DEAFNESS AND MOTHER-CHILD INTERACTION:

SCAFFOLDED INSTRUCTION

AND THE LEARNING OF PROBLEM-SOLVING SKILLS

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ABSTRACT

This study examines the effects of maternal teaching style on the developing problem-solving abilities of deaf and hearing preschool children. Mothers and children from three matched groups, hearing mother-deaf child, hearing mother-hearing child, and deaf mother-deaf child, were videotaped while the mother taught the child to construct a small pyramid from 21 interlocking blocks and again when the child attempted the task independently. The tapes were coded and analyzed to examine maternal instructional style and subsequent independent child performance. The mothers in the deaf mother-deaf child and hearing mother-hearing child dyads used appropriate scaffolding behavior significantly more often than the other mothers; their children were significantly more adept and independent problem-solvers than the deaf children of hearing mothers. The more contingent the mother's instructions, the more independent and successful the child. Scaffolding is discussed in terms of its benefits for instructing deaf children.

RESUME

Ce projet de recherche étudie les effets de la méthode d'enseignement de la mère sur l'habilité qui se développe chez les enfants sourds et entendants d'âge pré-scolaire à resoudre des problèmes. Des mères et des enfants de trois groupes semblables, mère entendante et enfant sourd, mère et enfant entendants, mère et enfant sourds, ont été filmés sur cassettes pendant que la mère enseignait à l'enfant comment construire une petite pyramide de cubes s'emboîtant les uns sur les autres et aussi pendant que l'enfant essayait la tâche indépendamment. Les cassettes ont été codées et analysees afin d'examiner le style d'enseignement maternel et la performance subséquente de l'enfant travaillant seul. Les mères des groupes mère-enfant sourds et mère-enfant entendants utilisaient plus souvent un comportement de support approprié que les autres mères; leurs enfants etaient plus aptes a résoudre des problèmes indépendamment que les enfants sourds des mères entendantes. Plus les instructions de la mère répondaient au comportement de l'enfant, plus l'enfant était indépendant et réussissait. Le système de support (scaffolding) est discuté en termes de ses bienfaits dans l'enseignement aux enfants sourds.

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CHAPTER ONE

Introduction

Deaf children experience a variety of problems because they lack a crucially important sensory modality. Educational, linguistic, and psychological research has provided many insights into the difficulties faced by deaf[1] children who live in a world where others can hear. A great deal has been written about the poor language skills and low levels of educational achievement of deaf children (see Allen, 1986; Brasel & Quigley, 1977; Moores, 1982, to cite only a few examples). The education of children for whom communication is hindered because of severe or profound deafness from birth is clearly a challenging process, both for the child and the teacher.

As is the case with hearing children, the mother is generally the first teacher with whom the deaf child has early and consistent contact. Approximately 9 out of 10 deaf children are born to hearing parents, while the remaining 10% are born to deaf parents (Schein & Delk, 1974). Previous research suggests that parental response to the diagnosis of deafness in the child is influenced by such factors as parental hearing status, prior experience with deafness, and expectations and attitudes of family members about deafness (Meadow-Orlans, 1987b). This implies that hearing parents may respond differently to the

diagnosis of deafness than deaf parents, for whom hearing loss is a familiar condition. Research suggests that this is indeed the case.

Meadow, Greenberg, Erting, and Carmichael (1981) have studied specifics of the linguistic and social interaction among hearing children and their mothers, deaf children and their deaf mothers, and deaf children and their hearing mothers. The most striking and consistent finding to emerge was the similarity in social and linguistic interaction of the deaf mother-deaf child pairs and the hearing mother-hearing child pairs. The mothers in these two groups were found to be less directive and their children demonstrated an ability to carry on more elaborate conversations than in the hearing mother-deaf child pairs.

By contrast, extensive research has shown hearing mothers of deaf children to be more didactic, more dominant, and more intrusive, but less flexible, less permissive, and less approving in their child-directed language than hearing mothers of hearing children of comparable age (Brinich, 1980; Goss, 1970; Greenberg, 1980; Henggeler & Cooper, 1983; Meadow et al., 1981; Schlesinger & Meadow, 1972; Wedell-Monnig & Lumley, 1980).

Most of the explanations in research to date suggest that these differences arise from the communication styles of deaf and hearing mothers with their deaf children. For example, several studies of the sign language acquisition of deaf children of deaf parents conclude that the

linguistic development of these children is very similar to the spoken language development of hearing children of hearing parents (Klima & Bellugi, 1974; Lane, Boyes-Braem, & Bellugi, 1976; Schlesinger, 1978; Schlesinger & Meadow, 1972; Siple, 1978). By contrast, Greenberg and Marvin (1979) suggest that there is a lengthy delay in the initiation of parent-child communication in hearing families of deaf children, resulting from delays in the diagnosis of deafness. Meadow-Orlans (1987a) suggests that the conflict between teachers' demands to communicate more and the deaf child's inability to communicate orally may create pressure on hearing mothers to try increasingly to elicit responses, leading to a more dominant communication style than that which is utilized by deaf mothers. It is clear that the delay in the language acquisition of deaf children of hearing parents has a pervasive effect on mother-child interactions; on the other hand, it also appears that deafness in and of itself does not preclude the development of positive mother-child interaction when both the mother and child are deaf. However, there has been little research to delineate the specific conditions in which these positive interaction patterns occur and the effects of early mother-child interaction patterns on the cognitive development of deaf children.

It is possible that this difference in parental response to deafness may affect not only communication styles, but also patterns of mother-child interaction for

these two groups of parents. It may be that one group has a more effective interaction style than the other, giving rise to more effective teaching strategies.

One available theoretical framework arises from the work of Wood, Bruner, and Ross (1976), who, basing their ideas on Vygotsky's "zone of proximal development," have proposed a theory of scaffolded instruction. Related research (Wood & Middleton, 1975) has shown that some mothers are better at this process than others. The major idea behind this research is that to the extent that mothers consider their children damaged or inadequate as potential learners, they will tend to use rigid teaching strategies that are not contingent upon their children's behavior. They may be working from some sort of plan or system that detracts from their taking into consideration the degree of success of their children's efforts during instruction.

Scaffolding, that is, giving the child just the needed encouragement and support and no more, is particularly useful in the analysis of patterns of mother-child interactions because the degree to which it is used can be described and quantified, thus making accurate comparisons among mothers and their children possible. Observing interactions between deaf and hearing mothers and their deaf children from this perspective may increase the understanding of the kinds of situations which influence maternal teaching styles and the subsequent effect of these

on children's initiative-taking and learning. In addition, the results of this study may provide important suggestions as to how parents may improve the effectiveness of their teaching interventions, particularly when childhood deafness is a factor.

CHAPTER TWO

Literature Review

Culture, Communication, and Cognition: A Dialectical Perspective

During the last decade, a growing interest in social interaction with young children has made researchers aware of the need to consider the social context in which cognitive skills develop. Infants develop within changing social worlds; in interaction with others they acquire new ways of responding to the people and things around them, including language and communication skills. The theoretical framework adopted in this study recognizes the usefulness of a dialectical interpretation of development such as has long been accepted in the Soviet Union (Cole & Scribner, 1978; Luria, 1979; Vygotsky, 1978) and is recently being given more serious consideration by Western scholars in a variety of areas, including intelligence testing (for example, Brown & French, 1979; Campione, Brown, Ferrara, & Bryant, 1984; Day, 1983), memory (for example, Rogoff & Gardner, 1984), and problem-solving (for example, Wertsch, 1978; Wertsch, McNamee, McLane, & Budwig, 1980; Wood et al., 1976).

Of particular interest is Vygotsky's[2] theory of cognitive development, which arose from his attempts to

formulate a theory of psychology built on the foundation of Marxist thought. Central to Vygotsky's theory is the notion that adult human cognitive functioning arises from culturally organized forms of social interaction. In other words, in order to understand the ontogenesis of cognitive functioning, it is necessary to examine the way in which children's social interaction with more experienced members of their culture leads to the mastery and internalization of that culture. Vygotsky argues that, humans being social creatures, all psychological processes are in origin essentially social processes: when children learn, they always do so in the context of interaction with others in the first instance, and of internalization in the second. Vygotsky (1978) specified some of the processes which make possible the transformation from social to individual functioning in his "general law of cultural development":

> An interpersonal process is transformed into an intrapersonal one. Every function in the child's cultural development appears twice: first, on the social level, and later, on the individual level; first between people (interpsychological), and then inside the child (intrapsychological). This applies equally to voluntary attention, to logical memory, and to the formation of concepts. All the higher functions originate as actual relations between human individuals. (p. 57; underlining is author's emphasis)

Vygotsky's theory of cognitive development rests heavily on the key concept of internalization. Children first experience active problem-solving in the presence of adults or more capable peers and gradually come to perform these functions independently. The process of internalization is cumulative: first the adult or knowledgeable peer controls and guides the child's activity, but eventually the adult and child come to share the problem-solving activity, with the child eventually taking the initiative and the adult correcting and supporting when the child fails or falters. This developmental progression from other-regulation to self-regulation is an important outcome of mother-child learning dyads (Wertsch, 1978).

Within the context of the gradual internalization of cognitive activities that were in genesis shared interactive processes, Vygotsky (1978) introduced the concept of the zone of proximal development, referring to

> the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or collaboration with more capable peers (author's emphasis)....The zone of proximal development defines those functions that have not yet matured but are in the process of maturation, functions that will mature tomorrow but are currently in an embryonic state. These functions could be termed the "buds" or "flowers" of development rather than the

> "fruits" of development. The actual developmental level characterizes mental development retrospectively, while the zone of proximal development characterizes mental development prospectively. (pp. 86-87)

An example may serve to clarify the preceding definition. Two children could be asked to sort a set of 20 pictures into 4 subgroups, each of which has characteristics distinct and separate from the other subgroups. Initially, neither child is successful; both sort the pictures into haphazard, taxonomically unrelated groups. Thus, the sorting task is beyond their actual level of development. The experimenter then sorts the pictures for the children, providing an explanation for the four categories. The pictures are once again scrambled and each child is asked individually to sort them. One child benefits from the instruction and sorts the pictures perfectly; the other child, in contrast, produces another haphazard arrangement. Vygotsky would view these children as having different developmental levels and different zones of proximal development: the child who succeeded after instruction has a higher potential developmental level within the zone of proximal development for the sorting task, than the child who did not.

It is interesting to note that Vygotsky's essentially interactive theory of learning had an important effect on the development of clinical testing in the Soviet Union. Both Vygotsky (1978) and his student Luria (1961) criticized

static measures of intelligence for having limited usefulness, since they tap only mental functions that have already developed fully. They advocated the use of dynamic testing procedures that would provide information on learning potential or the ability to benefit from instruction. However, further discussion on the topic of testing is beyond the scope of this research.

In considering specific forms of instruction, Vygotsky (1978) focused on how interpsychological functioning can be structured so that it will maximize the growth of intrapsychological functioning. He considered instruction to be of value only when it proceeds ahead of development, acting as a catalyst for those functions which lie in the zone of proximal development. According to Vygotsky, it is in this way that instruction plays a very important role in development.

The central question, thus, becomes how the adult effectively diagnoses the child's ideas and hypotheses. Wertsch (1984), in an attempt to clarify and expand Vygotsky's theory, stressed the importance of three conceptual issues which enable the adult to assess the child's learning potential and provide appropriate instructions: situation definition, intersubjectivity, and semiotic mediation.

A situation definition is the way in which a setting or context is represented by those who are operating in that setting. Collaboration in the zone of proximal development

typically involves the adult's representing objects and events in one way and the child's representing them in another; in spite of the fact that the adult and child are functioning in the same spatiotemporal context, they often understand this context in such different ways that they are not really doing the same task (Wertsch, 1984). For example, in the previously cited example of an adult teaching the children to sort pictures into categories, the adult and the children do not share a common initial representation of the pictures. The adult understands each picture as belonging to one of four categories. On the other hand, the children's initial sorting efforts are based on a representation of the pictures that does not take the four categories into consideration. In other words, an individual defines a situation in terms of the representation of objects and the representation of action patterns for dealing with those objects.

The child's situation definition corresponds to the actual level in the zone of proximal development; the children's initial efforts to sort the pictures may not represent random activity, but rather a different situation definition than that held by the adult. Successful use of the zone of proximal development requires the adult to bring the child's definition of the task closer to the conception held by the adult. The adult-child dyad in the example do not share a common situation definition and so they must redefine the situation until intersubjectivity exists

between them. One may speak of intersubjectivity as existing in this task setting when the adult and child largely share, and are aware that they share, the same situation definition. Hence, it becomes necessary for the adult and child to negotiate an intersubjective situation definition in order to define the child's level of potential development. This may require the child to change his or her understanding of objects and events, or it may require that both the adult and child negotiate an intersubjective situation definition that differs from both of their ways of understanding the situation on an intrapsychological plane. However, it is essential to recognize that the adult's willingness to accept a second situation definition temporarily is done as a means of carrying out the communicative task at hand.

Intersubjectivity is often negotiated, in Vygotsky's terms, through semiotic mediation, that is, mediation through signs, especially linguistic signs. By representing objects and events in speech in a certain way, the adult can attempt to negotiate a new level of intersubjectivity. In responding to the adult, the child may join in the process and set up bilateral negotiation. Thus, any disruption in communication between the adult and child will lead to difficulty in achieving intersubjectivity and, subsequently, in the adult's effectively diagnosing the child's zone of proximal development. However, the negotiations involved in the achievement of intersubjectivity are not always

necessarily undertaken by means of speech: Rogoff, Malkin, and Gilbride (1984) discuss mechanisms of joint attention, such as joint eye gaze, that are important in the formation of intersubjectivity between adults and infants as young as 4 months of age. Such mechanisms help to lay the groundwork for children's participation in subsequent zones of proximal development by enabling the adult and child to "calibrate the appropriate level of participation by the child, where the child is comfortably challenged" (p. 43).

According to Vygotsky, the dynamic edge of development consists of interactive processes that take place between the child and others, particularly adults or more capable peers. This is an important contrast to many other developmental theories which consider the child to be a self-enclosed unit of analysis and have not regarded interactive processes as an inherent part of the developmental process (Hickmann, 1985). In explaining the notion of the transition from interpsychological to intrapsychological functioning, Vygotsky attributed a crucial role to speech. When dealing with the function of speech in this process, he was mainly concerned with the social activity of speech, and included many aspects of communication in addition to language systems. In Vygotsky's view, it is through interaction with experienced members of the speech community that the child is exposed to linguistic norms. He asserted that the primary reason for adults and children to participate in social interaction is

to engage in communication and mutual regulation. It is in this context that Vygotsky proposed his notions of egocentric and inner speech.

This account grew out of his critical interpretation of Piaget's (1929) notion of egocentric speech, and in spite of their usage of the same nomenclature, Piaget and Vygotsky are referring to two very different theoretical constructs. Piaget described the phenomenon of children's egocentric speech as a manifestation of the child's immature and self-centered understanding of the world, and he argued that as the child becomes socialized this peculiar speech form disappears. In contrast, Vygotsky (1962) argued that egocentric speech is the bridge between external interpsychological functioning and internal intrapsychological functioning. According to Vygotsky, egocentric speech has its origins in earlier forms of social speech: "the scheme of development [is] first social, then egocentric, then inner speech" (p. 19). This implies that the very nature of egocentric speech must be based on the types of communication in which the child participated before the emergence of this speech function (Wertsch, 1979). In other words, the child's earlier communicative interactions involving "other-regulation" by adults lay the foundation for the later "self-regulative" capacities of egocentric speech. For Vygotsky, egocentric speech is the transition from overt verbalized thought to inner speech, and the reason for its appearance is that the new

internalized self-regulative function of speech is still not completely differentiated from its earlier social functions. However, unlike Piaget, who argued that egocentric speech dies out as a result of the child's socialization, Vygotsky (1962) believed that "it does not simply atrophy but 'goes underground,' i.e., turns into inner speech" (p. 18).

Wertsch (1979) proposes four levels in the transition from egocentric to inner speech, or from other-regulation to self-regulation, which, though not exhaustive, do define several points in the developmental path through which the child must pass in order to attain independent problem-solving abilities with regard to a particular task. At the first level, the mismatch between the adult's and the child's definition of the task situation is so great that they are actually participating in different activities. The crucial issue at this level is how the child begins to develop a definition of the task situation that will allow him or her to participate in the communicative context. By the second level, although still not functioning as an independent problem-solver, the child does have an evolving situation definition which enables functioning at the interpsychological plane. The transition from other-regulation to self-regulation is well under way by the third level, when the child's situation definition coincides with that of the adult. By this time, the child has already taken over much of the strategic responsibility for carrying out the task. The fourth and final level in this scheme

occurs when the child has taken over complete responsibility for the problem-solving effort. The process shifts from the interpsychological to the intrapsychological plane at this point, and the transition from other-regulation to self-regulation is complete. In many cases "egocentric speech will appear during, and shortly after the shift to the intrapsychological plane. This speech, with its self-regulative function, will be similar in many respects to the speech used earlier by the adult in carrying out other-regulation" (Wertsch, 1979, p. 17).

Vygotsky's dialectical perspective of cognitive development is central to the current research activities of Jerome S. Bruner and David J. Wood. Observing children in their usual settings through the use of naturalistic research methods, Bruner (1975) has identified a number of features of infant-parent interaction which help ensure the achievement of early, shared, intersubjective experiences and are largely achieved through the use of what would soon be referred to as "scaffolding." The first mention of the actual term scaffolding is provided by Wood et al. (1976), who describe it as a

> process that enables a child or novice to solve a problem, carry out a task or achieve a goal which would be beyond his unassisted efforts. This scaffolding consists essentially of the adult "controlling" those elements of the task that are initially beyond the learner's capacity, thus

> permitting him to concentrate upon only those elements that are within his range of competence. (p. 90)

The critical feature of scaffolded instruction is its interactive nature. There is ongoing interplay between mother and child in the joint completion of a task. As Palincsar (1986) notes, "Wertsch (1984) captures the spirit of scaffolded instruction well when he borrows a Russian expression in Vygotsky's work, obuchenie, or 'the teaching-learning process'" (p. 75).

Scaffolded instruction begins with the selection of the task, which is chosen for the purpose of teaching a skill that is emerging in the child's repertoire but is not yet fully developed (Applebee & Langer, 1983). The task is evaluated to determine the level of difficulty it is likely to pose for the child, with a view to breaking the task down into a series of manageable subgoals (Wood et al., 1976). Hodapp, Goldfield, & Boyatzis (1984) and Wood et al. (1976) stress the importance of eliciting and sustaining the child's interest in the task during the course of instruction. Hinting, questioning, explaining, and modelling are used to assist the child in learning the steps necessary to complete the task (Applebee & Langer, 1983; Cazden, 1983; Wood et al., 1976). There is considerable emphasis on the child's participation in the activity, providing evaluation of his or her ability vis-à-vis the task. This evaluation is conducted for the purpose of calibrating the level of difficulty of the task for the

child (Applebee & Langer, 1983; Wood & Middleton, 1975). The calibration supplies the mother with information to make appropriate adjustments in the level of instructional support and provides the child with information regarding any discrepancy between his or her production and the correct production (Wertsch, Minick, & Arns, 1984; Wood et al., 1976).

Finally, the ultimate result of receiving consistently well-scaffolded instruction for any individual is generalization to other contexts or activities where less and less help will be needed (Applebee & Langer, 1983). In the example of the adult teaching the child to sort the pictures, the specific aim was to enable the child to sort the pictures correctly and as independently as possible and, in the case of successful scaffolding, the child learned problem-solving skills of that type. Such generalization is facilitated by the gradual withdrawal of the scaffold as the child demonstrates increased competence with the task. From this perspective, the metaphor of the scaffold becomes clear because a scaffold provides a means of support that is both adjustable and temporary (Palincsar, 1986).

Using a dialectical interpretation of development between adults and children, David Wood has spent more than a decade analyzing the course of instruction in problem-solving situations. Wood and Middleton (1974, 1975) and Wood et al. (1976) examined the process which mothers use in successfully assisting their young children in the

solution of a well-defined problem. In this series of studies, mothers of preschool children were asked to teach their children to assemble a 21-piece construction toy, the completion of which was initially beyond the children's unassisted efforts. The instructional process was viewed as a hierarchical measure of the mother's intervention and, correspondingly, the levels of intervention were represented on an ordinal scale as follows:

Level 1. General verbal instruction. The mother attempts to activate the child towards some generally specified goal. For example, sne might say, "That was good. Can you make another like it?" or "What are you going to do next, another one?"

Level 2. Specific verbal instruction. The mother lays down some clear parameter for search or operation. For example, "Can you find a large one now?" or "No, you need one with a hole, don't you?"

Level 3. Mother indicates material. Here the mother intervenes directly in the process of construction and shows the child what material should be used, as in "You need that one over there."

