays alone. Pursues own activity, no interaction with others.

Example: playing alone with Lego
riding a trike around the perimeter of the yard

(b) Aimless wandering - child wanders from place to place, perhaps pausing very briefly once or twice.

(c) Observing/listening/onlooker - child watches and/or listens to other(s). Typically occurs across a distance.

Example: child at the window watching a group outside trying to build a sandcastle

12. Contribution: Social Skills With Other Children

A. **Parallel:** child plays independently, but engages in similar activity to neighbour(s), within 3'. No speech, social bids or turntaking. **Beside** rather than **with** others. Does not try to influence other(s)' behaviour.

(a) passive: child sitting at collage table watching other children - other children sitting very close by, working on gluing and stapling their own projects

(b) active: child is involved in the same activity as other children in the immediate vicinity.

Example: child in sandpit, s/he and others are all making sandcastles

B. **Simple:** child offers/exchanges social bids with partner. Does not necessarily involve language; other child may not respond). Interaction typically has a turntaking structure.

Example: two children at the woodwork table, talking to each other about what they are making
other child asks target child for a green circle, target child hands one over

C. **Reciprocal:** child and partner engage in action reversals, with a clear turn-taking sequence. No social pretend play.

Example: two children kicking a ball backwards and forwards to each other
games of hide and seek, tag

D. **Pretend Play**

(a) co-operative: child and partner are engaged in simple social play, with a script and complementary play roles
. . . scripts are organised, multi-event play sequences
. . . pretend acts are in a meaningful sequence
. . . roles must be clear from actions (may name/assign roles)

Example: three children pretending to make biscuits (at the dough table), talking about what ingredients they need to put in, all are involved in the same fantasy

(b) complex: as in co-operative play, plus child does one or more of the following:
. . . goes out of role to modify script
. . . makes a definite proposal to pretend ("You be the cat.")
. . . prompts the other child's actions ("Now you run away.")

Example: small group of children playing hospitals - one child pretends to fall over, another child then says to her friend, "Now you be the doctor and fix up his leg with plaster."

13. Exploration

(a) Verbal problem-solving/knowledge-seeking - why/who/what/if . . . then questions or statements

Example: asking an adult where kiwifruit comes from
talking through a problem ". . . now if we put that one under there, the yellow one will hold it up and we can add another one on top without it all falling over."

(b) Exploration with materials/problem-solving in play - experimenting with materials, may be overcoming obstacles, may try a number of different solutions.

Example: trying to stack stones, one on top of the other, working out how to balance them carefully aiming a ball before kicking it, lining it up to make sure it will go in the right direction. If it looks as though it's part of a routine (something that's been

done before), or like practising or consolidating, then it's *not* likely to be exploration.

14. Aggression

A. Verbal - swearing, imperatives (e.g., "MOVE!"), name-calling.

B. Physical - hitting, punching, shoving, kicking etc. Some degree of force, perhaps intimidation of another.
There will probably be physical contact (e.g., glaring at someone would not be coded); would also include intimidation with an object (e.g., threatening with a broom).

15. Contribution: Social Skills With Adults

(a) No interaction - there is no direct interaction between the target child and adult(s) during the observation. (However, an adult may talk to another child in the vicinity.)

(b) Group level only - e.g., adult talking to children en masse

(c) Adult unaware/ignores - child says something, but adult either does not hear or does not respond

(d) Interaction is only with the researcher - child approaches researcher; researcher should provide minimal response

16. Child → Adult: captures interactions initiated by the child

Code one or more

(a) Warm physical contact - child hugs, sits or stands close to adult
(b) Short verbal exchange - e.g., greeting, farewell, one or two brief verbal exchanges
(c) Conversation - three or more exchanges
(d) Request for help/information - initiated by child
(e) Rebuffs/rude/ignores - child deliberately rebuffs or ignores what adult has said or done

17. Adult → Child: captures adult's approaches/responses to child

A. **Intensity**

(a) Minimal: detached care - caregiver touches, makes other non-verbal response (e.g., smiling), or talks to child
. . . to discipline without explanation
. . . to move the child away from another child
. . . to answer direct requests for help
. . . to give verbal directives with no reply encouraged

Example: adult asks child to move to the table because it is lunch time
adult points to cupboard in response to child's question about where her shoes are

(b) Simply elaborated:

Adult
- . . . may maintain close proximity to child
- . . . acknowledges child's social bids and responds verbally
- . . . disciplines using redirection/explanation

Adult *does not*
- . . . elaborate or extend child's language
- . . . restate child's statements
- . . . engage child in conversation
- . . . play interactively with child to suggest material to structure play