Level 4. Mother provides material and prepares it for assembly. The mother not only indicates material but actually selects it and places it in a suitable orientation for construction, leaving the child the task of simply pushing the material together.

Level 5. Mother demonstrates an operation. The mother selects and assembles material while the child (hopefully) looks on. (Wood & Middleton, 1975, p. 184)

In addition, Wood et al. (1976) mention the importance of tutorial control of the child's frustration level.

The hypothesis, which was derived from the concept of scaffolding and was confirmed by the research, was that the lower the child's level of task competence, the higher the mother's typical level of tutorial interventions. In short, the general rule (the contingency rule) of scaffolding is that the most efficacious scaffolders are those whose behavior is contingent upon the actions of the child, rather than those who are habitually directive. More specifically, mothers whose children do well after instruction are those who are most likely to act in accordance with two rules of teaching: the first dictates that any failure by a child to bring off an action after a given level of help should be met by an immediate increase in help or control; the second rule states that after success, the mother should offer less help than that which preceded success (Wood & Middleton, 1975).

The role of dialogue is critical to the scaffolding process; it is the means by which support is provided and adjusted (Palincsar, 1986). As previously mentioned, Wertsch (1979) observed that when children are engaged in problem-solving, they will often conduct dialogues with themselves, posing and responding to questions, seemingly in

an effort to guide their actions, until they have mastered the task at hand. Wood and Wood (1983) found that different conversational styles of teachers significantly influenced children's patterns of responding and initiative-taking: the less controlling the teacher, the more lengthy and elaborate the children's conversational responses. This was also found to be true for teachers of hearing-impaired children (Wood, Wood, Griffiths, Howarth, & Howarth, 1982). More important, it was also demonstrated in subsequent research (Wood & Wood, 1984) that teachers of the deaf could be taught to adopt less controlling conversational styles with a resulting increase in the length and number of child-initiated conversations, than before the intervention was made.

Palincsar (1986) suggests that "scaffolded instruction...embodies the best of teaching practices" (p. 95). Hodapp et al. (1984) state, simply, that "scaffolding matters" (p. 780) and that in scaffolding, "mothers are providing an environment that serves to 'pull' higher-level behavior from the child, thus establishing a bridge between the child's social and cognitive worlds" (p. 781).

Theories of early cognitive development may be seen as located between two opposing views on the extremes of the same continuum: on one extreme end is the "learning by discovery" hypothesis, which suggests that one may leave to nature the child's total education by not intervening but

allowing the child to unfold; on the opposite extreme is the radical behaviorist view that learning occurs only as a result of reinforcement, which justifies directive instruction. (It is acknowledged that very few academics today would subscribe to either of these extreme positions, which are advanced here only for the purpose of stark clarity.) The concept of scaffolding is located midway along this continuum, emphasizing both the child's readiness to learn and the importance of adult assistance. According to several writings of Vygotsky, Bruner, and Wood, any notions of readiness for learning are less stringent, not so stage-governed and more specific to individual learners and the social situation in which they find themselves than the two extreme and opposing views mentioned above. Over the years, Vygotsky, Bruner, Wood and many others have viewed adults as having a central role not only in the instructional process but also in helping children to learn problem-solving strategies.

Childhood Deafness and Mother-Child Interaction

Vygotsky's claim that children first learn through socialization assumes communicative interaction for children and more experienced members of their culture. Although there are a few recorded cases of children who have suffered from extreme isolation (as presented by Shattuck, 1980, for example), communicative interaction between primary

caregivers and infants is virtually inevitable and unavoidable; it is triggered, if for no other reason, by such physical necessities as feeding, the need to be diapered, and physical comfort-seeking by the child (Bower, 1977). While interaction patterns between adults and children, particularly between mothers and infants, are not taught, there are common patterns, and although the mother is usually not conscious of any deliberate plan, they are relatively systematic.

This interactive process begins immediately in the child's life: research on early social interaction suggests that young children rapidly develop into socialized participants in their culture through a finely tuned combination of infants' skills and the guidance of more experienced people. Children are born with the ability to take initiatives in interaction episodes and they use this ability to put themselves in a position to gain the knowledge and skills of their culture (Bower, 1977). For example, the cries and smiles of new babies successfully elicit attention from adults. Rogoff et al. (1984) suggest that "infants come into the world equipped with effective ways of ensuring proximity to more experienced members of society and of becoming involved with their physical and social surroundings" (p. 32). Adult-infant interaction provides a social context to channel the development of already present skills in the infant into socially interactive behavior. Hodapp et al. (1984) suggest that

mothers provide social scaffolds to assist infants in the acquisition of skills related to paying attention together to the same objects and activities. In support of this contention, Butterworth and Cochran (1980) and Lempers (1979) have shown that 1-year-old babies can obtain information from the direction in which their mothers point and gaze.

The process of guided participation involves joint responsibility by the mother and infant for the structuring and pacing of the interaction. For example, Rogoff et al. (1984) observed adults' interactions with babies and described their joint responsibility for an activity. Each of 26 adults was observed interacting with a baby between 4 and 17 months of age, while playing with a jack-in-the-box. The data consisted of transcripts describing the sequence of adults' and babies' communicative actions: their vocalizations and intonations, postural changes, gaze, gestures, and actions with objects. The focus of interaction shifted from attempting to maintain joint attention when the baby was 4 months old, to managing joint use of the jack-in-the-box when the baby was 5 1/2 to 12 months old, to managing the social relationship in the joint activity through persistent symbolic communication when the baby was 12 to 17 months old. The characteristics of the infants and of the adult-infant interaction were well suited for helping the babies learn: as the child became capable of handling more components of the activity, the adult

withdrew some scaffolds and structured the activity differently.

Over the course of learning, reciprocal communication strategies are used to negotiate intersubjectivity, to assist the adult in assessing the child's current capacity to learn (the zone of proximal development), and to enable the child to learn a variety of culturally patterned behaviors. From children's infancy, adults provide scaffolding that allows them to participate in conversations that would otherwise be beyond their competence in discourse. Interactive strategies are utilized that appear to facilitate advances in communication and specific language abilities of children; these language-learning strategies of children and language-teaching strategies of parents are reciprocally related and change developmentally (Garnica, 1977; Snow, 1977). In other words, as the child becomes more skilled in the use of language and speech, the mother reduces the level of scaffolding and allows the child to participate conversationally to a greater extent. However, if the child indicates lack of understanding, the mother can quickly and subtly re-erect the scaffolding and assume greater control in the conversational process. For example, while reading the story of Goldilocks and the Three Bears, a mother may ask her child, "How many bears are there in the picture?" and the child may reply, "Two bears." In response to the child's error, the mother may increase her level of scaffolding by pointing to the picture (thereby

providing a visual support) and counting, "No, you see there are one, two, three bears."

Lasky and Klopp (1982) found that, in the case of mothers interacting with their normally developing children, maternal use of verbal and nonverbal communication patterns appeared "subtle yet related to their child's linguistic ability" (p. 17). There are, however, conditions which may influence the development of linguistic ability in the child; for example, the loss of a sensory modality (as in the case of deafness or blindness) may require alternate strategies of interaction for effective communication. Despite the logical necessity to distinguish between children who have a sensory problem and those who have mental deficiencies of some kind, many researchers have generalized their findings about mentally retarded, autistic, and other developmentally delayed children to include other disabled children, including those who have an impaired sensory modality of some kind (for example, Buckhalt, Rutherford, & Goldberg, 1978; Buium, Rynders, & Turnure, 1974; Kogan, Wimberger, & Bobbitt, 1969). These studies suggest that apparent status of the child as disabled in some way is the key factor in causing the mother to be more directive; they have shown that mothers of disabled infants and young children are more directive in their play sequences, assume more control of interactions, and take the initiative in interaction sequences more than other mothers. Stipek and Sanborn (1985) found that this

pattern of behavior was not restricted to mothers: they found that teachers of preschool children initiated considerably more interactions with disabled and "high-risk" children than with ordinary children.

However, recent research (Brooks-Gunn & Lewis, 1984) has begun to make distinctions between children who have impaired functioning in one sensory modality and those who are physically disabled or developmentally delayed. Several recent studies have changed the focus from the study of disabled status to that of the child's linguistic ability, with the result that a growing emphasis has been placed on the importance of children's linguistic ability in influencing how mothers will behave during interactions with their children. Brinich (1980) and Pellegrini, Brody, and Sigel (1985) suggest that communicative, rather than intellectual, difficulties may be the operative factor in the maternal emphasis on control. In other words, when a mother finds it difficult to establish reciprocal communication with her child, she may adapt to the situation by emphasizing control in the relationship. This implies that it may be the mother's reaction to the child's communicative disorder that inhibits reciprocal communication, rather than the communicative disorder itself. Vygotsky (1978) considers reciprocal communication to be essential for social interaction between children and adults; reciprocal communicative interaction is the cornerstone in the process of the transmission of culture

and the development of cognitive skills.

Faulty or inadequate mother-child communication sets into motion a pattern of interaction which has implications far beyond the immediate conversational context. If the child lacks the social speech which facilitates the achievement of intersubjectivity, the mother may not appreciate the child's actual performance potential. As a consequence, the mother may base her scaffolding on her faulty estimation of the child's ability, rather than on the child's actual needs. Lederberg (1984), in an examination of the interactions between deaf preschoolers and unfamiliar hearing adults, noted a tendency for the adults to modify their speech to match the levels of the children's oral linguistic ability, rather than to adjust their interactions to accommodate the specific type of communication problems posed by the children's deafness. Such a pattern of behavior may impede the child's ability to benefit from instruction; from this perspective, the mother's response to her child's communicative disorder has implications not only for the immediate conversational context, but for the child's mastery of cognitive skills as well.

Childhood deafness offers an opportunity to explore the effects of reciprocal communication on mother-child interaction and on the processes of development at particular times. The incidence of childhood deafness is relatively low: only about 1 child in 1000 is deaf (Freeman, Carbin, & Boese, 1981; MacDougall, 1987).

Approximately 9 out of 10 deaf children come from nuclear families that have no other deaf members, while the remaining 10% have at least one deaf parent or sibling (Schein & Delk, 1974). Similar findings were reported by the Office of Demographic Studies at Gallaudet College, which found that 91% of deaf American students were reported to have parents with normal hearing (Rawlings & Jensema, 1977). Taken together, the results of these surveys suggest that most deaf children "will be raised by parents who were unprepared for his or her deafness" (Schein, 1987, p. 12).

Parental response to the diagnosis of deafness in the child is influenced by "their own hearing status, by their prior experiences with deafness, the expectations and attitudes of family members about hearing loss, and whether the diagnosis reflects a shift in a prior understanding about the child's hearing status" (Meadow-Orlans, 1987b, p. 34). This implies that parental expectation is a powerful factor in determining the reaction to the diagnosis; it suggests, for example, that deaf parents who expect to give birth to a deaf child are more likely to accept the child's deafness readily than deaf parents who expect that their child will have normal hearing. There is some experimental and clinical evidence (Meadow & Meadow, 1971) that indicates that deaf parents of deaf children cope with the crisis of diagnosis more quickly and easily than their hearing counterparts, who are more likely to seek a confirmatory diagnosis or miraculous cure, even though deaf

parents give birth to normally hearing children in 9 out of 10 live births (Schein, 1987). One possible explanation for this difference is that, because of their prior experience with their own hearing impairment, deaf parents have a higher comfort level with their child's deafness, than do hearing parents of deaf children. Since the latter group of parents usually have no previous experience with congenital deafness, they may not consider initially that their child has a hearing loss and, later, may also experience difficulty and frustration in securing a firm diagnosis (Meadow, 1968b). For most parents with normal hearing, the diagnosis of deafness in a young child comes as a profound shock and is experienced as a tragic crisis with long-term implications for family life (Luterman, 1979; Meadow-Orlans, 1987b; Nash & Nash, 1987; Schlesinger & Meadow, 1972).

Childhood deafness arises from many causes, some of which are known and others not known. Nearly one hearing impaired child in three in the United States has one or more disabling conditions in addition to hearing impairment (Wolff & Harkins, 1986); a similar trend among deaf Canadian children was reported by MacDougall (1987), who found that between 30 and 35% of Canadian deaf children have additional physical or psychological impairments. Genetically caused deafness results in the lowest prevalence of additional disabling conditions (Wolff & Harkins, 1986); this implies that, as a group, deaf children of deaf parents are less likely than deaf children of hearing parents to have

educationally significant disabilities in addition to hearing loss. It is often difficult to determine the cause of deafness when no other family members are hearing impaired; in the 1982-83 Annual Survey of Hearing Impaired Children and Youth conducted by Gallaudet College, the cause of hearing impairment was listed as unknown for 39.5% of the students (Brown, 1986). Moores (1982), however, suspects that many of the children in this group may have inherited their deafness through a recessive gene in their parents. Other etiological and associated conditions such as maternal rubella, prematurity, meningitis, and trauma at birth are often associated with complications in addition to hearing impairment (Brown, 1986). It is essential that etiology of deafness be considered in any research on deaf children, so that superior performance by a particular group of deaf children not be confounded by better endowment.

Once hearing loss has been confirmed, the question of treatment and intervention arises immediately (Boothroyd, 1982). The specialist who is likely to have the most frequent contact with the young hearing-impaired child is the teacher trained in deaf education (Meadow-Orlans, 1987a). Early intervention programs for deaf children provide instruction, in varying degrees, for language acquisition, speech development, and the facilitation of social, emotional, and cognitive growth.

In the case of deaf children of deaf parents and hearing children of hearing parents, language and cognition

are likely to be the natural and unconscious outcome of ordinary mother-child interaction. For these two groups of children, the learning of language and the development of cognitive skills arise over routine interactions that take place during such activities as feeding and diapering. In contrast to deaf children of hearing parents, whose hearing loss precludes ease of communication with their parents, deaf children of deaf parents learn the language and social interaction of their culture more naturally, with less necessity for deliberate instruction (Stokoe & Battison, 1981). Deaf parents do not view deafness primarily as a handicap or disability, but rather as

> a condition that creates a different way of life for them as compared to society's hearing majority. Deaf parents do not deny the difficulties and inconveniences that deafness imposes, but they emphasize their capabilities and the ways in which their lives are arranged to take account of the problems. (Erting, 1987, p. 142)

Deafness is a physical disability which gives rise to particular forms of social organization (Erting, 1978). The most effective signal of membership in the deaf ethnic group is not the degree of hearing loss but, rather, the means of communication used (Padden, 1980). American Sign Language (ASL) is the primary cultural symbol and primary language used for communication among deaf people in North America (Rainer, Altsnuler, & Kallman, 1963; Siple, 1978). Klima

and Bellugi (1979) describe ASL as

> a form with its own highly articulated means for expressing and relating concepts, and with an underlying network of regularities connecting visual form with meaning. ASL is clearly a separate language, distinct from the spoken English of its surrounding community (p. 2)

American Sign Language fulfills all the requirements of a genuine language (Stokoe, Casterline, & Croneberg, 1965); the components of each individual sign are roughly equivalent to the phonemes of a spoken language, although they correspond to sign formation instead of speech-related phenomena (Klima, Bellugi, Newkirk, & Battison, 1979; Siple, 1978). A comparison of the general course of ASL and oral language acquisition suggests that certain general underlying capacities guide the course of all language acquisition (Siple, 1978). Investigations of the acquisition of specific ASL constructions further support the contention that there are general cognitive or linguistic universals underlying language acquisition. For example, at the phonological level, Lane et al. (1976) and McIntire (1977) have found that deaf children acquire handshapes developmentally, in the same manner that hearing children acquire certain sounds before others. Just as there is "baby talk" in spoken language, there are "baby signs" in ASL.

Extensive research suggests that while the strategies

may be different, deaf children of deaf parents, exposed to ASL as their first language, follow essentially the same patterns in acquiring that language as do hearing children acquiring spoken language (Klima & Bellugi, 1974; Schlesinger, 1978; Schlesinger & Meadow, 1972; Stuckless & Birch, 1966). Research examining interactions between deaf mothers and their deaf children underlines the similarity in interaction patterns of hearing mothers and their hearing children and deaf mothers and their deaf children.

Meadow et al. (1981) have studied specifics of the linguistic and social interaction among hearing children and their mothers, deaf children and their deaf mothers, and deaf children and their hearing mothers. The most striking and consistent finding to emerge was the similarity in social and linguistic interaction of the deaf mother-deaf child pairs and the hearing mother-hearing child pairs. The mothers in these two groups were found to be less directive and their children demonstrated an ability to carry on more elaborate conversations, more of which were child-initiated, than in the hearing mother-deaf child pairs.

For deaf children of hearing parents, however, early experiences with social speech are more frequently one-way, from mother to child. Regardless of the communication method chosen, hearing parents of deaf children are more likely to have some conscious plan for teaching their child the formal rules for speaking and for structuring the language than are either deaf parents of deaf

children or hearing parents of hearing children. Instead of focusing on their child's initiatives and responses, the mothers in this group may try to recall and put into practice the teaching plan supplied to them by the expert in deaf education; because language-learning is an interactive, rather than a one-way, process, the development of language may therefore be compromised. In support of this, Musselman, Lindsay, & Wilson (1988), reporting on a longitudinal study involving 80% of the children enrolled in public preschool programs for hearing impaired students in Ontario, suggest that language is better learned through informal interaction than through formal structured training. This argument gives rise to three implications: first, that the linguistic input from hearing mothers to their deaf children is both qualitatively and quantitatively different in comparison to the linguistic input from deaf mothers to their deaf children or hearing mothers to their hearing children; second, that deaf children of hearing parents exhibit a greater linguistic deficiency than either deaf children of deaf mothers or hearing children of hearing mothers; and finally, that deaf children of hearing mothers consequently take fewer initiatives in interaction episodes than the children in either of the two preceding groups.

Several studies have, in fact, indicated that deaf children of deaf parents have better language skills than deaf children of hearing parents (Meadow, 1968a; Quigley &

Frisina, 1961; Stuckless & Birch, 1966). One must bear in mind that a part of the reason for this may well be that, as already mentioned, the latter group of children are more likely than the former to have disabling conditions in addition to hearing loss. This likelihood notwithstanding, however, researchers have recently suggested that differences in input may be a source of the linguistic deficiency so commonly observed in deaf children of hearing parents. Hearing mothers of deaf children have been described as more didactic, dominant, and intrusive and less flexible, permissive, and approving in their child-directed language than hearing mothers of hearing children of comparable age (Brinich, 1980; Goss, 1970; Greenberg, 1980; Henggeler & Cooper, 1983; Meadow et al., 1981; Schlesinger & Meadow, 1972; Wedell-Monnig & Lumley, 1980). Hearing mothers of deaf children use fewer questions, ask for fewer suggestions, and use language which allows for less child initiative and response than hearing mothers of hearing children (Goss, 1970). In observing the use of language by three hearing mothers of young deaf children, Cheskin (1981) noted that each mother used a repetitious and restrictive vocabulary and missed many opportunities for involving her child in verbal interaction. In a similar study, Cheskin (1982) found that hearing mothers used most of their language to describe or control behavior. Wood, Wood, Griffiths, and Howarth (1986) state that "the usual effect of infant deafness on hearing adults is to lead them into

into spirals of increasing control over the child, creating mutual frustration and a non-contingent social learning environment" (p. 167). Hearing mothers tend to be tense and tend to spend more time teaching their deaf children, who were described as less compliant, less attentive, and less responsive than the hearing children with whom they were compared. Deaf children of hearing mothers were also found to initiate fewer conversations than hearing children of hearing mothers or deaf children of deaf mothers (Meadow et al., 1981). The general direction of the results of these studies, which involve infants, preschoolers, and young school-age children, is reflected in studies of the academic achievement of older deaf children. Deaf children of deaf parents consistently perform at a higher level on tests of academic achievement than the deaf children of hearing parents (Brasel & Quigley, 1977; Brill, 1969; Meadow, 1968a; Sisco & Anderson, 1980; Stuckless & Birch, 1966; Vernon & Koh, 1970). It appears that most deaf children of deaf parents are more adept at problem-solving than most deaf children of hearing parents, and that this difference persists beyond the preschool years.

Until studies can provide precise descriptions of the effects of maternal speech on child language development, the effects of deviations in maternal speech features with deaf children must remain to some degree a matter of speculation. Nevertheless, some broad inferences may be drawn. Both the learning of language and socialization

arise over spontaneous, everyday routine interactions between adults and children, particularly between mothers and infants, when the individuals involved base their initiatives and responses on the dynamics of the given situation; this appears to be the pattern by which hearing children of hearing mothers and deaf children of deaf mothers learn the language and cognitive skills of their culture.

On the other hand, there are several possible explanations for the directive behavior of hearing mothers toward their deaf children. First, it may be that hearing mothers consider their deaf children to be defective or inadequate as communicators and, consequently, as potential learners. Nienhuys, Cross, and Horsborough (1984) suggest that parental expectations about childhood deafness may impose untoward constraints on mother-child interactions and consequently inhibit the deaf child's communicative development. Second, the likelihood has already been mentioned of hearing mothers following some conscious, deliberate plan during interactions with their deaf children. Mothers of deaf children are usually supplied with an instructional strategy or plan by a teacher of the deaf, speech pathologist, audiologist, or some other expert in deaf education. In interactions with their deaf children, hearing mothers may tend to try to recall and enact the steps in their teaching plans, instead of focusing on the child's initiatives and responses; they seem to base

their patterns of interaction on a deliberate teaching plan constructed on the basis of expert advice, rather than on the child's behavior. Third, if they are denying the diagnosis of deafness, hearing mothers may continue to interact with their children as though they can hear; this behavior will interfere with the mother's ability to scaffold effectively. It is important to emphasize that there is no reason to assume that scaffolding behaviors are outside these mothers' competencies; it is more likely that they have not considered basing their interactive behavior on their children's actions, which they have come to accept as indicating inability. Finally, even after they have accepted the child's deafness, hearing mothers may feel a lack of confidence in their own ability to communicate with him or her. Mothers may seek to control the conversations and interactions in order to minimize the risk of misunderstanding their children (C. J. Erting, personal communication, December 16, 1986; Harris, 1978). By assuming additional control in interactions, the mother reduces the possibility of misunderstanding, as well as the need to acknowledge the full implications of the deafness.

Children are born with the ability to take initiatives (Bower, 1977), but if they are not given the opportunity or reinforcement for doing so, initiative-taking on the part of the child may tend to disappear. Once children no longer take initiatives, the mother has little behavior upon which to make her own initiatives and responses contingent. A

circular pattern of interaction may arise between the deaf child and hearing mother: since the mother does not tend to make her behavior contingent on the child's initiatives and responses, the child may learn to be helpless and develop passive behavior. If, however, hearing mothers could be shown that other deaf children learn easily and if they could learn to watch the behavior of their child more closely, it might help to raise their expectations for their own deaf children.

Statement of the Research Question

Vygotsky (1978) argued that the ontogenesis of human cognitive functioning has its roots in social interaction: when children learn, they virtually always do so in the context of interaction with more experienced members of their culture. Children first experience active problem-solving in the presence of adults or more capable peers; first the adult or knowledgeable peer controls and guides the child's activity, with the child eventually taking the initiative and the adult correcting and supporting when the child fails or falters. This developmental progression from other-regulation, or interpsychological functioning, to self-regulation, or intrapsychological functioning, is the means by which children acquire culture and develop cognitive skills. Within the context of the gradual internalization of cognitive activities that were originally shared interactive processes, Vygotsky (1978) introduced the concept of the zone of proximal development, referring to "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or collaboration with more capable peers" (p. 86; underlining is author's emphasis).

Vygotsky's dialectical perspective of cognitive development is reflected in the writings of Jerome S. Bruner

and David J. Wood, who introduced the concept of a scaffolding process that

> enables the child or novice to solve a problem, carry out a task or achieve a goal which would be beyond his unassisted efforts. This scaffolding consists essentially of the adult "controlling" those elements of the task that are initially beyond the learner's capacity, thus permitting him to concentrate upon only those elements that are within his range of competence. (Wood et al., 1976, p. 90)

Although the scaffolding process has been shown to be characteristic of effective instruction between mothers and their young children (Wood, 1980; Wood & Middleton, 1974, 1975; Wood et al., 1976), not all mothers are equally skilled in the application of the technique, which requires that mothers tailor their teaching strategies to the child's behavior during each particular interactive episode.

Research has shown that mothers base their communication and interaction patterns largely on their children's linguistic abilities (Brinich, 1980; Lasky & Klopp, 1982; Pellegrini et al., 1985). In other words, the more able the child as communicator, the more the mother's behavior will tend to be contingent on the child's initiatives and responses. In this connection, childhood deafness offers an opportunity to explore the effects of successful and unsuccessful attempts at scaffolding on the development of children's problem-solving abilities.

Hearing mothers and their deaf children do not share an easily or commonly accessible language; most deaf mothers of deaf children, on the other hand, do share a common language with their children (Rainer et al., 1963; Siple, 1978) and have, moreover, been shown to have a more positive acceptance of deafness than hearing mothers of deaf children (Meadow & Meadow, 1971). Hearing mothers have consistently been found to be more dominating of and intrusive with their deaf children, than deaf mothers of deaf children, who generally utilized similar interaction strategies as hearing mothers of hearing children (Meadow et al., 1981). The deaf children of hearing parents, in the same research, were reported to be less compliant, less attentive, and less responsive than the deaf children of deaf parents and hearing children of hearing parents with whom they were compared.

The major idea behind the research in this dissertation is that to the extent that mothers consider their children damaged or inadequate as potential learners, they will tend to use rigid, non-contingent teaching strategies, working from some sort of plan or system that does not take into consideration the degree of success of their children's efforts during the instruction period. Instead of focusing on the child's initiatives and responses, they may try to recall and enact the steps in their teaching plans. Research cited above suggests that hearing parents of deaf children tend to consider their children defective, and, in

accordance with this belief, they are more directive and controlling in interactions with their deaf children than are either deaf mothers of deaf children or hearing mothers of hearing children. Scaffolding is of particular importance in the analysis of patterns of mother-child interactions in that it is a descriptive approach that has actual stages. Observing interactions between deaf and hearing mothers and their deaf children in the light of scaffolding theory may increase the understanding of the kinds of situations which trigger this directive maternal behavior and the subsequent effect on children's initiatives and responses. In addition, the theory of scaffolding may provide important insights leading to improved intervention strategies when childhood deafness is a factor.

There are four main objectives of the study, each of which is embodied in a hypothesis, as follows:

1. There is no significant difference[3] in the degree to which the instructional behavior of hearing mothers of hearing children and deaf mothers of deaf children is contingent upon the responses of their children.

2. The teaching behavior of hearing mothers of deaf children is less likely to be contingent on the initiatives and responses of their children than that of the mothers in the two above-mentioned groups.

3. Deaf children of hearing mothers are less likely to develop efficient and independent problem-solving abilities than hearing children of hearing mothers and deaf children

of deaf mothers.

4. The mothers' instructional behavior is related to the exhibited differences in their children's efficiency as problem-solvers.

CHAPTER THREE

Methodology

The aim of this study was to examine the effects of parental response to deafness on the deaf child's developing problem-solving strategies. More specifically, it investigated the process whereby mothers, both deaf and hearing, teach their deaf children to solve problems, and focused on the impact of the nature and quality of mother-child interaction on the evolving problem-solving skills of deaf preschoolers.

It was hypothesized that the mothers in the deaf mother-deaf child and hearing mother-hearing child pairs would use similar scaffolding processes when instructing their children, basing their tutorial behaviors on their children's responses, and that these children would demonstrate efficient and independent problem-solving skills. By contrast, it was anticipated that hearing mothers of deaf children would be more directive in their teaching and that their deaf children would consequently have less opportunity to become adept and independent problem-solvers than the children in the two preceding groups.

A pilot study was conducted in the greater Montreal area prior to the undertaking of the present research. The pilot study was identical to the present research in objectives and methodology, with the exception that it was conducted on a

substantially smaller scale.

Material

The mothers were asked to teach their children to assemble a wooden pyramid constructed of 21 interlocking pieces, as shown in Figure 1. This toy was devised by Wood[4] (see, for example, Wood, 1980; Wood et al., 1976; Wood & Middleton, 1974, 1975) to investigate the interactions between mothers and their children in a situation where the mothers were teaching their children to construct the pyramid.

> Wood et al. (1976) describe the pyramid as follows: The material is wood. The toy consists of 21 blocks that combine to form a pyramid standing about 9 in. high with a 9 in. square base. There are six levels in the pyramid. The top block is a solid square with a circular depression in its bottom. Each remaining layer is composed of 4 equal sized blocks made up of two locking pairs. Each pair fits together by a hole and peg arrangement. When one pair is fitted in the correct orientation, two other half pegs are brought together; the other pair brings together two half-holes. These form the means for connecting the two pairs to form the four piece layer. The blocks were designed so that all pegs would fit into all holes. In addition to pegs and holes, each four-block layer has a shallow round depression in its base and a matched elevation on top.

> These can only be formed by putting the appropriate pairs together in the correct orientation, since each block possesses one-quarter of each of these larger connectives. (p. 91-92)

The pyramid was chosen for several reasons. First and foremost, it has been shown to be both entertaining and challenging to children while also being sufficiently complex to ensure that children's performance over time can develop and change. Additionally, the extensive experience of Wood and others has proven the pyramid to be an appropriate task for young children to attempt, and typical behaviors of 3-, 4-, and 5-year-olds in constructing the pyramid have been documented. In short, the task of assembling the pyramid is "one that is 'fun,' one that is multifaceted and therefore 'interesting,' one that is within easy reach of a child's skills and one that is continuous in its yield of knowledge" (Wood et al., 1976, p. 91).

Subjects

The focus of the research was on mother-child dyads representing three combinations of deaf and hearing mothers and deaf and hearing children. Four sets of dyads in each combination were involved in this research: deaf mother-deaf child, hearing mother-hearing child, and hearing mother-deaf child (N=12 dyads). The mother-child dyads were matched as closely as possible on demographic variables such as

socio-economic status of the parents, presence of an intact two-parent family, birth order of the child (see Appendix A), as well as age, sex, and educational background of the child (see Appendix B). Although the hearing children were located in preschool programs in the greater Montreal area, it was necessary to contact educational authorities in several different parts of the country, as well as a neighboring state, before being able to locate comparable deaf subjects. Table 1 describes various factors influencing the socio-economic status of the mother-child dyads participating in the study, while other relevant characteristics of the children and their families are presented in Table 2.

The deaf children of deaf parents were recruited from two preschool programs in Ontario in which the total communication philosophy (which, as described by Freeman et al., 1981, promotes whatever means are available and suitable for the deaf child to develop and to maintain early communication with others, including manual and auditory-oral methods) was advocated. The children, all of whom are boys, ranged in age from 5 years 1 month to 5 years 4 months of age, with a mean age of 62.3 months. All of the deaf children in this group were selected from middle-income, intact two-parent families in which American Sign Language is the first language used in the home. All of the deaf mothers worked outside the home. Similarity was noted in the family and educational backgrounds of the deaf parents, all of whom were themselves born to hearing parents. Each of the deaf parents had been

Table 1

Distribution of Socio-Economic Status Factors for Three Groups of Mother-Child Dyads

FACTOR		Group: Hearing mother-deaf child	Group: Hearing mother-hearing child	Group: Deaf mother deaf child
FAMILY INCOME				
Both parents present	4		4	4
Father employed	4		4	4
Mother employed	3		2	4
PARENT EDUCATION				
Father graduated H.S.[a]	2		4	4
Mother graduated H.S.	3		4	3
Father graduated H.S.+[b]	1		4	1
Mother graduated H.S.+	0		3	0

[a] "H.S." means "high school."

[b] "H.S.+" means "college or other post-secondary."

Table 2

Distribution of Child and Family Status Factors for Three Groups of Mother-Child Dyads

FACTOR	Group		
	Hearing mother-deaf child	Hearing mother-hearing child	Deaf mother-deaf child
CHILD			
Average age	60.0 mo.	60.8 mo.	62.3 mo.
Boys	1	2	4
Girls	3	2	0
First-born or only	2	2	2
Second or later	2	2	2
FAMILY			
Mean no. children	2.3	2	2.3
First language:			
English	4	4	0
ASL	0	0	4

educated in an oral program until his or her early teenage years, at which time a transfer was made to a total communication program. With regard to birth order, it was not possible to have children as closely matched as on the other variables: one child was the older of two children, two were the younger of two, and one was the third child of four.

Four normally hearing children, two girls and two boys, were selected from three preschool programs in the greater Montreal area. They ranged in age from 4 years 10 months to 5 years 5 months, with a mean age of 60.8 months. All of these children were selected from intact middle- to upper middle-class homes in which standard English is spoken as the first language. Two of the mothers worked outside the home. Two of the children had no siblings, one was the youngest of four children, and one was the younger of two.

The deaf children of hearing parents were enrolled in preschool programs located in New Brunswick, Ontario, Saskatchewan, and Vermont, in which the oral-aural approach was utilized. In this system, according to Moores (1982), "children receive input through speechreading (lipreading) and amplification of sound, and they express themselves through speech. Gestures and signs are prohibited" (p. 9). The children, three girls and one boy, ranged in age from 4 years 9 months to 5 years 4 months, with a mean age of 60.0 months, and were members of intact middle-class families in which standard English is the first language spoken in the home. All except one of the mothers worked outside the home.

Two of the children were the older of two siblings, while the remaining two were the younger of two.

The children in all three groups seemed to have nonverbal intelligence within the normal range, as estimated by school records and results of informal pretesting conducted by the investigator. Consideration was given to the administration of nonverbal intelligence tests as a criterion for matching children on measures of mental ability. However, because of a lack of confidence in the results of formal I.Q. testing of deaf children, such testing was rejected in favor of estimates of intelligence provided by school records. Additionally, pretesting of similar problem-solving abilities as are required in the construction of the wooden pyramid was conducted. Pretesting of this nature by the investigator also provides a more coherent introduction to the construction of the pyramid task than does formal test administration, since it involves only the mother and child and thereby allows the child to become more relaxed in the presence of the researcher.

Unaided hearing levels for the children in the deaf mother-deaf child pairs were no better than 90 dB in the speech range (250 to 4000 Hz) in the better ear. None of these children wore hearing aids during the observation sessions, although three of the deaf mothers reported that their children wore their hearing aids most of the time. The remaining mother stated that her child used hearing aids only at school. All of the deaf children of deaf parents used

American Sign Language during the videotaping sessions, both with their mothers and the investigator.

Unaided hearing levels for the deaf children of hearing mothers were slightly more varied than for the other deaf children: for one child, the unaided hearing level was no better than 90 dB for the previously mentioned frequencies, for another child, it was no better than 75 dB, and for the remaining two children it was no better than 70 dB. All of the children in the deaf child-hearing mother group wore two hearing aids during the observation sessions, and, according to their mothers, all of these children wore their hearing aids all the time they were awake. As indicated by the audiograms in Appendix C, the children in this group for whom aided hearing levels were available showed considerable gain when amplification was worn. (There are some ambiguities in the audiograms, as aided results are unavailable for two of the children, and on certain audiograms it is unclear as to whether unaided thresholds are true thresholds.)

In all cases, deafness was assumed to have been present from birth. All four deaf children of deaf parents had bilateral sensori-neural deafness which was hereditary in origin. The etiologies of the children in the hearing mother-deaf child group were more varied: two children were deaf due to unknown causes, one due to genetic causes, and one through complications caused by prematurity. Because premature birth often leads to associated educationally significant disabling conditions, this child had been examined

periodically by a child team composed of physicians, occupational therapists, and psychologists, who diagnosed no other disabling condition except the hearing impairment. All children in the deaf mother-deaf child dyads had two deaf parents; all children in the hearing mother-hearing child and hearing mother-deaf child dyads had two hearing parents. No deaf child had any known disabling condition in addition to deafness.

Age at the time of diagnosis differed considerably between the two groups of deaf children. The deaf children with deaf parents were, on the average, 6.5 months old when deafness was confirmed by a doctor or audiologist; the deaf children with hearing parents had a mean age of 11.5 months at the time of diagnosis. All four deaf mothers reported that they knew the child was deaf within the first four months of life. The deaf children of deaf parents began wearing hearing aids, on the average, at 21 months of age, while the deaf children of hearing parents were first equipped with hearing aids at an average age of 16.8 months. All of the deaf children had been involved in early intervention programs with an emphasis on parent involvement for at least two years, while all of the hearing children had had at least one year's experience in a preschool or nursery setting. All of the children had prior experience in being videotaped, either for educational or research purposes.

Similarity was noted in the educational levels achieved by the mothers in the three groups. Three of the mothers in

each group were high school graduates; one of the mothers in each of the deaf mother-deaf child and hearing mother-deaf child dyads had not completed high school; and one of the hearing mothers of hearing children was a college graduate.

One deaf mother-deaf child dyad was disqualified from participation in the study and had to be replaced when a serious visual impairment in the child, which had not been noted by the investigator during testing, became very obvious on viewing the tapes.

Procedure

The aim of this thesis was to study the relationship between a mother's tutorial style and general aspects of her deaf child's developing problem-solving strategies. Because such developments usually take place in naturalistic settings such as the home or the classroom, observations were made in the home environment. Bruner (1983) noted that studying children in naturalistic settings provides richer and more substantial data than laboratory observations.

Each mother was seen individually with her child prior to the videotaping session. At that time the purpose of the study and procedures were outlined. Mothers were told that a study of child development was being conducted in which the experimenter wished to observe and record audiovisually the child playing with the mother. Each mother was interviewed to obtain information concerning the family's socio-economic

status and the child's history (see Appendices A and B, respectively). These data were used to match the subjects as closely as possible. Mothers were assured that strict confidentiality would be maintained for all information and videotapes of persons involved in the research (see Appendix D for letter of confidentiality).

For each dyad, the testing session took place on another day within a 14-day time span. The first part of the videotaped session involved a 20- to 30-minute period of free play. For the first 10 to 15 minutes, the mothers and children were asked to play with a familiar toy which the children particularly enjoyed. The purpose of this was to help the subjects relax in the presence of the investigator and the videotape equipment and to obtain a sample of the behaviors of the mothers and children during a normally occurring interaction. During the remaining part of the free play session, the mothers and children were asked to play with a construction toy provided by the investigator (see Figure 2) which requires problem-solving strategies analogous to those required to assemble the wooden pyramid. It was anticipated that this activity would elicit scaffolding behaviors from the mothers similar to those they would use when instructing the children to build the pyramid. An additional purpose of this activity was to obtain some initial impression of the relationship between the mothers' teaching styles and the children's abilities to solve problems.

Following the free play session, each mother was shown

the wooden pyramid while her child played in another room. The investigator addressed her in speech or sign language, as appropriate. In the case of her child being a son named Jimmy, the mother would have been addressed as follows: "This is a toy which has been designed for children of Jimmy's age. Let me show you how it fits together. You see there are two levels and this top piece. Each level fits together this way (here the investigator assembled one level). All the others are the same. Would you like to put the other levels together yourself?" The mother was then left to assemble the toy a few times. The investigator next explained to the mother: "I want you to help Jimmy put the blocks together. However, before you start to teach him, leave him for about 5 minutes to play with the blocks. You can then teach him how to assemble them in any way you like. I have no idea how mothers might do this, so just be as natural as you can and try whatever you think might work. When you have taught him once, we'll ask him to leave the room while the toy is taken to pieces again, and then I will ask him to do it alone. The important thing is to see how much he can do on his own."

At this point, in each case, the children were asked to enter the room to see, but not play with, the assembled pyramid. The children then left the room and the pyramid was disassembled by the investigator and arranged on the table in a uniform pattern. The children were not allowed to see the pyramid being disassembled, as the reversibility of an action may itself be viewed as a learning strategy (Inhelder &

Piaget, 1958), thereby reducing the possibility of linking the child's subsequent performance directly and solely to the mother's teaching style. The children again came into the room, and this time were asked by their mothers to build the blocks into the pyramid which they had just seen. Any children who succeeded in building the pyramid with no help from their mothers would have been disqualified from participation in the study at this point, since scaffolding would not have been needed in this task for these children. However, this never occurred, and so the instruction session began.

Initially, in each case, the children were left alone for up to 5 minutes, both to settle them into the situation and to familiarize themselves with the blocks. The mothers were then allowed to intervene and give instructions. The instruction session lasted as long as it took the mothers and children to complete the pyramid. The mothers were told that after they had taught them, the children would be asked to leave the room while the pyramid was again disassembled by the investigator. The investigator then asked the children to try the task on their own (i.e., the post-instruction session). Each taping session was dated and timed. Total testing time, including free play, instruction, and post-instruction sessions, ranged from 31 minutes 22 seconds to 66 minutes 13 seconds, with a mean duration of 39 minutes 53 seconds. Some of the variability in testing time may be accounted for by the time involved in the initial free play between the

mothers and children. All but one of the children chose to play a game or assemble a puzzle with their mothers during this time, and the children in the deaf mother-deaf child pairs completed these activities quickly and displayed impatience to play with the investigator's toys. A more detailed description of the time involved for the various testing activities, excluding initial free play, is shown in Table 4.

Following testing, the investigator met individually for another session with one mother in each group, at which time the investigator and mother viewed the videotape together; this was accompanied by an extremely open-ended interview, which was also recorded audiovisually. The mother was encouraged to respond to portions of the videotape. This session offered the investigator an additional opportunity to observe the mother's attitudes toward her child and made it possible to obtain the mother's views of the interaction which had occurred between her and her child. It would have been preferable to view the tape with all mothers, but time, distance, and travel costs prohibited this. The remaining three mothers in each group were sent a copy of the videotaped interaction in which they had participated, as well as a response sheet designed to elicit their reactions to the session (see Appendix E). The response sheet was completed and returned by each mother, without exception. Each of the twelve mothers agreed that she had done a reasonably good job teaching her child to build the blocks. In addition, all but

Table 3

Mean Duration of Test Activities for Three Groups of Mother-Child Dyads in Minutes and Seconds

Activity	Group		
	Hearing mother-deaf child	Hearing mother-hearing child	Deaf mother-deaf child
1. Free play: I.T.[a]	11:35	6:14	7:01
2. Free play: P.[b]	4:00	4:00	4:00
3. Instruction	8:51	7:26	7:19
4. Post-instruction	12:43	11:04	6:43
Total duration	37:09	28:44	25:03

Note. Time for free play was determined by researcher.

[a] "I.T." refers to the investigator's toy.

[b] "P." refers to the pyramid.

one of the mothers indicated that their teaching behavior on the videotape was representative of the way they would usually teach their children to do something new. The remaining mother, a hearing mother of a deaf child, felt that she taught her child more quickly on the videotape than she would in a naturally occurring situation.

Coding System

The coding system used for data analysis examines interaction at both the individual and dyadic levels and is designed to summarize the interaction in terms of extent of maternal control and the response of the child, as well as to identify the initiator. This coding system was originally developed by Wood and Middleton (1974) and was modified slightly by the present author.

Three words have a technical meaning in the following discussion: event, intervention, and response. An "event" refers to the act of the mother or child in selecting or arranging the pieces. There are 20 possible correct events in constructing the pyramid; this fact is helpful in contrasting one child's performance with that of another. In analyzing the task of assembling the pyramid, the most obvious unit is an individual act of construction, giving 20 units, events, or sequences of construction activity leading to the 21-piece pyramid being completely assembled. D. J. Wood (personal communication, August 28, 1986) uses the term "intervention"

to indicate the mother's tutorial behavior and "response" to refer to the child's behavior in assembling the pyramid following an intervention. This terminology is continued in this study, although it is acknowledged that instruction is an interactive process; a mother who scaffolds well is a very responsive teacher.

The coding system differentiates between child-initiated constructions and mother-initiated interventions. Level 0 indicates a construction attempt initiated by the child. In the event that the child makes an inappropriate construction in a self-initiated act or an error in response to a maternal instruction, the mother may intervene at any one of five levels. The following descriptions of the coding levels are paraphrases of the descriptions used by Wood (1980) and Wood and Middleton (1975):

Level 1. The mother simply tries to encourage the child (verbally, gesturally, using sign language, or a combination of words and signs) to enter into the task activity. She might say or sign, "What are you going to do now?" or "Would you like to make something with the pieces?"

Level 2. The mother attempts to establish guidelines which assist the child's search for the pieces to be assembled. For example, she might say or sign, "I think you need the very big pieces" or "Get the little ones." The defining characteristic of this level is that the mother identify critical features of the pieces but take no part in the actual search for them. Level 2 interventions include

non-verbal expressions (for example, general encouraging gestures, smiles, etc.) which may communicate meaningful guidelines to the deaf child. One hearing mother had the habit of speaking softly to her deaf child out of his range of vision, which led to the problem of interpretation. Verbal interventions which are clearly not observed by the deaf child and are delivered below his hearing threshold are not scored. At this particular level, consensus between the co-raters was particularly helpful in coding these rare situations.

Level 3. The mother actually intervenes in the selection process itself by indicating pieces to be used. She might simply point or point and say (or sign), "You need that little one, there." Here she is leaving the child with the task of working with the pieces indicated, while the problem of orienting them correctly remains.

Level 4. The mother intervenes not only in the selection of the pieces but also in their actual arrangement. She lines up two or more blocks such that the child need only push them together. In fact, she leaves the child with only one degree of freedom: to perform or not perform the act of putting the pieces together.

Level 5. The intervention is a full demonstration in which the mother takes the appropriate pieces and prepares and assembles them while the child merely looks on.

The form for recording the mother's interventions and the child's responses during the instruction phase is shown in Appendix F and is discussed below:

Time that Event Starts. Each event begins with the mother or child taking the initiative in selecting or arranging pieces.

Event Number. The event number refers to the act of assembling any two pieces of the pyramid.

Interaction Event. An interaction event is initiated by the mother when she directs the child either by word or action toward some task activity. This interaction can be terminated in one of two ways: first, if the child makes a fresh selection of blocks or in any other way changes the material with which he or she is working, or second, if the child is not moved to action by the mother's suggestion and the mother moves on to suggest a new goal or operation. However, where the mother continues to request the same goal, the interaction event continues until such time as the child responds or a new goal is suggested. If the mother offers more than one level of help within a single interaction event, only the highest level is scored. The coding system used to analyze the videotaped mother child interactions is outlined in Table 4.

Each event begins with a code I0 to I5, corresponding to the coding levels discussed previously. I0 refers to any construction attempt initiated by the child, whereas I1 to I5 refer to mothers' interventions at the corresponding levels. For example, I3 refers to the mother's intervention at level 3. Similarly, interventions coded D1 to D5 indicate the mother's pointing out the discrepancy between the goal and the construction made by the child. D2, for example, indicates

Table 4

Definitions of Mother-Child Interaction Coding Categories

Category	Definitions
	CONSTRUCTION ACTIVITIES BY THE CHILD
IO	Construction event initiated by the child.
R+	Successful construction by the child in response to the mother's intervention.
R-	Child's error in response to the mother's intervention.
R-rej	Child's immediate and spontaneous rejection of his or her own error.
Ig	Child's overt ignoring of the mother's interventions.
	INTERVENTIONS BY THE MOTHER
I1	General verbal or signed prompt to the child to enter into the activity.
I2	Communication that gives specific verbal or signed information about the next relevant step: "You need the big ones now."
I3	Selection of block by pointing or handing it to the child.
I4	Lining up of two or more blocks so that the child need only push them together.
I5	Full demonstration by the mother.

the mother's correction at level 2 in response to the child's error. In the situation where the mother holds up the last piece, the intervention is coded as I1 since there is no selection involved.

The child's construction activities are recorded. The code "R+" is used when the child shows he or she understands and subsequently acts upon the suggestion made. The code "R-" indicates that the child cannot follow the instruction. It should be noted, however, that self-corrected mistakes made without appeals for help are not coded as "R-" but rather as "R-rej" (meaning that the child rejects the error). Accordingly, "R-rej" is not coded as a mistake as long as the child corrects the construction immediately and spontaneously and does not appeal for help. The code "Ig" is used to show that the child is ignoring the instruction and simply does not respond to the maternal intervention.

Construction Event. Any time the mother or child attempts to put two blocks together, the act is scored. Individual pieces are numbered in the order in which they were assembled.

Independent Child Activity. Construction events initiated by the child are noted and coded as I0. In those instances where the child is succeeding under his or her own efforts, the mother is still considered contingent if she offers such D1 comments as, "Good boy, try some more."

Layer. The layer of the pyramid involved in the construction event is noted, with 1 indicating the largest, or

bottom, layer and 6 indicating the smallest, or top, layer.

In spite of the investigator's instructions to allow the children to assemble the pyramid independently, all mothers, with only one exception, intervened to some extent during the post-instruction session. The same coding scheme that was used to analyze the instruction session was applied for the post-instruction session. The form for recording the intervention levels and responses observed during the post-instruction session is shown in Appendix G.

Data Analysis

This thesis attempts to compare the teaching styles of three different groups of deaf and hearing mothers, with a view to understanding their effects on the problem-solving skills of their deaf and hearing children. In doing so, the aim was to replicate and confirm prior findings, building on information known from prior related research with normally hearing children and their mothers and teachers. It is acknowledged that this research falls short of ideal methodology. To give just one reason, this study is flawed by the lack of random sampling in subject selection. However, the relatively small population of deaf children in Canada, particularly those with deaf parents, led to difficulty in locating comparable subjects and rendered random sampling impossible. Theoretically, it would be ideal to examine children, none of whom had ever been taught to solve problems,

since they would all be starting from comparable zero baselines. This is analogous to an experimental approach where all subjects would have identical pre-test scores. However, pure experimental research is not possible with children. This study represents a comparative case study approach and, as such, reliable direct comparisons are not possible, since both the children and mothers have had prior experience in problem-solving situations. A purely ethnographic approach was also beyond the scope of this research, due both to time constraints and the fact that hypotheses had been formulated prior to the videotaped sessions. Nevertheless, in spite of the restrictions imposed by reality, care was taken to ensure that the mother-child interactions under observation resemble normally occurring situations as closely as possible.

The use of a mixed methodologies approach, combining elements of experimental and ethnographic research, seems to provide the most appropriate and promising way of working within the social and practical limitations of studying mother-child interactions. In fact, Mathison (1988) views triangulation, or the use of multiple methods, as a valuable strategy for increasing the validity of research findings: "Regardless of which philosophical, epistemological, or methodological perspectives an evaluator is working from, it is necessary to use multiple methods and sources of data in the execution of a study in order to withstand critique by colleagues" (p. 13). She elaborates that

> we attempt to make sense of what we find and that often requires embedding the empirical data at hand with a holistic understanding of the specific situation and general background knowledge about this class of social phenomena. This conception shifts the focus on triangulation away from a technological solution for ensuring validity and places the responsibility with the researcher for the construction of plausible explanation about the phenomena being studied. (p. 17)

The procedures and materials used in this research are directly modelled on those used by Wood (1980), Wood et al. (1976), and Wood and Middleton (1974, 1975). However, the choice of 12 mother-child dyads divided into 3 groups has evolved from the particular research questions under investigation and seems to be the most practical approach to testing the hypotheses. Analysis of the videotaped interactions made use of both descriptive and statistical methods.

Analysis of the scores resulting from the coding scheme described previously made it possible to obtain three principal measures from the videotapes of the instruction and post-instruction sessions: first, the degree to which the mother's interventions were contingent on the child's behavior during the instruction session, second, the extent of the child's success in completing the task during the post-instruction session, and third, the degree to which the mother's interventions were related to the child's later

success in assembling the pyramid independently.

The mother's intervention was considered to be contingent on her child's previous response if she offered less help following a successful construction attempt by the child, if she offered more help following a failed attempt, or if she offered no help following a successful self-initiated attempt. More precisely, maternal interventions were contingent if they met any one of the following three criteria. First, if the child succeeded following instruction, the mother's subsequent intervention was contingent if her assistance dropped by no more than three levels. (For example, if the mother lined two blocks up so that the child needed only to push them together (Level 4) and the child was successful in doing so, the mother's teaching behavior was contingent on her child's response if in her next intervention she merely pointed to the blocks (Level 3), described the next step by means of language (Level 2), or offered only general encouragement, such as, "Good girl, try some more" (Level 1).) Second, if the child did not produce the correct construction following instruction, the mother's behavior was contingent if she increased her assistance by no more than three levels. Finally, the mother's behavior was contingent following a successful self-initiated attempt by the child (Level 0) if she subsequently offered no help or only general encouragement.

On the other hand, a mother was considered to have used a non-contingent intervention under the following conditions:

if she offered increased assistance following her child's success; if she offered decreased help following the child's failure; or if she continued to offer the same level of help following either a success or failure by the child, rather than adjusting her level of assistance in the appropriate direction. A mother was also considered to have used a non-contingent intervention if she increased her level of help by more than three levels following her child's failure or if she decreased her level of help by more than three levels following her child's success.

The child's success during the post-instruction session was defined as the proportion of correct unassisted construction attempts in relation to the total unassisted construction attempts. Given that the data are not the result of a standardized, norm-referenced test, it is clear that inter-coder reliability is not measurable in the usual statistical sense. However, to increase confidence in the experimenter's ability to understand the dynamics of the mother-child interaction under investigation, a co-rater was used to obtain some indication of reliability. The co-rater, although hearing, has used American Sign Language since infancy because her parents are deaf. It should also be noted that the investigator has used sign language in her work for the last eleven years. Corresponding 10-minute intervals from randomly-chosen videotapes of one mother-child dyad in each of the three groups, during both the instruction and post-instruction sessions, were coded independently by the

investigator and the co-rater. Inter-coder agreement was noted on 90% of the interactions in the instruction sessions and on 95% of the interactions in the performance sessions. Coding decisions for the remaining data were made by consensus between the two coders. The use of a co-rater was helpful in the interpretation of both instructional and motivational cues given by the mothers, as such interactions occasionally seemed ambiguous. For example, the mother's comment of "Oh?" with a rising intonation may be a code between a particular mother and child.

Determining with certainty the exact nature of what someone hears or understands is technically impossible, since there is no way to get inside an individual's mind; in attempts to do so, inferences are usually made from behavior. With this in mind, it was anticipated that difficulties might be encountered in determining whether or not linguistic communications given by the hearing mothers were received by their deaf children. Upon viewing the videotapes, however, it became apparent that three of the mothers in the hearing mother-deaf child group were consistently successful in eliciting their children's attention prior to instructing them, usually by calling the child's name loudly or by cupping the child's chin in their hand to establish eye contact. The remaining mother in this group frequently spoke softly to her child while sitting behind him, and any messages which were clearly not received by the child were not coded.

On the other hand, it was often not clear whether or not

the deaf child received the full and exact content of the hearing mother's linguistic message or that the hearing mother completely understood her deaf child's speech. The decision was therefore made to code each linguistic message as long as it was acknowledged by the partner, regardless of the ambiguity of the content to the coders or the partner. Hearing mothers tended to use repetition, pointing, or handling of the blocks when their deaf children did not seem to understand them.

In addition to analyzing the videotapes, the data obtained during the pre- and post-testing interviews assisted in the interpretation of the mother-child interactions observed during testing.

CHAPTER FOUR

Results

Findings Related to the Hypotheses

Mothers who are said to scaffold well are those whose teaching strategies are appropriate to their children's initiatives and responses. The videotapes of the mother-child interactions were made in as naturalistic settings as possible. However, the research was not limited to a purely ethnographic methodology. In addition, statistical tests were applied to help determine the likelihood of observations being merely random occurrences or systematic variations among clusters of variables. In the final analysis, however, the interpretation of the researcher is of paramount importance and statistics are provided as an aid, not an arbiter, in this process. Mathison (1988) suggests that the use of multiple methodologies results in a more holistic interpretation of the social phenomena under investigation than is provided by the use of a single method of data collection and analysis:

> The value of triangulation is not as a technological solution to a data collection and analysis problem, it is as a technique which provides more and better evidence from which researchers can construct meaningful propositions (author's emphasis) about the social world. The value of triangulation lies in providing evidence

such that the researcher can construct explanations of the social phenomena from which they arise. (p. 15)

Taken together, the descriptive and statistical analyses of the activities of the mother-child dyads are indicative of the ability of mothers and children to sustain interaction and dialogue over a prolonged period of time. This ability presumes the competence and the willingness to engage in two-way communication which requires constant attending of both members of the pair to the messages of the other, in order to complete the task at hand. All these skills are assumed to be developmental in nature, in that children who are more mature socially and linguistically should be more able to benefit from the kind of instructive interaction that will help them to become more efficient and independent problem-solvers.

The major idea behind this research was that to the extent that mothers considered their children damaged or inadequate as potential learners, they would tend to use a rigid, non-contingent teaching approach, working from some sort of plan or system that does not take into consideration the degree of success of their children's efforts during the instruction period. There were four main objectives of the study, each of which is embodied in a hypothesis, as follows:

1. There is no significant difference[3] in the degree to which the instructional behavior of hearing mothers of hearing children and deaf mothers of deaf children is contingent upon the responses of their children.

2. The teaching behavior of hearing mothers of deaf children is less likely to be contingent on the initiatives and responses of their children than that of the mothers in the two above-mentioned groups.

3. Deaf children of hearing mothers are less likely to develop efficient and independent problem-solving abilities than hearing children of hearing mothers and deaf children of deaf mothers.

4. The mothers' instructional behavior is related to the exhibited differences in their children's efficiency as problem-solvers.

It may be recalled that contingent interventions must fit one of the following criteria: the mother increases her level of help one, two, or three levels following the child's failure; similarly, she decreases her level of help one, two, or three levels following the child's success after instruction; or she either does not intervene or offers only general encouragement following the child's success on a self-initiated construction attempt. In addition, a mother is considered to have used a non-contingent intervention if she offers increased assistance following her child's success, offers decreased help following the child's failure, or if she continues to offer the same level of help following either a success or failure by the child, rather than adjusting her level of assistance in the appropriate direction. A mother is also considered to have used a non-contingent intervention if she increases her level of help by more than three levels

following her child's failure or if she decreases her level of help by more than three levels following her child's success.

The test for the significance of the difference between two independent proportions (Ferguson, 1976) was judged to provide the most conservative and appropriate measure of whether the mother-child interactions in one group of dyads were significantly more or less contingent compared to those in another group of dyads. Statistical tests of significance were applied to interaction events, many of which were elicited for each dyad. However, because of the small number of subjects and the fact that the data were collected in varying home environments, rather than in a standard milieu such as a laboratory, the decision was made to be as conservative as possible in judging the outcome of the results. Accordingly, significance criteria for two-tailed tests were used in the interpretation of the scores, even though one-tailed tests might have been appropriate, since the direction of the results were predicted. Taking this most conservative approach increases confidence in the results based on statistical tests.

Hypothesis 1. Despite maximizing the risk of rejecting significant relationships, the hypothesis that there was great similarity in the instructional behavior of the mothers in the hearing mother-hearing child and deaf mother-deaf child dyads was supported. The figures in Table 5 indicate that virtually no significant differences were found between these two groups in terms of the degree of the mothers' sensitivity to their

Table 5

Proportions of Contingent and Non-Contingent Interventions During Instruction by Hearing Mothers of Hearing Children and Deaf Mothers of Deaf Children

Intervention	Group		z
	Hearing mother-hearing child	Deaf mother-deaf child	
Contingent	67	77	1.70 ns
More help	24	29	.82 ns
Less help	32	28	.57 ns
No help	44	43	.17 ns
Non-contingent	33	23	1.69 ns
More help	38	37	.05 ns
Less help	18	21	.31 ns
Same level	44	42	.19 ns

Note. "ns" means not statistically significant at .05.

children's responses or their instructional activities vis-à-vis contingency-non-contingency. Although the figures suggest that the instructional behavior of deaf mothers of deaf children is more contingent than that of hearing mothers of hearing children, the differences are not statistically significant and may have occurred by chance. These results suggest that hearing and deaf mothers use similar scaffolding strategies when teaching their hearing and deaf children, respectively, in problem-solving situations. For this reason, the data in these two groups have been added together so that they can be compared jointly with those of hearing mothers of deaf children. For the reader's interest, comparisons of the proportions of contingent and non-contingent interventions for hearing mothers of deaf children and hearing mothers of hearing children are provided in Appendix H-1, while those for hearing mothers of deaf children and deaf mothers of deaf children are given in Appendix H-2.

Each of the tables associated with the first hypothesis shows three different indices of contingent and non-contingent behavior. Those aspects of contingent intervention which are presented include the proportion of contingent interventions following the child's failure after instruction, the proportion of contingent interventions following the child's success after instruction, and the proportion of times the mothers did not intervene following a successful child-initiated construction. The characteristics of

non-contingent interventions under consideration are the proportion of non-contingent interventions following the child's failure, the proportion of non-contingent interventions following the child's success, and the proportion of non-contingent interventions which remained at the same level of assistance.

Hypothesis 2. Table 6 shows the proportions and characteristics of contingent and non-contingent interventions for hearing mothers of deaf children compared to those of the combined deaf mother-deaf child/hearing mother-hearing child group. The figures are indicative of the mothers' sensitivity to their children's behavior when instructing them in a problem-solving situation. The figures suggest that for the most important comparisons, concerning the proportion of contingent and non-contingent instructions, hearing mothers of deaf children exhibited less sensitive behavior toward their children's actual responses than the other mothers.

Although the mothers in all three groups tended to use a higher proportion of contingent than non-contingent teaching strategies, hearing mothers of deaf children produced a significantly lower proportion of contingent responses and a significantly higher proportion of non-contingent responses. In other words, deaf mothers of deaf children and hearing mothers of hearing children seem to be better scaffolders than hearing mothers of deaf children when instructing their children in problem-solving situations. In all, six of the eight comparisons concerning contingency and non-contingency

Table 6

Proportions of Contingent and Non-Contingent Interventions During Instruction by Hearing Mothers of Deaf Children Contrasted with those of Other Mothers

Intervention	Group		
	Hearing mother-deaf child	Hearing mother/child and deaf mother/child	z
Contingent	58	72	2.65 **
More help	50	27	3.70 **
Less help	44	30	2.22 *
No help	6	43	5.92 **
Non-contingent	42	28	2.65 **
More help	18	38	2.40 *
Less help	27	19	1.09 ns
Same level	55	43	1.31 ns

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

shown in Table 6 are statistically significant, while the remaining two approach significance at the .05 level.

The hearing mothers of deaf children differ from the other two groups of mothers not only in the proportion, but also in the manner of their contingent and non-contingent instructional behaviors. Mothers in the deaf mother-deaf child/hearing mother-hearing child group offered the largest proportion of contingent responses following the child's success on a self-initiated construction attempt. In other words, the mothers in this group tended not to interfere when their children were experiencing success on independent construction attempts. This finding takes on added importance when it is revealed that 48% of the construction attempts for the hearing mother-hearing child dyads were child-initiated, 54% for the deaf mother-deaf child dyads were child-initiated, while only 14% for the hearing mother-deaf child dyads were child-initiated; it is probable that this indicates a habitual pattern that has existed for many years. If the hearing mothers of deaf children have not been good scaffolders in the past, perhaps that is why their deaf children take so few initiatives. These children have learned to be sensitive to what their mothers tell them to do, rather than take initiatives on their own. Children who seldom take initiatives are not likely to be good learners. Surely this deserves further research, especially because when it is discovered that a child has a serious hearing impairment, the parents are usually given some advice and instruction. This

Table 7

Proportions of Three Types of Contingent Interventions During Instruction by Hearing Mothers of Deaf Children Contrasted with those of Other Mothers

Intervention	Group		
	Hearing mother-deaf child	Hearing mother/child and deaf mother/child	*z*
More help	50	27	3.70 **
Less help	44	30	2.22 *
No help	6	43	5.92 **

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

would be an appropriate and convenient time to include instructions on scaffolding.

Hearing mothers of deaf children not only offered a significantly lower proportion of contingent interventions than the mothers in the deaf mother-deaf child/hearing mother-hearing child group, but, moreover, their pattern of contingent instructions differed significantly from that of the other mothers (see Table 7). Typically, hearing mothers of deaf children offered contingent instructions following their children's failures (50% compared to 27% for the other mothers), whereas the other mothers offered no help (43%

compared to 6%) because the self-initiated efforts of their children had been successful and therefore help would not have been appropriate. These figures suggest that there is a tendency for hearing mothers of deaf children not to allow their children much opportunity to initiate independent construction attempts, and it appears that the children in this group are less likely to initiate successful construction attempts. In fact, during instruction, deaf children of hearing mothers initiated only 21 constructions, compared to 60 for the deaf children of deaf mothers and 51 for the hearing children of hearing mothers. In addition, it should be noted that hearing mothers of deaf children intervened significantly more frequently during instruction than either hearing mothers of hearing children ($z = 6.2$, $p < .01$) or deaf mothers of deaf children ($z = 7.36$, $p < .01$). The hearing mothers, then, maintained a tighter control over the amount of instructions given to their deaf children both preceding and following the children's construction attempts. These results may indicate that these children are already well along the way to learning to be helpless: the deaf children of hearing mothers may initiate fewer actions because their mothers, following a very rigid teaching approach, have never allowed them the freedom to experience independence or success. In other words, it appears that a circular pattern has been set up between the hearing mothers and their deaf children: the mothers in this group have allowed their children fewer degrees of freedom in problem-solving

situations, and the children have learned not to initiate actions independently, but rather to rely on their mothers for additional assistance. This behavior has, naturally, led the mothers to expect little independent performance from their deaf children, and so they provide more help.

Examination of the mothers' non-contingent instructional behavior, however, does not reveal as clear a pattern as their contingent interventions. The preceding analysis of the mothers' contingent behavior might lead one to expect that the non-contingent interventions of the mothers in the combined deaf mother-deaf child/hearing mother-hearing child group would tend toward allowing their children excessive independence. In other words, it might be anticipated that these mothers would provide the greatest proportion of non-contingent interventions by offering less help following the child's failure. Conversely, it might be expected that the hearing mothers of deaf children would tend to provide more help following the child's success, when their behavior was non-contingent, than the other mothers.

Table 8 indicates almost the reverse pattern, however. Both groups have a high proportion of non-contingent instructions at the same level (55% for the hearing mothers of deaf children and 43% for the other mothers). The remaining proportions indicate a pattern contrary to the expected findings: the mothers in the deaf mother-deaf child/hearing mother-hearing child group were more likely to offer increased help after success than the other mothers (38% as opposed to

Table 8

Proportions of Three Types of Non-Contingent Interventions During Instruction by Hearing Mothers of Deaf Children Children Contrasted with those of Other Mothers

Intervention	Group		z
	Hearing mother-deaf child	Hearing mother/child and deaf mother/child	
More help	18	38	2.40 *
Less help	27	19	1.09 ns
Same level	55	43	1.31 ns

*$p < .05$.

18%). In addition, the hearing mothers of deaf children were more likely than the other mothers to offer less help after failure (27% as opposed to 19%). In other words, hearing mothers of hearing children and deaf mothers of deaf children often help their children after successful construction attempts, whereas hearing mothers of deaf children often do not help their children after they have failed. This pattern was not predicted. Therefore, although not strictly related to the hypothesis, this pattern seems to work more in favor of deaf children of deaf mothers than deaf children of hearing mothers. Even if an intervention is non-contingent, it

appears to be more advantageous to be helped after success than to be ignored after failure.

There were no significant differences in the frequency of interventions between hearing mothers of hearing children and deaf mothers of deaf children, indicating a similarity in the degree to which the two groups of mothers intervened when instructing their children. It is interesting to note that there is a negative correlation between the frequency of maternal interventions during instruction and the children's later success in assembling the pyramid independently (Spearman rank correlation coefficient; Siegel, 1956) which is significant beyond the .01 level ($r = -.76$). This supports Wood and Middleton's (1975) finding that "the sheer quantity of exposure to instruction *per se* has no effect upon the child's task ability" (p. 186). In fact, the results from this study suggest a clear distinction between quality and quantity: it appears that more instruction may actually be harmful to learning, if it is not based on the child's successes and failures. Wood et al. (1976) suggest that "problem-solving activity often has a deep structure that may not be apparent, until a long sequence in process is near completion" (p. 97). In Vygotskian terms, frequent interventions may actually interfere with the mother's ability to diagnose her child's zone of proximal development.

It is not only in the amount, but also in the kind of help that one finds differences in the tutorial interventions of the three groups of mothers. Table 9 shows the

Table 9

Proportions of Interventions at Different Levels During Instruction by Hearing Mothers of Hearing Children and Deaf Mothers of Deaf Children

Intervention Level	Group		z
	Hearing mother-hearing child	Deaf mother-deaf child	
1	2	2	.10 ns
2	53	56	.35 ns
3	22	32	1.21 ns
4 & 5	23	10	1.92 ns

Note. Levels 4 & 5 are grouped together since they both involve actual maternal manipulation of the blocks.

proportions of interventions at each level for the hearing mothers of hearing children and deaf mothers of deaf children and the degree to which the proportions at each level differed from one another. Once again, there were virtually no significant differences in this aspect of the instructional behaviors of the mothers in the hearing mother-hearing child and deaf mother-deaf child groups, while significant differences were found between hearing mothers of deaf children and the mothers in each of the two preceding groups (see Appendixes H-3 and H-4, respectively). Consequently, the data for the hearing mother-hearing child and deaf mother-deaf child dyads have been added together to make them easier to compare with those for the hearing mother-deaf child pairs.

Table 10 indicates significant differences in the proportions of interventions at two levels between hearing mothers of deaf children and the other mothers. Hearing mothers of deaf children tended to provide most of their interventions by means of pointing to, positioning, or actually performing a full demonstration (56% compared to 44% for the other mothers). By contrast, the mothers in the deaf mother-deaf child/hearing mother-hearing child group tended to give most of their instructions by means of language (54% as compared to 35% for the hearing mothers of deaf children), describing a relevant feature of the next step of the construction (for example, "Look for the big blocks now"), a difference which is significant at the .01 level. For example, Figures 3, 4, and 5 show three mothers instructing

Table 10

Proportions of Interventions at Different Levels During Instruction by Hearing Mothers of Deaf Children Contrasted with those of Other Mothers

Intervention Level	Group		
	Hearing mother-deaf child	Hearing mother/child and deaf mother/child	*z*
1	9	2	2.28 *
2	35	54	3.03 **
3	30	27	.44 ns
4 & 5	26	17	1.69 ns

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

their children to "Look for the big blocks" during the Instruction Session. In Figures 4 and 5, the hearing and deaf mothers, respectively, give their instructions by means of language to their hearing and deaf children, while in Figure 3, the hearing mother of the deaf child actually does a full demonstration of the construction. In addition, the hearing mothers of deaf children tended to provide significantly more facilitative interventions aimed at keeping their children on task (for example, "Good girl, try some more" or "Sit up and pay attention") than did the other mothers ($p < .05$). By providing more facilitative interventions, fewer instructions as to what steps to take next, and more manipulative use of the blocks than the other mothers, the hearing mothers of deaf children followed a more tightly controlled teaching strategy. Their interactive behavior, which tends to be largely one-way, appears to be telling the children to do as they are told, rather than allowing them the opportunity to do it themselves. It also appears that deaf children of hearing mothers find it harder to keep on task than deaf children of deaf mothers. Perhaps this arises from their lower rates of success, which offer less satisfaction than the other children derive from such activities and may also explain why their mothers are constantly encouraging them to pay attention.

Wood et al. (1976) compared the number and type of tutorial interventions used when teaching hearing 3-, 4-, and 5-year-olds to assemble the pyramid. Qualitatively speaking, the tutor's role with the

3-year-olds was to stimulate and keep the children attending to the task at hand, a job which required almost step-by-step interventions. The predominant mode of interaction with the 3-year-olds was demonstration and block manipulation on the part of the tutor, but by the time the children were 4 years old, the tutor's interventions were by means of language, with a shift in emphasis from showing to telling. The tutor of the 5-year-olds who scaffolded well was characterized basically as a confirmer of constructions, giving assistance only when the child experienced difficulty. It is from this viewpoint that the mother may be clearly seen as providing a scaffolding function when teaching the child to assemble the pyramid. As the child progressed from 3 to 5 years of age, the mother's role in problem-solving situations moved from luring the child into the activity, to interpreting discrepancies for the child, to merely confirming the child's constructions.

The tutorial actions of mothers in the hearing mother-hearing child and deaf mother-deaf child pairs most closely resemble the tutors of the 5-year-olds in the above-mentioned research. For one thing, the hearing mothers of hearing children and deaf mothers of deaf children utilized higher proportions of instructions in language than did the hearing mothers of deaf children. In addition, all of the mothers in these two groups felt that, when teaching a child to do something new, it was more important to watch the child and respond to his or her moves, than it was to formulate and

follow a careful plan. One of the hearing mothers of hearing children elaborated on this responsive teaching approach: "I think it is better to follow the flow of the child as you never (mother's emphasis) know how they'll proceed or react....The parent is meant to facilitate, not direct."

On the other hand, the activities of the hearing mothers of deaf children more closely resemble those of the tutors of the 3-year-olds. Three of the four mothers in the hearing mother-deaf child group felt that forming and following a careful plan took precedence over responding to the child's leads during instruction. One mother in this group described how she had worked daily to help improve her daughter's speech since the child first received her hearing aids at 9 months of age. Every evening, the mother placed her child in a high chair and gave her speech lessons for 1 hour. This practice was still in effect at the time of videotaping, when the child was over 5 years of age. Another mother in this group was more succinct: "Stick to a routine and be firm."

Hypothesis 3. The third major focus of the study involved an analysis of the children's attempts to assemble the pyramid independently after having been taught once by their mothers. Only those constructions made without the mother's assistance were coded in determining the child's successful attempts. As predicted, there was no significant difference in the proportions of unassisted correct constructions for children in the hearing mother-hearing child and deaf mother-deaf child dyads. It was clearly shown that

the deaf children of deaf mothers produced a significantly much higher proportion of unassisted correct constructions than did the deaf children of hearing parents ($z = 5.35$, $p < .01$), also as hypothesized. The hearing children also produced a significantly much higher proportion of unassisted correct constructions than did the children in the deaf child-hearing mother pairs ($z = 6.87$, $p < .01$). When the data from the deaf mother-deaf child and hearing mother-hearing child dyads were combined, these children were found to produce significantly more unassisted correct constructions than the children in the hearing mother-deaf child pairs ($z = 5.46$, $p < .01$). There seems to be a link between the way the hearing mothers instruct their deaf children and the relative inability (perhaps emerging inability) of these children to solve problems independently.

Those mothers who intervened less frequently during the instruction and post-instruction sessions had children who performed more independently during the post-instruction session. In fact, a negative correlation was obtained between the frequency of the mothers' interventions during instruction and the frequency of child-initiated construction attempts ($r = -.59$, $p < .05$) during the post-instruction session. This is consistent with the finding that, during the post-instruction session, the children in the deaf mother-deaf child and hearing mother-hearing child pairs initiated more independent construction attempts than the children in the hearing mother-deaf child pairs ($z = 7.07$, $p < .01$; $z = 5.18$,

$p < .01$, respectively).

There is no theoretical reason to hypothesize any difference between boys and girls[5] in the processes under investigation, nor does the slight variability in the children's age[6] seem to be related to any differences in their post-instruction performance. The data obtained do not suggest that there were any systematic differences, and so these questions have not been examined rigorously since they are beyond the scope of the study. The sex and age of the child appear not to be a major factor.

Hypothesis 4. The final and perhaps most important finding of the research involves the correlation between the mothers' instructional activity and the children's post-instruction performance. The data indicate a significant correlation between these two measures ($r = .69$) at the .05 level. This finding supports previous findings by Wood (1980), Wood et al. (1976), and Wood and Middleton (1974, 1975) that "the most effective instructors were those who...were systematically most responsive to the effects of their instruction on the child" (Wood & Middleton, 1975, p. 186). More explicitly, the data point out a strong similarity in the tutoring styles of the mothers in the deaf mother-deaf child and hearing mother-hearing child pairs, a strong similarity in the problem-solving abilities of the children in these two groups, and a correlation between the mothers' teaching strategies and subsequent child performance. These are important results for they suggest that the teaching

style of deaf mothers of deaf children and hearing mothers of hearing children is characterized by the mother's attempts to adapt her level of instruction to meet the child's prevailing needs. In short, in comparison to hearing mothers of deaf children, deaf mothers of deaf children and hearing mothers of hearing children tend to be very responsive teachers. Perhaps the hearing mothers believe, consciously or not, that their deaf children are defective or inadequate as potential learners, and therefore try to do more for them, thus setting up one-way, instead of interactive, communication patterns. Teaching strategies which are not based on children's actual responses do not enable them to become independent and efficient problem-solvers; rather, it appears that deaf children of hearing mothers learn to become dependent on the assistance of others.

Unexpected Findings

It would be ideal to conduct a purely ethnographic study to examine mother-child interactions using a large random sample. However, the utilization of mixed methodologies, taking advantage of aspects of both ethnographic and experimental methods, appears to provide the most promising approach to accommodating the necessary social and practical limitations associated with studying mothers and children (Mathison, 1988). This is especially important in research involving deaf children, since the incidence of childhood

deafness is relatively low.

The use of videotapes to collect data allows for repeated analysis of observations, and the lack of a perfectly controlled experiment allows for the possibility of serendipitous findings to emerge.

Re-examination of the videotapes revealed additional similarities and differences in the mothers' teaching strategies during the instruction session. Hearing mothers of hearing children were consistent in first eliciting the child's attention, and then simultaneously verbally instructing and directing visual attention to the blocks. Deaf mothers, on the other hand, achieved the same objectives sequentially rather than simultaneously: initially, they elicited the child's attention; next, they provided instructions; and finally, they directed the child's visual attention to the blocks. While the hearing mothers of hearing children used auditory and visual channels to teach their children, the mothers in the deaf mother-deaf child group used only the visual modality, thereby necessitating the sequential teaching approach. The hearing mothers of deaf children were consistent in first establishing eye contact with their children prior to giving instructions. However, after setting up visual contact, they tended to give explanations and instructions as though their children's auditory systems were intact, simultaneously giving verbal explanations and directing visual attention to the blocks, thus interfering with the sequential communication needed by the deaf children

for comprehension. The simultaneous auditory-visual teaching behavior of the mothers in this group resembled that of the hearing mothers of hearing children.

The following transcribed excerpts from the videotapes contrast the sequential teaching approach used by the deaf mothers with the simultaneous strategy which the other mothers tended to use. Each excerpt represents the first 1 1/2 minutes of the instruction session. The first conversation occurs between a hearing mother (HM) and her hearing child (hc). The mother and child establish mutual visual contact only once, and then only briefly, during the following exchange; most of the conversation occurs while both the mother and child are looking at the blocks.

HM: First of all, since we're going to make a big stack, we start with the big ones first, OK?

hc: (Looks at blocks) Oh.

HM: (Puts big blocks in a pile) Let's get all the big ones together.

hc: (Helps mother push away smaller blocks) I want to do the big ones.

HM: OK, you're going to do 'em all. OK. We'll match the biggest ones, right? (Child assembles two blocks) How do you know these two go together? (Mother looks up at child)

hc: I know. (Smiles and looks up at mother)

HM: (Looks down at blocks and smiles) You just know, huh? 'Cause you peeked, is that it?

hc: (Continues assembling blocks) No.

HM: OK, then the other two big ones have to go together.

hc: (Continues assembling all four big blocks) This one goes like this, oh, it won't go in.

HM: It's stuck on the tablecloth. (Pulls the tablecloth and child then finishes assembling first layer) Next size. (Child picks up block and places it on completed layer) No, that's too, uh...

hc: No?

HM: Remember? Work on these. Get all these together first. (Points to next size block; child picks up indicated block and looks at mother inquiringly) Find all those size woods first.

In the following exchange between a hearing mother (HM) and her deaf child (dc), the mother gives instructions while at the same time directing the child's visual attention to the blocks. This approach is, of course, inappropriate with a deaf child and tends to result in one-way communication directed by the mother.

HM: (Takes two big blocks and puts them in center of table; points to one of the blocks) Susie, there's a hole and there. (Points to other block; child tries unsuccessfully to join them; mother points to blocks again) Can you put them in there? Can you make a circle? (Child tries unsuccessfully to assemble them again; mother takes the blocks) Here. Mommy will show you the first one. Look. See? Goes in there! (Child pushes the two blocks together) See? And... (Mother lines a third big block up with the first two and child pushes

fourth big block and looks at child) Where does this one go? (Child correctly joins it onto the first three blocks) There, look. (Mother taps child's arm and points down to center of assembled blocks; child looks down) See, Susie, is that round?

dc: Round.

HM: Round. (Child puts next size block on top of the first layer) OK, this is the next one. (Mother taps block) Where is the other one? (Child picks up another block the same size) Where is the other one? (Child tries unsuccessfully to join the two blocks) No. (Mother points to the pile of unassembled blocks) Look.

In marked contrast to the two preceding mothers, who used a simultaneous auditory-visual communication approach, the deaf mother (DM) in the following conversation consistently established visual contact with her deaf child (dc), gave instructions by means of language, and then directed the child's visual attention to the blocks.

DM: (Mother taps child's arm; child looks up at her) OK, you must have a big block. Find a big one. (Mother looks down at blocks)

dc: (Child looks down at blocks) I think I see two. (Child selects two big blocks)

DM: OK. You need two more. (Mother taps child's arm until he looks up at her) Wait. Stop. You need to pick four at a time. (Mother looks down at the pile of blocks; child looks down at the two blocks he has already chosen and begins

at a time. (Mother looks down at the pile of blocks; child looks down at the two blocks he has already chosen and begins to assemble them; mother again taps child's arm until he looks up at her) Jimmy, look at me. I'm not finished. Four blocks the same, the same size. You need two more the same as those. (Mother points to the two blocks the child is holding; child looks down at the blocks; mother taps child's arm but he does not look up; mother cups child's chin in her hand until she establishes eye contact with him) Where are two others? Find two others. (Mother looks down at the pile of blocks)

dc: (Child looks down at blocks and points to one) That one over there. (Mother touches indicated block and looks inquiringly at child; child nods; mother hands block to child) OK. (Child tries to assemble blocks)

DM: (Mother taps child's arm until he looks up at her) Find one more. (Child looks down at blocks again; mother taps child's arm until he looks up at her) Find one more like this one. (Mother points to a big block)

dc: (Child looks at the pile of blocks and points to one) That one! No...a big one...there! (Child looks up at mother)

DM: (Mother nods approval) OK. Bring it here. (Child picks up the block and puts it in the pile with the other big blocks) Fine. (Mother taps child's arm until he looks up at her) Fine. Now look for the circle in the middle of the blocks. (Mother looks down and points to one block)

These excerpts, taken together with the statistical

results, suggest that the instructional behavior of deaf mothers may provide important information concerning effective interaction strategies with deaf children. The deaf mothers consistently operated within the visual modality for communication and instruction. However, the hearing mothers of deaf children operated as though their deaf child's auditory system was almost fully functional, using visual and auditory methods simultaneously (see Figure 3); this approach seems to interfere with the two-way communication necessary for socialization and instruction, perhaps causing less effective interaction to take place. One deaf mother drew particular attention to the importance of establishing and maintaining visual contact with deaf children during communication:

> Recommended! A mother should keep trying to make sure her child is watching her communicating with him as often I see a mother talking or speak [sic] in hopes that the child can hear her...it's much better to make the child watch Mother's face--when talking. Also (mother's emphasis) use facial expressions are important, too! [sic]

Deaf mothers seem to understand clearly the necessity of maintaining the deaf child's visual attention while communicating, as shown in Figure 6. Hearing mothers prevent the two-way communication that is necessary for optimal socialization and instruction when they do not make use of the deaf child's visual, as well as auditory, modality. (Compare,

for example, the visual attention of the deaf child of the hearing mother in Figure 3 with that of the deaf child of the deaf mother in Figure 5.) Hearing mothers can learn a great deal from deaf mothers about the importance of vision for learning and communication, to the great benefit of their deaf children.

Previous research shows that teachers of the deaf can be taught to make their conversations with their students contingent on the children's initiatives and responses, and that their students subsequently produce more and longer conversational exchanges (Wood & Wood, 1984). Because communication is frequently strained and defective between deaf children and their hearing parents, what has been learned about scaffolding, with its emphasis on interaction and dialogue, may prove to be especially useful in early intervention programs for hearing impaired children and their parents. Hearing parents of deaf children would undoubtedly benefit from instruction in the theory and application of scaffolding, with its goal of reciprocal, two-way communication.

Re-examination of the videotapes also revealed similarities and differences in the children's independent construction performance during the post-instruction session. The two children who produced the highest proportions of correct unassisted constructions were observed using, in Vygotskian terms, egocentric speech during their initial independent construction attempts. The first child, a deaf

boy, actually turned his hand toward himself and signed, "No," following an incorrect construction, which he then proceeded to correct spontaneously (see Figures 7 and 8). The second child, a hearing boy, engaged in almost whispered discourse with himself during his early independent efforts. Following these initial uncertain construction attempts, each child went on to assemble the blocks smoothly, and the egocentric speech disappeared. The egocentric speech seemed to function in a self-regulatory capacity, enabling the children to provide their own scaffolds until the required skills had been internalized.

An additional area of statistical analysis concerns unanticipated interventions by the mothers in the post-instruction session. Although the mothers had been asked to allow the children to assemble the blocks independently, all of the mothers, with the exception of one deaf mother, continued to intervene periodically. The mothers in the hearing mother-deaf child pairs interfered significantly more often than the mothers in either the deaf mother-deaf child or hearing mother-hearing child dyads ($z = 7.07$, $p < .01$; ($z = 5.18$, $p < .01$, respectively). Since it could conceivably be argued that any differences in the children's performance might be due to these additional interventions that were given in spite of the investigator's instructions to the mothers to let the children build the pyramid alone, the frequency of post-instruction interventions was correlated statistically with the proportion of unassisted correct constructions. A

negative correlation (r = -.57) was obtained, replicating Wood and Middleton's (1975) earlier finding with hearing children and hearing mothers. Thus, despite the extra help from their mothers, the deaf children of hearing mothers were significantly less successful in their "independent" constructions. Children who are helped too often do not seem to benefit. It may well be, as Wood and Middleton (1975) suggest, that "mothers intervened in the post-instruction session to keep a failing child going: it was the least competent children who attracted the extra interventions" (p. 187). Lack of success may arise from an inadequate teaching style. The deaf children of hearing mothers appeared to be less competent than the other children in the research; perhaps their lower competence has arisen over time from the inadequate teaching styles of their mothers.

There were no significant differences in the proportions of maternal interventions at each level during the post-instruction session for the hearing mother-hearing child and deaf mother-deaf child pairs (see Appendix H-5); these data are therefore combined so as to provide a clearer contrast with the hearing mother-deaf child group.

Table 11 provides some additional insights into the mothers' overall teaching strategies when compared to the figures in Table 10. The unanticipated instructional behavior of the hearing mothers of deaf children during the post-instruction session closely resembled that of the same group of mothers during instruction, both in terms of

Table 11

Proportions of Interventions at Different Levels During the Post-Instruction Session by Hearing Mothers of Deaf Children Contrasted with those of Other Mothers

Intervention Level	Group		χ
	Hearing mother-deaf child	Hearing mother/child and deaf mother/child	
1	17	14	.56 ns
2	29	68	4.43 **
3	30	11	2.38 *
4 & 5	24	7	2.46 *

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

frequency and levels of interventions. Furthermore, as a comparison between Tables 10 and 11 reveals, the hearing mothers of deaf children used roughly the same proportions of interventions at each level during the performance session as they had earlier during the instruction session. In other words, although they had been requested not to intervene during the post-instruction session, the hearing mothers taught their deaf children how to assemble the pyramid all over again. In connection with this finding, the deaf children of hearing mothers overtly attempted to elicit

maternal attention while attempting to construct the pyramid independently significantly more often than either deaf children of deaf mothers (z = 10.39, p < .01) or hearing children of hearing mothers (z = 10.69, p < .01). Apparently, these children have learned to seek someone's help, even when they are expected to work independently. Perhaps the deaf children of hearing parents may be displaying signs of having learned to be helpless by 5 years of age, or even earlier.

In striking contrast to the consistent intervention pattern of the hearing mothers of deaf children, the post-instruction teaching behavior of the mothers in the deaf mother-deaf child and hearing mother-hearing child dyads differed markedly from their earlier behavior during instruction. For one thing, these mothers intervened less frequently during the post-instruction session: the deaf mothers intervened 50 times during instruction and only 15 times during the post-instruction session, while the hearing mothers of hearing children intervened 55 and 29 times, respectively. This was the only case in which the behavior of the hearing mothers of hearing children was different from that of deaf mothers of deaf children, and if the difference conveys any advantage to any group, it is to the deaf children. Clearly, deaf children are not inferior to hearing children in their potential to learn how to solve problems. This is another unanticipated, but statistically significant, finding. It is also educationally significant in that it offers some hope that, if hearing mothers of deaf children can

be taught to understand the high potential of their children, their subsequent change in behavior might lead to more successful interaction strategies--better scaffolding--to the advantage of their deaf children.

On the other hand, the hearing mothers of deaf children intervened 129 times during instruction and 111 times during the post-instruction session. The relatively infrequent instructional behavior of the deaf mothers of deaf children and hearing mothers of hearing children during the latter session was largely focused on verbal or signed prompts; there was much less use of pointing or handling of the blocks than there had been during instruction. Whereas the hearing mothers of deaf children used the post-instruction session as an opportunity to re-teach problem-solving skills, the deaf mothers of deaf children and hearing mothers of hearing children allowed their children to proceed independently, offering hints by means of language when the children experienced frustration or repeated failure.

CHAPTER FIVE

Discussion

Findings Related to the Hypotheses

The development of cognitive capacities in deaf children has been the focus of much educational research over the past two decades. A growing number of studies has underlined the importance of considering the social context in which cognitive skills develop, both for deaf and hearing children. Increasingly, both Soviet and Western scholars (such as Vygotsky and Bruner, respectively) have come to view early interactive experiences between mothers and their children as inherent to the developmental process. The present study examined the effects of parental response to deafness on the deaf child's developing problem-solving strategies, by examining three types of mother-child dyads: deaf mothers and their deaf children, hearing mothers and their hearing children, and hearing mothers and their deaf children. It was hypothesized that the mothers in the deaf mother-deaf child and hearing mother-hearing child pairs would use similar scaffolding strategies when instructing their children, basing their tutorial behaviors on their children's responses, and that these children would demonstrate efficient and independent problem-solving skills. By contrast, it was anticipated that hearing

mothers of deaf children would be more directive in their teaching and that their deaf children would consequently have less opportunity to become adept and independent problem-solvers than the children in the two preceding groups. These questions were examined by asking mothers to teach their children to assemble a construction toy out of wooden blocks.

As hypothesized, there was great similarity in the teaching behavior of the hearing mothers of hearing children and deaf mothers of deaf children. This is consistent with the findings of Meadow et al. (1981), who found a striking consistency between the patterns of interaction of hearing mothers and their hearing children and deaf mothers and their deaf children in a free play situation. In spite of the fact that the deaf mothers in the present research communicated with their deaf children through the visual modality, their interaction patterns with their children closely resembled those of the hearing mothers with their hearing children: both groups of mothers tended to provide most of their instruction by means of language, and there was great similarity in the frequency of maternal interventions and the degree to which these interventions were contingent on the children's initiatives and responses; in other words, these parents were skilled in scaffolding. This supports the idea that the mothers in these two groups use similar scaffolding strategies when instructing their children. From a Vygotskian perspective, it appears that

hearing and deaf mothers utilize common strategies in negotiating intersubjectivity in problem-solving situations with their hearing and deaf children, respectively.

The deaf mothers seemed to have the same expectations for their deaf children's involvement in and success with the task as did the hearing mothers for their hearing children; the deaf mothers did not appear to consider their deaf children to be damaged or inadequate as potential learners in any way. This may be, as Erting (1987) suggests, due to the fact that deaf parents do not view deafness primarily as a handicap or disability, but as "a condition that creates a different way of life for them as compared to society's hearing majority" (p. 142). The following quote of one of the deaf mothers in the study capsulizes this notion:

> I can raise my children better because they are deaf. When they were born, I knew right away that they were both deaf. It was easy for me to accept, because I am deaf myself....I know what deaf [people] can do.

Perhaps the most striking and consistent finding to emerge from this research was the difference in instructional styles of the hearing mothers of deaf children and the other mothers. These mothers tended to be more directive and intrusive when teaching their deaf children than did the other mothers when interacting with their children. The higher frequency of maternal interventions, the lesser extent to which these interventions were

contingent on the child's previous behavior, and the greater proportion of interventions aimed at keeping the child on task combine to produce the more rigid, inflexible teaching behavior of the hearing mothers of deaf children when compared to the other mothers. In other words, they were not as skilled at scaffolding as the other mothers because their actions were not as highly contingent on the child's behavior. This finding is in accord with the growing body of studies which consistently finds hearing mothers to be more dominant and intrusive toward their deaf children, than the hearing mothers of hearing children (for example, Brinich, 1980; Goss, 1970; Greenberg, 1980; Henggeler & Cooper; 1983; Schlesinger & Meadow, 1972; Wedell-Monnig & Lumley, 1980) and deaf mothers of deaf children (for example, Meadow et al., 1981) to whom they were compared. In Vygotskian terms, then, the hearing mothers of deaf children appeared to utilize more directive interpsychological processes when negotiating intersubjectivity with their children, than did the other mothers.

There may be at least two possible explanations for this difference in maternal behavior. First, the hearing mothers are experiencing a traumatic reaction to the diagnosis of deafness in their child, a response not usually felt with such intensity by deaf mothers of deaf children. This emotional response may give rise to maternal interaction styles which are incompatible with reciprocal

mother-child socialization and communication. Second, hearing mothers may experience a lack of confidence in their ability to communicate with their hearing-impaired children. This may, in turn, lead to an increase in maternal control of mother-child interactions as a means of minimizing possible misunderstanding. Each of these possibilities will be discussed in turn.

With respect to parental response to the diagnosis of deafness, Moses (1985) identifies various states of grief, including denial, guilt, depression, anger, anxiety, and coping, commonly experienced by parents of disabled children. If the hearing mothers are denying the child's deafness, they will find it difficult to make the necessary adjustments which deafness requires for effective, reciprocal communication and interaction. Some support for this idea was provided serendipitously by repeated observations of the videotapes. These unanticipated findings were particularly useful in terms of triangulating, that is, in qualitatively substantiating hypotheses which had already been supported by the use of quantitative methods. As noted previously, the deaf mothers consistently delivered their instructions in a sequential manner: first they would elicit the deaf child's attention, then provide an explanation by means of language, and then direct visual attention to the blocks. This teaching approach implies not only a different pattern, but also a different pace, of interaction. Despite the fact that each of the deaf mothers

had been raised by hearing parents, none of them used a simultaneous visual-auditory approach when instructing her child. Instead, each of the mothers in this group used a sequential, visual approach, which is far more effective for conveying information to or between deaf persons. Erting (1987) notes:

> One effect of this single rather than dual channel capacity is a dramatic decrease in the amount of information easily accessible to deaf individuals when compared with their hearing counterparts. Because a deaf person requires as much information as a hearing person, a basic goal for deaf people is to acquire information and to communicate with others in the most efficient way possible, both to avoid visual fatigue and to free their visual attention for the next activity or demand. This goal is not peripheral; rather, it is a central organizing principle for their lives. Success in achieving it is necessary in a world in which effective information processing and management are keys to survival. (p. 131)

In contrast to this sequential, visual teaching approach, the hearing mothers of hearing children utilized auditory and visual channels simultaneously when instructing their children, speaking to the children and pointing to the blocks as a means of explaining the solution (see Figure 4). Although the hearing children used the visual channel in

learning to construct the pyramid, their use of vision was in no way comparable to the concentrated visual attention required of the deaf children in the remaining two groups. The hearing mothers of deaf children tended to use the same teaching approach, thereby forcing their deaf children to choose between relying on a defective auditory or an intact visual modality. It is natural for hearing parents to try to communicate with their deaf children using the same approaches which enable them to communicate and interact reciprocally with hearing children. By continuing to interact as though their deaf children are able to listen normally, the hearing mothers are rendering what might otherwise be effective scaffolding techniques inoperative. It is important to emphasize that scaffolding behaviors are not outside the hearing mothers' competencies; rather, it is more likely that they have not considered basing their instruction on their children's behaviors, which they have come to accept as indicating inability. It may also be that the latter group of mothers increased their use of pointing, manipulating, or actually arranging the blocks, relative to the other mothers, because their children were more responsive to instructions delivered visually, when they were forced to make a choice.

The second possible explanation for the difference in the mothers' behaviors also concerns parental acceptance of the child's deafness, which is central to the deaf child's cognitive development. Although some hearing parents may

have accepted their child's deafness, they may experience a lack of confidence in their ability to communicate with their hearing-impaired child. As suggested by C. J. Erting (personal communication, December 16, 1986) and Harris (1978), hearing mothers may seek to control the conversations and interactions in order to minimize the risk of misunderstanding their children. Some support for this notion is provided by an analysis of the types of interventions given by the mothers in this group: whereas the other mothers tended to offer most of their instructions by means of language, thereby allowing their children more degrees of freedom in responding, the hearing mothers of deaf children provided over half of their instructions by means of pointing to, manipulating, or actually arranging the blocks. This difference in maternal teaching styles is evident by a comparison of Figures 3, 4, and 5. By providing more direct instructions to their children than the other mothers, the hearing mothers restricted the choice of options available to their deaf children in responding. Even when the hearing mothers did instruct their children by means of language, they tended to be repetitive, rather than provide additional information, as evidenced by one hearing mother's instruction sequence to her deaf child: "Look for the big blocks. The big blocks. The big blocks. Look. The big blocks. Big ones. I said big blocks." Snow (1977) suggests that consistent redundancy may primarily serve the purpose of minimizing confusion between mothers and

children; however, the poor independent performance of this group of deaf children does not appear to indicate the effectiveness of this approach in this situation.

Increased maternal control also minimizes the mother's need to acknowledge that her child is deaf, as indicated by the following comment of a hearing mother of a deaf child: "The reason some deaf kids are more motivated than others is because of their parents, especially their mothers, because they have to force their kids constantly to improve and do their lessons every day." This statement was made by a mother who is compulsive about never missing a daily teaching session with her deaf daughter: since the child's diagnosis over 4 years ago, this hearing mother has been giving her daughter a 1-hour speech and auditory training lesson at the same time every day, closely adhering to the lesson plan provided by the child's speech clinician. In sharp contrast to this statement, a mother in the deaf mother-deaf child group who had been raised by hearing parents, had these thoughts on the same subject:

> My mother never respected me and never communicated with me. Hearing parents must first accept their child's deafness; if not, they will push the child too hard. The [hearing] parents need to accept the deafness and change their attitudes because you can't change the deafness.

Children whose mothers allowed them more opportunities to respond tended to initiate a higher proportion of

construction attempts during the instruction session than children whose mothers did not. Approximately half of the construction attempts for the hearing mother-hearing child and deaf mother-deaf child dyads were child-initiated, compared with only 14% for the hearing mother-deaf child pairs. One possible explanation of great theoretical and practical interest focuses on Bower's (1977) notion of children's risk-taking. According to Bower, children are born with the ability to take initiatives, but if they are not given the opportunity, and reinforced for doing so, initiative-taking on the part of the child may disappear. Because the mothers in the hearing mother-hearing child and deaf mother-deaf child dyads based their instructional strategies on their children's behavior, they tended not to intervene when the child was succeeding independently, thereby allowing increased opportunity for initiative-taking. Also, initiatives on the part of these children were positively reinforced, both by the mothers' encouraging comments and, perhaps more importantly, by the success of their initiative-taking.

In contrast, the mothers in the hearing mother-deaf child group appeared to focus on a preconceived teaching plan rather than on their children's behavior, and, in accordance with this plan, missed opportunities that arose naturally for their children to take initiatives. These deaf children were, consequently, robbed of opportunities to practice their inherent capacity to take initiatives. In

comparison to other children, they initiated fewer than one third of the construction attempts. This resulted in far fewer instances of success on which their mothers could base positive reinforcement. More serious, perhaps, there was little behavior on which their mothers could make their own initiatives and responses contingent. The rigid teaching approach adopted by the hearing mothers of deaf children was a double-edged sword: not only did it appear to extinguish initiative-taking abilities in the children, but it also made effective scaffolding by the mothers less possible and more difficult.

The third hypothesis, that deaf children of hearing mothers are less likely to develop efficient and independent problem-solving abilities than hearing children of hearing mothers and deaf children of deaf mothers, was supported. As predicted, there was great similarity noted in the frequency of the independent construction attempts made by the children in the hearing mother-hearing child and deaf mother-deaf child groups, as well as the extent to which these attempts were successful. Presumably, the behavior that was observed during the study was similar to the usual patterns that had evolved over similar mother-child interactions prior to the videotaping sessions. It was probably not the single instance under observation that was responsible for the poorer problem-solving behavior of deaf children of hearing mothers, but, rather, a pattern that had been in effect for some time, perhaps even years.

One possible explanation for the poorer performance of the deaf children of hearing parents is that the condition which caused their deafness may have impaired them in some other way as well. To the extent that this is true, it would invalidate the idea that the effects on the children were caused by the mothers' inadequate scaffolding behavior. However, the subjects were selected with a view to avoiding this possibility, and there is no reason to believe that the findings are confounded by the presence of additional disabling conditions.

There seems to be a link between the way the hearing mothers instruct their deaf children and the later relative inability (perhaps emerging inability) of these children to solve problems independently. For example, although the hearing mothers provided approximately 25% more interventions during instruction than the other mothers, their deaf children produced less than half the number of correct unassisted constructions in comparison to the other children during the post-instruction session. These results imply that sheer quantity of instruction does not in and of itself lead to increased problem-solving ability in the child. In fact, the results from this study suggest that more instruction, if not based on the child's performance, may actually be harmful to learning; this is in harmony with the findings of Wood et al. (1976). Stipek and Sanborn (1985), in an investigation of teachers' interactions with disabled and nondisabled children,

propose an explanation for the frequent interventions given to the disabled children relative to the other children. They suggest that

> a teacher's perception of a child as handicapped may interfere with his or her ability to perceive situational cues indicating whether the child actually needs assistance. The teacher who perceives a child as handicapped, therefore, may offer help whether or not help is needed. (p. 286)

In Vygotskian terms, frequent interventions may interfere with a mother's ability to diagnose her child's zone of proximal development. It may well be that hearing mothers of hearing children and deaf mothers of deaf children, when observing their children's uncertain efforts at an unfamiliar task, are more likely to wait before intervening, giving the children the benefit of the doubt and increased time and opportunity to try to succeed independently, than are hearing mothers of deaf children, who appear to interfere and assume control much sooner under similar circumstances.

The final hypothesis, which involves the correlation between the mothers' instructional activity and the children's post-instruction performance, was supported, consistent with the findings of Wood (1980), Wood et al. (1976), and Wood and Middleton (1974, 1975). In short, the most effective instructors were those whose teaching approach was systematically based on the initiatives and

responses of the child, rather than on some preconceived teaching plan. In other words, the instructional behaviors of the mothers in the hearing mother-hearing child and deaf mother-deaf child pairs were quite similar in the degree to which they were responsive to both the child's prevailing successes and needs; these children had, in turn, developed independent and efficient problem-solving skills, in marked contrast to the deaf children of hearing parents.

Schlesinger (1987) has observed a sense of powerlessness in hearing parents of newly diagnosed deaf children. Based on the study of poor, deaf, and otherwise disabled persons, she describes powerlessness as "an individual's perception of self as not having the cognitive competence, psychological skills, instrumental resources, and/or environmental support systems needed to successfully influence his or her environment" (1987, p. 4). Hearing parents, unable to establish reciprocal communication with their deaf children, may tend to question their parenting ability and to feel helpless. One measurable outcome of powerlessness in these parents, Schlesinger suggests, may be their tendency to assume control in interactions with their deaf children, from the stage of infancy, when early attempts to establish reciprocity do not meet with success. The child's inability to respond as expected can lead even the most sensitive parent into a cycle of failure and helplessness (Goldberg, 1977). The same may be true from the infant's perspective: "An unpredictable, unreadable,

and unresponsive mother can lead the most highly endowed infant into a cycle of failure and helplessness" (Schlesinger, 1987, p. 2). It is possible, as suggested previously, that hearing mothers may seek to control the conversations and interactions with their deaf children as a means of minimizing the risks of misunderstanding them. As evidenced by the present research, however, this approach neither reduces the incidence of misunderstanding nor does it lead to improved communication; in contrast, it leads to "spirals of increasing control" (Wood et al., 1986, p. 167) on the part of the mother, which seems to impede the development of effective problem-solving skills in the child.

Unexpected Findings

The use of videotapes to collect data allowed for repeated analysis of observations, and the lack of a perfectly controlled experiment allowed for the possibility of unanticipated findings to emerge. In particular, the videotapes provided unexpected insights into three different aspects of mother-child interaction when childhood deafness is a factor: communicative style, learning patterns, and maternal teaching approaches. Each will be discussed in turn.

The first unanticipated finding, the difference in communicative style of deaf mothers of deaf children and

hearing mothers of deaf children, has been described previously. The use of a sequential, visual approach appears to be a necessary adjustment when instructing deaf children if all of the information is to be conveyed and received. Such an adjustment infers a prior acceptance of the deafness and a recognition of the importance of the visual channel to that person. However, as Erting (1985) found in an investigation of communicative interaction in a preschool for deaf children, "hearing people have great difficulty shifting from an auditory to a visual orientation when interacting with deaf children" (p. 124). She suggests that one possible explanation for this difficulty may be the fact that speaking and hearing are central aspects of a hearing person's identity; a full understanding of the importance of vision to the deaf child may, therefore, not be an easy concept for a hearing mother to grasp. Also, perhaps parents who are emotionally denying the diagnosis of deafness continue to communicate with their child as though he or she can hear. In fact, it may be the case that hearing parents' communicative style may give some clues as to the degree of their acceptance of, and ability to cope with, their child's deafness.

Second, the videotapes were also useful in substantiating hypotheses about the ways in which children, in general, acquire cognitive skills. The two children who achieved the greatest number of unassisted correct

constructions during the post-instruction session, a deaf child of deaf parents and a hearing child of hearing parents, appeared to be using egocentric speech in what seemed to be a self-regulatory capacity during independent attempts to construct the pyramid. In the case of the hearing child, the egocentric speech was on the soundtrack of the videotape; in the case of the deaf child, he could be seen turning his hand toward his face and signing to himself (see Figures 7 and 8). The implication is that, in spite of the difference in hearing status and relative importance of sensory channels in communication, hearing and deaf children acquire cognitive skills according to similar patterns of development. In other words, deafness in and of itself does not imply a different or deviant learning pattern in any way. Another implication of the use of egocentric speech by the two children is that Vygotsky's (1962) claim that "the scheme of development [is] first social, then egocentric, then inner speech" (p. 19) seems to hold true for both hearing and deaf children. Careful attention to children's language when they are attempting to complete a task may be of great help to parents and teachers by providing an approximate indication of the degree of mastery of the cognitive skill.

The third major unexpected finding of the study involves the unanticipated interventions by the mothers in the post-instruction session. Although the mothers had been asked to allow the children to assemble the blocks

independently, all but one of the mothers, with the exception of one deaf mother, continued to intervene periodically. However, the hearing mothers of deaf children intervened over three times more frequently than the other mothers during these sessions; yet their children produced less than half the unassisted correct constructions when compared to the children in the remaining two groups. There is no reason to assume that the deaf children of hearing mothers were inherently any less capable than the other children. Rather, the fact that each of the hearing mothers sought to control her deaf child's actions, even when explicitly asked not to do so, suggests an apparent lack of confidence in the child's abilities. It seems to be precisely this lack of confidence which leads to the more directive teaching approach on the part of the hearing mothers.

Limitations

Although the quantitative and qualitative findings of this research lend strong support to a dialectical perspective of cognitive development in deaf children, caution should be exercised in generalizing beyond the context of this study. For one thing, the number of subjects involved in the research was small. For another, because deafness is a low-incidence disability and great care was taken in locating comparable deaf subjects, the

mother-child dyads involved in this research do not represent a random sample.

The methodology employed in this study may be criticized on the grounds of not selecting deaf children who use the same communication method. However, the nature of deafness precludes the possibility of locating deaf children of deaf parents whose language and communication background mirrors that of deaf children of hearing parents. In the former instance, American Sign Language or some other manual communication system has usually been available to the deaf child since birth; in the case of deaf children of hearing parents, even if some form of signing were used with the child, it would not have been initiated until after the diagnosis of deafness, at the earliest. In addition, hearing parents would not be expected to demonstrate the same degree of fluency in signing as deaf parents. The decision was made, therefore, to select two groups of deaf children for whom the communication method had been consistent, if not strictly comparable, since birth.

Despite the limitations imposed by research using a small number of subjects, none of whom are strictly comparable in the experimental sense, no apologies are made for the methodology chosen. As the section on Unexpected Findings shows, field observation studies using qualitative as well as quantitative analyses can lead to unanticipated learnings, particularly in areas not well studied.

Implications for Practice

In light of the evidence provided by this research that the nature and quality of early mother-child interaction appears to be strongly linked to the child's later cognitive development, it is clear that early parent counselling is vital to the child's later educational achievement. Luterman (1979) and Moses (1985) emphasize a holistic approach to early intervention, stressing that "children, not functions, develop and grow" (Moses, 1985, p. 85). Such a conceptualization recognizes the interrelationship among hearing, vision, cognition, and social-emotional development. The emotional state manifested by most parents, in particular hearing parents, while trying to deal with the impact of having a deaf child, must be acknowledged and dealt with constructively through counselling if subsequent attempts at intervention are to meet with success. If left unresolved, the trauma of the diagnosis "may continue to fester, creating angry, uncooperative, overprotective or unrealistic parents at many stages of the educational process" (Meadow-Orlans, 1987b, p. 37). Meadow-Orlans continues:

> Both the evidence of hearing parents' responses to the diagnosis of deafness and speculations about the effect of stress on parent-child interactions in the infant's first year of life would lead to the conclusion that early counseling of families could be

> exceedingly important for the future socialization of these children. (p. 37)

Most educational and rehabilitation programs providing services to deaf children currently offer early intervention programs with an emphasis on parent involvement. All too frequently counselling has been considered to be an optional or unnecessary part of this process, or it has tended to focus on technical aspects, such as care and handling of the hearing aid.

The present research, however, indicates that early counselling of parents and families is required if hearing parents are to deal constructively with the emotional impact of the diagnosis and understand fully the implications of operating largely in a visual modality for communication and learning. This counselling must include advice on the necessity to make teaching behaviors contingent on the child's actions. Otherwise, attempts at early intervention may actually be counterproductive, leading parents to focus rigidly on the teaching plan rather than on the child's initiatives and responses. In this event, the parents are actually being taught to interact with their deaf child in a pattern which deviates markedly from that which they would probably intuitively use when interacting with hearing children. In fact, if early intervention does not include advice on contingency and scaffolding, it may be better not to intervene at all.

Counselling which enables hearing parents of deaf

children to meet with their deaf counterparts may prove particularly beneficial by providing the opportunity to meet and interact with persons who have learned successfully to cope with deafness. In fact, the presence of deaf adults as professional or resource persons in early intervention programs is highly desirable for at least two reasons. First, the deaf child is given the opportunity to interact with someone who understands the importance of relying on vision for the acquisition of information. In addition the deaf adult will probably tend to interact with the deaf child in a more contingent manner than the hearing parents are capable of during the months immediately following the diagnosis, when they are dealing with their own emotional trauma. Second, as Meadow-Orlans (1987a) suggests, the presence of a deaf adult may be very helpful in assisting parents to envision their child as a competent, productive, and contented adult. The deaf adult may also serve as an instructor for the parents by modelling contingent intervention strategies.

Another area of applied interest involves classroom instruction. The American Annals of the Deaf reported in its 1987 directory edition ("Schools and Classes for the Deaf in Canada," 1987) that less than 6% of all Canadian teachers of the deaf included in its listing are deaf. This implies that most teachers of the deaf in Canada may suffer from similar attitudes and interaction patterns as the hearing mothers of deaf children in this study. In this

event, these hearing teachers may be reinforcing the cycle of dependency and helplessness initiated at home, years earlier, by the hearing parents of deaf children. Teaching programs should take into consideration the importance of providing future teachers of the deaf with instruction in the theory and practice of effective scaffolding. Snow (1979) underlines the importance of contingent responding in conversational exchanges between hearing mothers and hearing children, and there is every reason to believe that her advice is just as applicable for teachers and parents when interacting with deaf children: "If one were asked right now to advise an anxious mother how to teach her child to talk, the best answer would be 'Watch what he's doing, listen to what he's saying, and then respond'" (p. 375).

One deaf mother, who, along with her deaf daughter, was a subject in the pilot study of this research, provided an anecdote which points out the helpless behavior of a group of deaf children of hearing parents in a school setting. After the study had been completed in her case and she had viewed herself on videotape, she was told the hypotheses of the research. In this connection, she described the following situation, which had occurred the year previously when she had been employed as a teacher of deaf kindergarten children. During winter, she noticed a habitual behavior among her students: at recess time, when the children were preparing to play outside in the snow, certain children regularly put on their snowsuits independently, while the

others stood patiently and waited for the teacher to dress them. It did not take long for a pattern to emerge: those deaf children who initiated dressing themselves all had deaf parents, while the children who depended consistently on the teacher for assistance had hearing parents. Had the latter group of children learned to be helpless? The actions of these children were in accord with those of the deaf children of hearing parents, who had sought maternal assistance much more often than the other children, during both the instruction and post-instruction sessions. Had they been "taught" to do so? Had they learned to be helpless?

Suggestions for Further Research

The fact that all four hypotheses were confirmed and that the findings are in harmony with a large body of well-established research indicates that the area of assisted problem-solving is in need of further research. It is well established that scaffolding is an important interactional pattern when instructing any child, but it may be even more crucial when teaching children with some sensory impairment, such as deafness. Previous research (Wood & Wood, 1983, 1984) has shown that teachers can be taught the technique of contingent interaction in conversational exchanges with deaf children. In the present study, the hearing mothers of deaf children noticed an

aspect of their instructional behavior with which they were not satisfied: when observing themselves on videotape, all of the mothers in this group (who scaffolded the least of all the mothers in the study) expressed the unsolicited observation that they had intervened too much. Other research also suggests that hearing mothers are, in general, more dominant and intrusive toward their deaf children than is helpful to their children's development.

A note of optimism should be sounded, however: the very fact that the hearing mothers of deaf children in this study were self-critical suggests that they are open to feedback. In addition, although these mothers provided significantly less contingent interventions than the other mothers, they nevertheless made slightly over half of their instructions contingent on their child's previous behavior. These mothers, then, have already indicated a willingness and ability to scaffold; could they be taught to increase the effectiveness of their scaffolding to the benefit of their deaf children?

In research where random samples are, for whatever reason, not feasible, replication becomes even more important. If attempts at replicating the present study were to lead to similar findings, there would be greater confidence in the importance of scaffolding in deaf children's cognitive development. Longitudinal research would be of great theoretical and applied interest if deaf children of hearing mothers who were taught scaffolding

techniques showed continuing benefits over time. Such research might provide insights into questions such as the following: Can hearing mothers of deaf children be taught to improve their scaffolding behavior? If so, is their instruction beneficial to the cognitive development of their deaf children, as Wood (1980) and Wood and Middleton (1974, 1975) have shown it is to hearing children? Also, are the effects and benefits of scaffolded instruction durable over time?

CHAPTER SIX

Conclusions

The results of the present study strongly suggest that deafness in and of itself does not necessarily give rise to deficient learning. While the particular strategies of communication may differ between hearing and deaf children, the fundamental patterns of social interaction with their caregivers which lead to cognitive and social-emotional growth are strikingly similar. Deafness does not imply an inability to communicate; deaf children have the capacity to think and learn, but, like other children, they must have the opportunity to learn from other people, particularly when they are young. It is important that the quality of reciprocal interaction be high for all children, but it may be even more crucial for caregivers to take special pains in the case of children with some sensory impairment, such as deafness. The nature of deafness implies that certain adjustments in communicative approach must be made if effective two-way interaction is to occur.

Regardless of hearing status, each child can only learn adequately as a result of completed communicative acts. In fact, all socialization results from successful reciprocal communication. For this, children are utterly dependent on the effectiveness of their primary caregivers, usually mothers, as communicators. Recent research (Wood, 1980;

Wood et al., 1976) suggests that tutors who are good scaffolders communicate better than those who are not. Many mothers are excellent at scaffolding, but research has shown that those who are not can be taught to improve this skill.

The present research is both revealing and optimistic: not only does it describe differences in teaching approaches among parents of deaf children, but it also proposes instructional strategies which should be of benefit to the cognitive development of these children. Observation of hearing mothers instructing their hearing children in a home situation suggests that the most effective teaching occurs when the focus is on the children's activities, particularly their initiatives and responses. Analysis of deaf mothers instructing their deaf children shows that the teaching and learning styles of these two groups of mothers and children are very similar. However, hearing mothers of deaf children do not appear to teach as effectively as other mothers, and the results of the present study suggest that it is their response to the deafness, rather than the deafness itself, which gives rise to the inadequate learning of the children. In this connection, it is also possible that hearing parents are not operating in a vacuum: if hearing teachers are subject to the same attitudes toward the learning potential of deaf children, educational programs may well be providing institutional support for the idea of teaching in a preconceived manner, rather than following the deaf child's lead. Perhaps early family counselling which includes

instruction on the importance of carefully watching and responding to the child may assist hearing parents and teachers to facilitate the development of effective, independent problem-solving skills in deaf children.

Much educational research and practice in the area of deaf education has focused on the inability of the deaf child to hear, giving rise to a conception of deaf children as abnormal hearing children. However, the fact that the deaf children of deaf mothers in this study demonstrated considerable ability, at times surpassing their hearing counterparts, suggests that the fault does not lie in the deaf children, but in the tendency of their hearing mothers to teach them as if they were defective hearing children. This can be changed. The results of this research strongly suggest that, were the hearing mothers of deaf children to become as effective scaffolders as the deaf mothers of deaf children, their children, too, would be characterized by high levels of achievement. An urgent future study would be a longitudinal one, focusing on the changes in the problem-solving abilities of deaf children after their hearing mothers had been taught to scaffold more effectively. As far as the literature shows, this has not yet been done, but the results of this study, and those of David Wood and others, suggest that immediate gains of deaf children of hearing parents could be made with a minimum of expense and effort. Surely it makes more sense to develop the inherent abilities of deaf children, rather than concentrate on their shortcomings.

Notes

[1] The term "deaf" is used in the present context to refer to individuals "whose hearing is disabled to an extent...that precludes the understanding of speech through the ear alone, with or without the use of a hearing aid" (Moores, 1982, p. 6). "Deafness" is contrasted with "hearing impairment," which includes the entire range of hearing loss.

[2] Although Vygotsky originally wrote more than 50 years ago, the first of his major writings was only introduced to the English-speaking world in 1962. During the past two decades, he has become an important and growing force in North American psychology and his ideas have greatly influenced such cognitive and developmental psychologists as Jerome Bruner and David J. Wood.

[3] The decision has been made not to follow the tradition of stating predictions as null hypotheses and hence it really is expected that there will be no significant difference in this instance.

[4] The procedures used in the present research are directly modelled on those used by Wood (1980), Wood et al. (1976), and Wood and Middleton (1974, 1975) and similarities in methodology are, therefore, inevitable. Direct quotes from original sources have been used where appropriate. However,

this presentation will not attempt to give further credit to these sources in every possible instance.

[5]Analysis of the data showed no significant difference between girls and boys in the hearing mother-hearing child ($z = 1.18$, $p < .14$) or hearing mother-deaf child pairs ($z = 1.22$, $p < .11$) in terms of proportion of successful self-initiated construction attempts during instruction. However, there were some apparent trends, and this clearly deserves further study.

[6]Although there was a small difference in the mean age of the children in the three groups, it was so slight (60.0 months for the deaf children of hearing parents, 60.8 months for the hearing children of hearing parents, and 62.3 months for the deaf children of deaf parents) that the investigator is convinced that any differences in the children's problem-solving performance can be accounted for by factors other than age.

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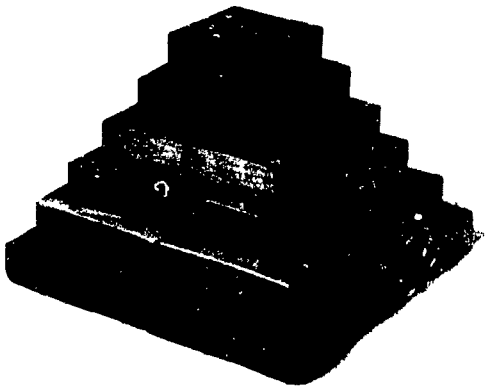


Figure 1. The wooden pyramid.

Figure 2. The construction toy used during the free play session, shown assembled (above) and unassembled (below).

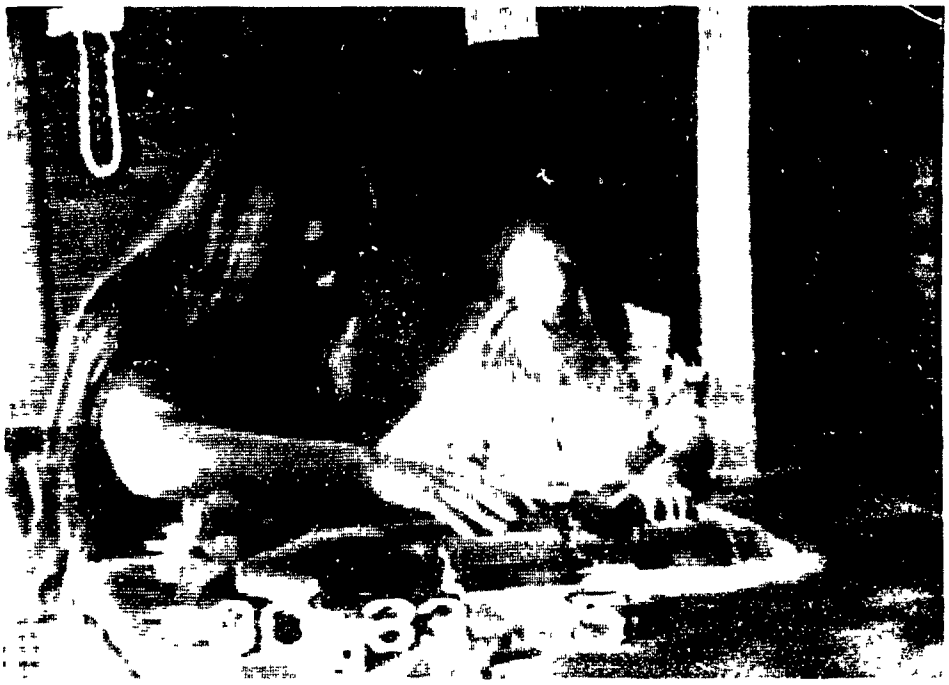


Figure 3. A hearing mother simultaneously instructing her deaf child to "Look for the big blocks" and demonstrating the construction during the Instruction Session.

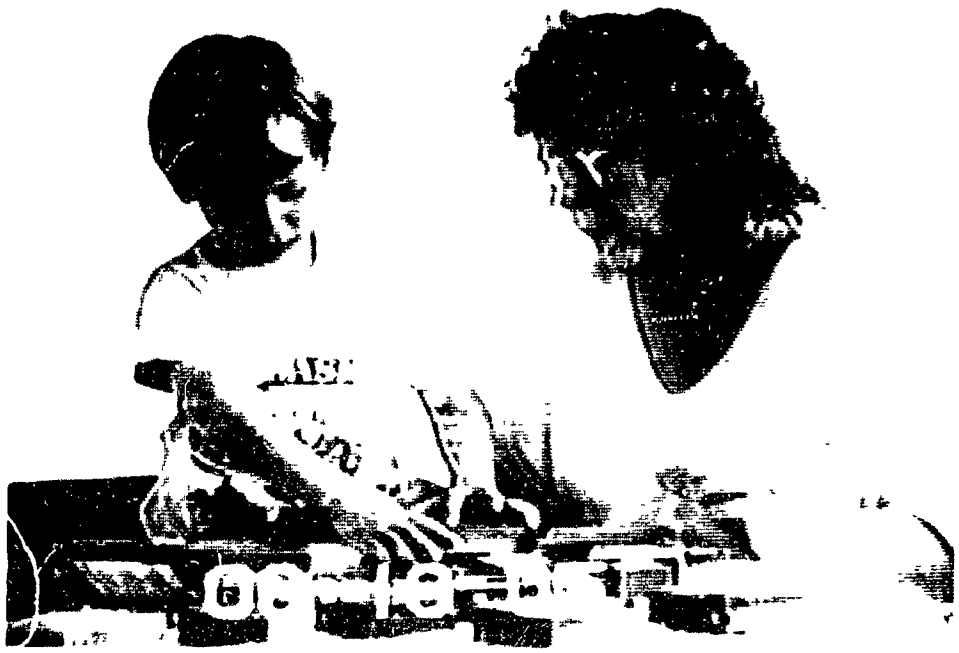


Figure 4. A hearing mother instructing her hearing child to "Look for the big blocks" during the Instruction Session.

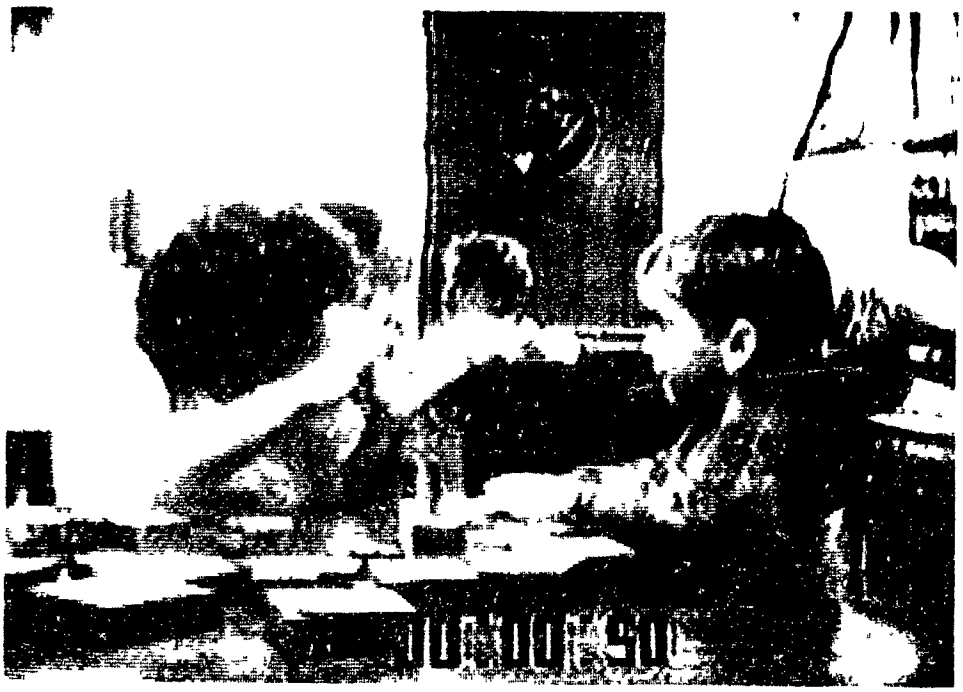


Figure 5. A deaf mother instructing her deaf child to "Look for the big blocks" during the Instruction Session.

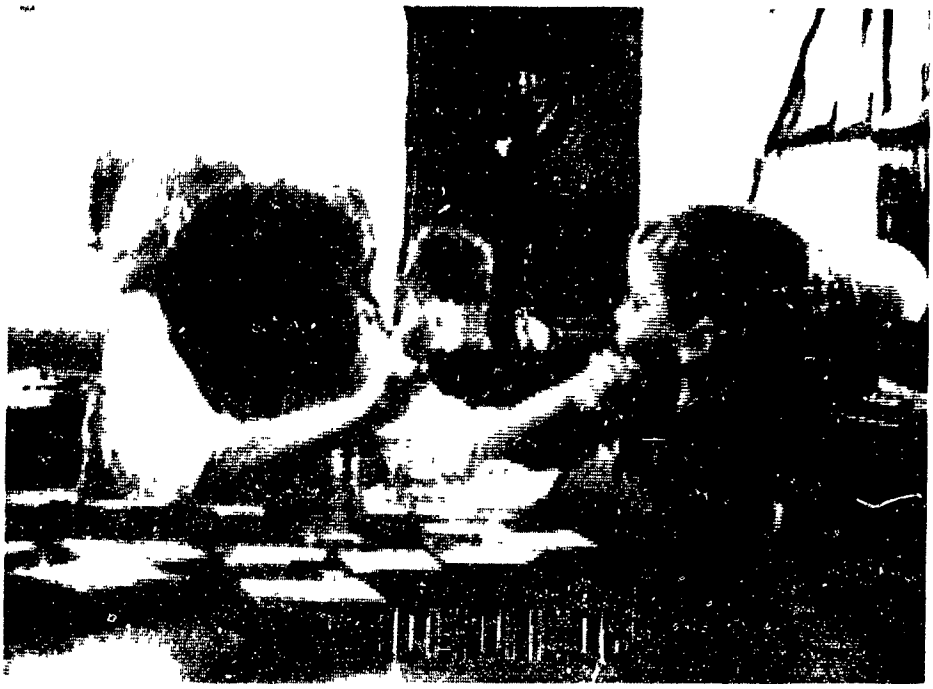


Figure 6. A deaf mother maintaining visual contact with her deaf child while she gives him instructions during the Instruction Session.

"No...

...I [want that one over there]."

Figure 7. A deaf child of deaf parents correcting himself in sign language while attempting to construct the pyramid independently during the Post-Instruction Session.

"Fine."

"[I want a] different [one]."

Figure 8. A deaf child of deaf parents signing to himself while attempting to construct the pyramid independently during the Post-Instruction Session.

Appendix A

McGill University
Department of Educational Psychology and Counselling

Background Information Form on Families Participating in the Problem-Solving Project

A. MOTHER

1. Name_____

2. Address_____

3. Phone_____Voice_____TTY_____

4. Age_____

5. Marital Status_____

6. Current or most recent occupation_____

7. Length of time in most recent occupation_____

8. If less than five years in most recent occupation, describe employment pattern since leaving school:_____

_____

_____

_____

9. Last grade completed or degree obtained_____

10. Mother's hearing status: Deaf___ Hearing___ Hard-of-Hearing___

11. Is there anything you want to add about yourself?_____

_____

_____

_____

_____

_____

_____

B. Father

1. Name_____

2. Age_____

3. Current or most recent occupation_____

4. Length of time in most recent occupation_____

5. If less than five years in most recent occupation, describe employment pattern since leaving school:_____

_____

_____

_____

6. Last grade completed or degree obtained_____

7. Father's hearing status: Deaf___ Hearing___ Hard-of-Hearing___

8. Is there anything you want to add about your husband?_____

_____

_____

_____

_____

C. SIBLINGS

Sex (M/F)	Age	Living at Home (Y/N)	Hearing (H) Deaf (D)	Other Handicaps (Specify)
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Is there anything you want to add about your other children?_____

_____

_____

Appendix B

McGill University
Department of Educational Psychology and Counselling

Background Information Form on Children Participating in the Problem-Solving Project

Child's Name_____

Date of Birth_____

Today's Date_____

I. PREGNANCY/CONDITION OF BABY AT BIRTH

1. What was the condition of the mother's health during pregnancy?_____

_____

2. Did the mother contract rubella during pregnancy? Yes___No___

3. What was the length of pregnancy?_____

4. What was the child's birth weight?_____

5. Did your child show any signs of abnormalities, difficulties, or problems during the delivery, at birth, or after birth? Yes_____No_____ If yes, describe:_____

_____

_____

_____

_____

_____

6. Is there anything you want to add about your pregnancy or the birth of your child?___ _____

_____

_____

_____

II. DEVELOPMENTAL INFORMATION

1. Has your child received any medical treatments for illness or disability? Yes_____No_____ If yes, explain:_____

_____ _____

_____

_____

_____

2. Has your child received any medical treatments for meningitis or high fever? Yes_____No____ If yes, explain:_____

_____

_____

3. At what age did the child:

crawl_____ sit alone_____ walk alone_____

babble_____ stop babbling_____ say/sign words_____

4. The child can:

walk up and down stairs alone Yes_____ No_____

run well without falling Yes_____ No_____

dress and undress him/herself correctly Yes_____ No_____

5. During infancy, was your child able to play alone occasionally? Yes_____ No_____ If no, explain:_____

_____

_____

b) Can your child play by him/herself? Yes_____ No_____ If no, explain:_____

_____

_____

c) The child enjoys the following play activities:

looking at books Yes_____ No_____

playing with puzzles Yes_____ No_____

playing with construction toys Yes_____ No_____

coloring or drawing Yes_____ No_____

using playdough Yes_____ No_____

imaginative play Yes_____ No_____

riding a tricycle Yes_____ No_____

playing on playground equipment Yes_____ No_____

d) Is the child easily frustrated (i.e., can he/she stay on task, or does he/she change activities every five minutes?)?

Yes_____ No_____ If yes, explain:_____

_____

_____

_____

e) Does your child enjoy playing with other children?

Yes_____ No_____ If no, explain:_____

_____

_____

_____

f) Are there any foods the child refuses to eat because of texture? Yes_____ No_____ If yes, explain:_____

_____

_____

6. Does the child have any uncorrected vision problem?

Yes_____ No_____ If yes, describe:_____

_____

_____

7. Is there anything you want to add about your child's hearing loss?_____

_____

_____

_____

_____

_____.

IV. SPEECH AND LANGUAGE INFORMATION

1. How does the child communicate needs and desires?_____.

_____.

_____

_____

_____

_____

_____

2. How do you communicate with your child? For example, if you wanted your child to get a toy from another room, how would you communicate that to him/her?_____

_____

_____

_____

_____

_____

_____

3. The child initiates communication:

never_____seldom_____sometimes_____often_____always_____

7. Does the child wear glasses or use anything else for vision correction? Yes_____ No_____

8. Is there anything you want to add about your child's physical development?_____

_____

_____

_____

III. HEARING AND AUDITORY INFORMATION (FOR DEAF CHILDREN ONLY)

1. What age was the child when the hearing loss was first noticed?_____

2. What age was the child when the hearing loss was confirmed by a doctor or audiologist?_____

3. At what age did the child begin wearing hearing aids?_____

4. The child wears his/her hearing aids:
some of the time_____most of the time_____all of the time_____only at school_____

5. Describe the child's hearing loss and etiology, if known:

_____

_____

_____

6. Do any other relatives have a hearing loss or hearing problems? Yes_____No_____ If yes, describe relationship to the child:_____

_____

4. Is there anything you want to add about your child's speech and language development?_____

_____

_____

_____

_____

V. EDUCATIONAL INFORMATION

1. (For deaf children only) Was your child involved in an early intervention program? Yes____No____ If yes:

How old was the child when he/she entered the program?____

How long was he/she involved in the program?_____

Describe the program:_____

_____

_____

2. Is your child currently enrolled in an educational program? Yes_____No_____

3. If so, state the length of time the child has been involved in the program and describe the program:_____

_____

_____

_____

4. Does anyone in the family have a learning problem? Yes_____ No_____ If yes, describe:_____

_____

_____

_____

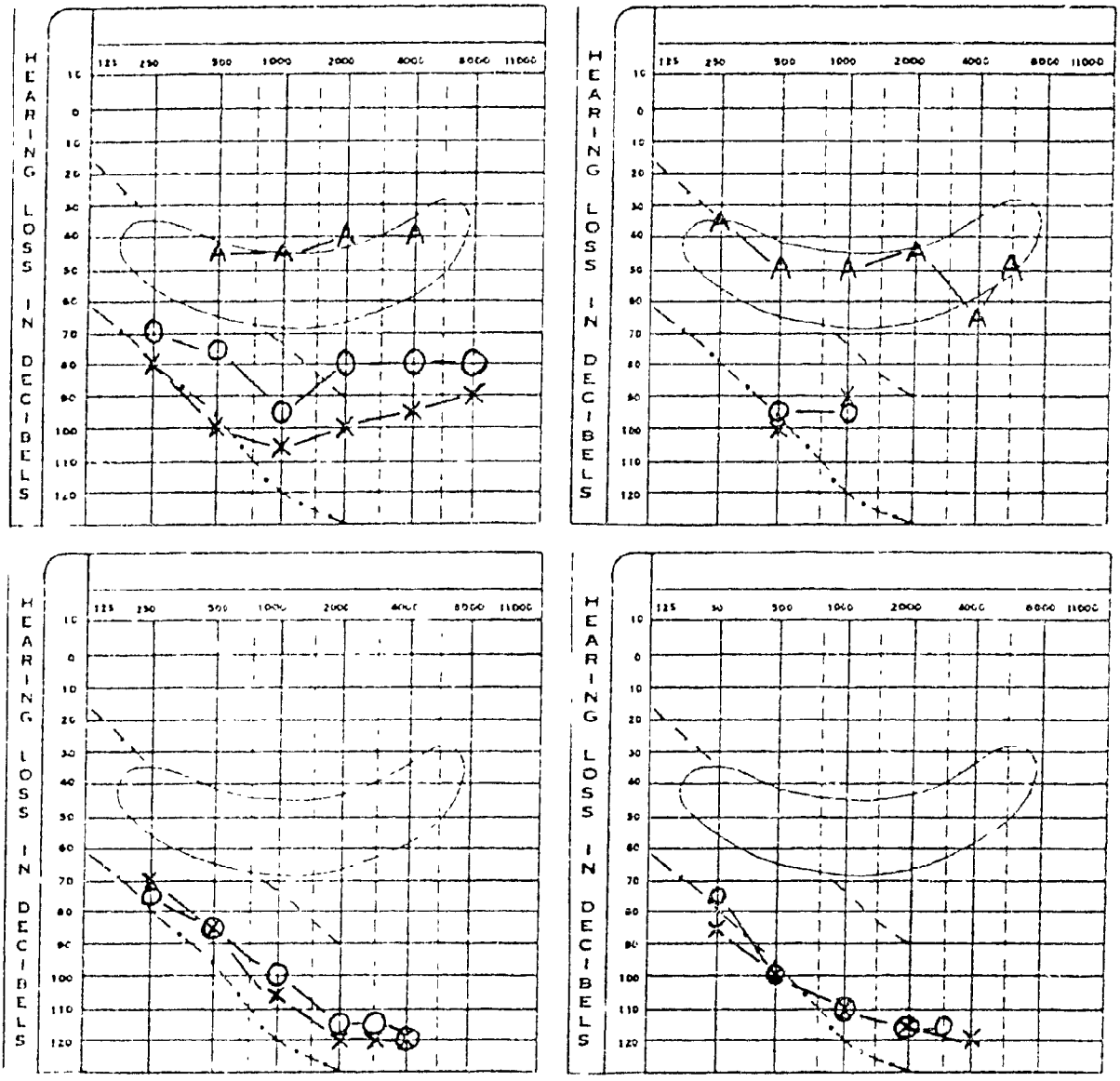
5. Is there anything you want tc add about your child's education?_____

VI. OTHER

1. Is there anything you wish to mention that we haven't already discussed?_____

APPENDIX C

Aided and Unaided Audiograms for Four Children in the Hearing Mother-Deaf Child Group



Note. Aided audiograms were available for only two of the children in this group. "A" refers to hearing threshold levels for 5% warble tone in free field; "X" and "O" refer to unaided pure tone hearing threshold levels for the left and right ear, respectively.

Appendix D

Letter of Confidentiality to Mothers

October 5, 1987

Mrs. John Doe
123 Maple Street
Winnipeg, Manitoba
A1B 2C3

Dear Mrs. Doe:

As you are aware, the purpose of this research is to elicit generalizations about ways of improving the ability of hearing-impaired children to develop problem-solving skills. It is not intended to provide any information about any particular child or parent. For this reason, information concerning individuals is of no interest to the intended research reports, which will protect the anonymity of the people who agree to participate.

This letter conveys to you my intention of maintaining strict confidentiality of all information and videotapes of persons involved in this project.

Yours truly,

Janet R. Jamieson

Appendix E

McGill University
Department of Educational Psychology and Counselling

Mothers' Response Form

Please read these questions carefully before you watch the videotape. If you want to comment on any of the items, feel free to use the space underneath. Without your feedback, the results of this research will not be complete.

1. I did a reasonably good job of teaching my child to build the blocks.	Strongly Agree ☐	Agree ☐	Disagree ☐	Strongly Disagree ☐

Comments: _____

2. When I teach my child to do something new, I usually do it the same way I did on the videotape.	Strongly Agree ☐	Agree ☐	Disagree ☐	Strongly Disagree ☐

Comments: _____

3. After I taught him/her, my child did a good job of building the blocks alone.	Strongly Agree ☐	Agree ☐	Disagree ☐	Strongly Disagree ☐

Comments: _____

4. My child communicates thoughts and ideas well.	Strongly Agree ☐	Agree ☐	Disagree ☐	Strongly Disagree ☐

Comments: _____

5. My child is skilled at solving problems like the blocks puzzle.	Strongly Agree ☐	Agree ☐	Disagree ☐	Strongly Disagree ☐

Comments: _____

6. a) When teaching my child to do something new, it is important to have a careful plan before starting and follow it.	Strongly Agree ☐	Agree ☐	Disagree ☐	Strongly Disagree ☐

Comments: _____

	Strongly Agree	Agree	Disagree	Strongly Disagree
b) When teaching my child to do something new, it is important to watch what he/she does, so that I can decide what to do next.	☐	☐	☐	☐

Comments: _____

_____

c) Which of the two is more important: ☐ a) a careful plan
☐ b) watching the child

Comments: _____

_____

7. Do you have any suggestions about teaching children which you'd like to tell me, based upon your experience? _____

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Appendix F

Coding Sheet for Instruction Session

Time That Event Starts	Event Number	Child-Initiated Events	Attempted Elicitations of Maternal Approval	Maternal Interventions	Construction Event	Layer

Appendix G

Coding Sheet for Post-Instruction Session

Time	Intervention Level & Comments	[illegible]	Mother's Behavior

Appendix H-1

Proportions of Contingent and Non-Contingent Interventions During Instruction by Hearing Mothers of Deaf Children and Hearing Mothers of Hearing Children

Intervention	Group		z
	Hearing mother-deaf child	Hearing mother-hearing child	
Contingent	58	67	1.46 ns
More help	50	24	3.44 **
Less help	44	32	1.49 ns
No help	6	44	5.37 **
Non-contingent	42	33	1.46 ns
More help	18	38	2.29 *
Less help	27	18	1.01 ns
Same level	55	44	1.02 ns

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

Appendix H-2

Proportions of Contingent and Non-Contingent Interventions During Instruction by Hearing Mothers of Deaf Children and Deaf Mothers of Deaf Children

Intervention	Group		
	Hearing mother-deaf child	Deaf mother-deaf child	*z*
Contingent	58	77	3.16 **
More help	50	29	2.72 **
Less help	44	28	2.16 *
No help	6	43	5.82 **
Non-Contingent	42	23	3.16 **
More help	18	37	1.97 *
Less help	27	21	.63 ns
Same level	55	42	1.11 ns

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

Appendix H-3

Proportions of Interventions by Hearing Mothers of Deaf Children and Hearing Mothers of Hearing Children at Different Levels During Instruction

Intervention Level	Group		z
	Hearing mother-deaf child	Hearing mother-hearing child	
1	9	2	1.67 ns
2	35	53	2.31 *
3	30	22	2.40 *
4 & 5	26	23	.39 ns

*$p < .05$.

Appendix H-4

Proportions of Interventions by Hearing Mothers of Deaf Children and Deaf Mothers of Deaf Children at Different Levels During Instruction

Intervention Level	Group: Hearing mother-deaf child	Group: Deaf mother-deaf child	z
1	9	2	1.62 ns
2	35	56	2.51 *
3	30	32	.33 ns
4 & 5	26	10	2.31 *

*$p < .05$.

Appendix H-4

Proportions of Interventions by Hearing Mothers of Deaf Children and Deaf Mothers of Deaf Children at Different Levels During Instruction

Intervention Level	Group: Hearing mother-deaf child	Group: Deaf mother-deaf child	z
1	9	2	1.62 ns
2	35	56	2.51 *
3	30	32	.33 ns
4 & 5	26	10	2.31 *

*$p < .05$.

Appendix H-5

Proportions of Interventions by Hearing Mothers of Hearing Children and Deaf Mothers of Deaf Children at Different Levels During the Post-Instruction Session

Intervention Level	Group		z
	Hearing mother-hearing child	Deaf mother-deaf child	
1	7	26	1.80 ns
2	69	67	.16 ns
3	14	7	.71 ns
4 & 5	10	0	1.34 ns