Example: adult asks child to stop throwing a heavy block of wood around as someone might get hurt and offers a ball instead

(c) Intense: adult
- . . . restates child's social bids
- . . . engages child in conversation
- . . . suggests materials to structure child's play
- . . . may hug or hold child
- . . . disciplines using redirection etc., accompanied by detailed explanation, which may involve discussion/negotiation with child

Example: adult asks child to stop throwing a heavy block of wood around, asks child what might happen if it landed on somebody's foot and then asks child to suggest something else that would be more suitable for throwing around
adult responds to child's question regarding where kiwifruit come from, then explains how long they take to grow and how you know when they are ripe

B. **Physical Contact**

(a) No close contact: adult may be physically close, but does not actually touch child, stand or sit close to the child to enhance communication.

(b) Warm, positive: adult touches, sits or stands next to child in a warm and friendly manner, may guide child's actions, proximity may enhance relationship.

(c) Intense: adult hugs or holds child.

C. **Intellectual**

(a) No cognitive language extension: adult's response/activity does not extend child's play, language and/or knowledge.

Example: adult answers a child's question about the name of a colour made by mixing two other colours together, but does not suggest other possible combinations or ask child if s/he can guess what blue and yellow mixed together will make

(b) Cognitive/language extension: adult extends child's play, language and/or knowledge, e.g., by elaborating on a theme.

Example: adult explains about the concept of gravity when watching children throw objects of various weights from a height and suggests timing how long it takes for different objects to reach the ground

D. **Tone (of Adult)**

(a) Positive: overall nature of interaction is warm, positive, accepting, non-confrontational etc.

(b) Negative: overall nature of interaction is cold, negative, dismissing, rude, confrontational etc.

APPENDIX 2

MASTER 2/2/94

CHILD OBSERVATION SCHEDULE RESEARCHER: _____

1. CHILD'S ID _____
   DESCRIPTION _____
4. DATE _____
6. TYPE _____
8. OBSERVATION 1 2 3 4 5

2. GENDER ☐ a) male ☐ b) female
3. TIME ☐ a) a.m. ☐ b) p.m.
5. ECS ID _____
7. AGE RANGE ☐ a) Mixed ☐ b) preschool
9. LOCATION ☐ a) INDOOR ☐ b) OUTDOOR

10. GROUP SIZE AND COMPOSITION
    a) Alone
    b) 1 adult (within 1 metre)
    c) 1+ adult (distant)
    d) More than 1 adult
    e) With 1 child
    f) With 2-5 children
    g) With more than 5 children

TARGET CHILD'S COMPETENCY/BEHAVIOUR EXAMPLES
CODE MOST COMPLEX BEHAVIOUR SEEN DURING OBSERVATION PERIOD (11 & 12)

11. ALONE
    a) Solitary play
    b) Aimless wandering
    c) Observing/listening/onlooker (distant)

12. CONTRIBUTION: SOCIAL SKILLS WITH OTHER CHILDREN
    A PARALLEL
       a) ____ Passive
       b) ____ Active
    B Simple (collaborative/interactive)
       a)
       b) Couldn't hear
    C Reciprocal (role/action reversal)
    D PRETEND PLAY
       a) ____ Cooperative
       b) ____ Complex

13. EXPLORATION
    a) Verbal problem-solving/knowledge seeking
    b) Exploration with materials/problem-solving in play

14. AGGRESSION
    a) Verbal
    b) Physical

15. CONTRIBUTION: SOCIAL SKILLS WITH ADULTS
    a) No interaction
    b) Group level only
    c) Adult unaware/ignores
    d) Interaction is only with the researcher

{ONE-TO-ONE INTERACTION BETWEEN ADULT AND CHILD, NO: STOP HERE
YES: COMPLETE SECTION BELOW}

16. CHILD → ADULT EXAMPLES

a) Warm physical contact
b) Short exchange (e.g. greeting)
c) Conversation
d) Request for help/info
e) Rebuffs/rude/ignores
f) Child responds non-verbally appropriately (this is not child → adult!) *

17. ADULT → CHILD

A INTENSITY
a) Minimal
b) Simple/elaborated
c) Intense
d) Conversation (couldn't hear content)

B PHYSICAL CONTACT
a) No close contact
b) Warm, positive
c) Hugs or holds

C INTELLECTUAL
a) No cognitive language extension
b) Cognitive language extension

D TONE
a) Positive
b) Negative

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18. BRIEF DESCRIPTION OF GENERAL CONTEXT AND BEHAVIOUR OBSERVED, INCLUDING ANY LANGUAGE: