Research in Concept Development and Attainment in Children-
Implications for the Teaching of Concepts to the Deaf Child

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Deaf people have long been believed to be cognitively inferior to their normal-hearing contemporaries, even in nonverbal areas of cognition, because of their lack of sufficient and/or effective language. Many, many studies, however, have been and continue to be carried out to investigate learning and cognition among deaf people.

The deaf children of our nation, as observed by Furth (1973), have been subjected to all degrees of achievement testing. But as he further observed, "Their overall scores have never been demonstrated to be greatly lower than national norms, although occasionally some significant differences in favor of the hearing norms are reported" (p. 91). These differences, Furth continues, usually occur with lower age level groups, "when deaf children are particularly likely to misunderstand test instructions and to feel anxious about the test situation" (p. 91).

Furth (1966) investigated the relationship of language and intelligence in an effort to answer questions concerning possible retardation of general intelligence due to language deficiency. He also looked at the relationship of impaired linguistic ability to performance of tasks. He concluded that language did not influence intellectual development in any particular ways. But language did provide opportunities for more experience by giving more information, allowing exchange of ideas, and furnishing readily available symbols, or words, and language habits, or syntax, in specific situations. Persons lacking in linguistic skills or experience, according to Furth, were not permanently or generally retarded in intellectual ability. However, they may be considered temporarily retarded in
particular stages of language development because of insufficient general experience. Also, in situations where words and syntactical knowledge may be particularly helpful in solving a problem, the deaf person may be hindered in the solution. Overall, Furth (1966) concludes,

It seems that the deficient performance of the deaf on some intellectual tasks can be more adequately accounted for by experiential than by linguistic deficiency, insofar as the former is more varied and flexible and related specifically to the particular area in which the deaf are observed to fail, while linguistic deficiency is almost general and could be only awkwardly related to an intellectual performance that was not generally retarded. (p. 153)

Conceptual development and its attainment is an important part of a child's growing experience and understanding of the world around him. The research of this paper will emphasize this development and attainment by the normal-hearing child in particular, with implications for the teaching of concepts to the deaf child. Studies of concept formation, testing of deaf subjects, and teaching methodologies will also be presented and discussed. One standardized test of basic concepts, the Boehm Test of Basic Concepts, will serve as the source of concept choices for teaching procedures on which the included lesson plans are based.

Before studies concerning concept development and its attainment by the deaf child can be discussed, it is necessary to define the meaning of a concept. This term and its meanings, however, can be very ambiguous, so consequently definitions can vary and/or likewise be ambiguous.

According to Engelmann (1969), "A concept is a set of characteris-
tics that is shared by all in a particular set and only these instances" (p. 9). He adds that the concept will depend upon the universe, or context, in which it is presented. Klausmeier and Ripple (1971) define a concept as follows:

A concept is a mental construct, or abstraction, characterized by psychological meaningfulness, structure, and transferability, that enables an individual (1) to cognize things and events as belonging to the same class and as different from things and events belonging to other classes; (2) to cognize other related superordinate, coordinate, and subordinate concepts in a hierarchy; (3) to form principles and to solve problems involving a concept; and (4) to learn other concepts of the same difficulty in less time. (p. 430)

The various characteristics noted by Klausmeier and Ripple will be discussed and clarified in a later section.

Bourne (1966) additionally defined a concept. He stated that "a concept exists whenever two or more distinguishable objects or events have been grouped or classified together, set apart from other objects on the basis of some common feature or property characteristic of each" (p. 1). DeCecco (1968) stated, "A concept is a class of stimuli which have common characteristics. These stimuli may be objects, events or persons. . . . A concept is not a particular stimulus but a class of stimuli" (p. 388).

Finally, Johnson (1964) added, "A concept may be called a mediating construct since it is supposed to mediate between observable stimulus materials. . . and observable responses, sorting them, on the other side" (p. 28).

Obviously definitions of what concepts are are as many and varied as
the authors who propose them. Furth (1966) delves more extensively into clarification of some of the additional terms used in discussing concepts. Later, in discussing teaching methods, further terms will be likewise defined and discussed. Furth defined language, linguistic competence, concept, symbol, and thinking in an attempt to differentiate and detail what these terms mean and their use in studying concept development. Furth (1966) considered language as the "natural, verbal language of a society" (p. 18). Linguistic competence indicated "the specific skill of the person who has learned a language. A minimum criterion of linguistic competence is an implicit comprehension of linguistic structures" (p. 18). A concept is a characteristic of thinking behavior that lends itself to expressive verbalization, but Furth adds that the concept may or may not be verbalized while the person is thinking, leaving the person unconscious of the concept. "A symbol is used in connection with some explicit object of event, something one can designate or the sound of a person's voice or the movement of a hand or at least something experienced as similar to an outside event" (p. 22). Dreams or images may correspond to the experience similar to that experienced in an outside event. Symbolic use implies thinking and meaning to Furth, where the symbol is a product of thinking and directly refers to thinking. Thinking itself designates any activity related to or which demonstrates human intelligence of the scope of infant to adult behavior. Thinking, Furth adds, is not restricted to humans and is a continuing part of psychological processes.

Furth (1966) discusses another interesting aspect of concepts. He emphasizes that concepts are not apart from a person, even though the English language gives impressions to the contrary. Verbs such as "obtain", 
"transfer", and "know" may imply that a person has an awareness of the actual concept or its verbalization. Concepts are not a separate entity, but our language tends to indicate a separation of thinking and concepts with statements that indicate that a person has or knows a particular concept, such as color names. Studying concepts has been likened by Furth (1966) to studying the walking behavior in taking steps. As Johnson (1964) notes, "A concept is not a fact that can be observed. . . . A concept is best treated as a hypothetical construct, like intelligence, that is intended to explain the observed facts" (p. 27-8). Furth (1966) continues, however, to observe that people still tend to want to give a name to a concept, which can cause confusion when trying to differentiate it from other concepts. Names do not necessarily serve as an inherent part of a concept, and the thinking itself may be the concept in question.

Obviously concepts present a difficult, misunderstood, and probably little understood area of language, learning, and psychology. Studies conducted in the area have had conflicting results, and most likely will continue to do so until problems in research design especially are solved. Several studies will be reviewed, though, as a source of information and methods in the study of concepts, and as a further illustration of the difficulty in defining and using information about concept development and attainment.

A study conducted by Kelly and Tomlinson-Keasey (1976) investigated information processing of visually presented word and picture stimuli by hearing-impaired and normal-hearing children of a mean age of four years, 11 months. Initially the authors believed that the dominance of visual processing over verbal processing might exist for the hearing-impaired
subjects, so they wanted to compare the processing means used by the hearing-impaired group versus the normal-hearing group. First of all, speculations about the normal-hearing subjects' processing centered on more easy processing of auditory and visual inputs, with storing of both to allow easy reintegration for verbal output. Bower (1972) postulated two modes of memory processing, imagery and verbal inputs. He stated,

When the learning materials are words, the verbal system is clearly involved in the learning and the imaginal system may be engaged to an extent depending upon both learning strategy and the strength of the connections between verbal and imaginal repertoires. (p. 83)

Bower (1972) presented a model which involved, besides the major input "DOG", interconnected sublists of information such as:

1) graphemic - what the word looks like, how to spell it
2) phonemic - what it sounds like and its articulation
3) semantic - definition of meanings (several possibilities)
   superordinate, subordinate categories, verbal associations
4) sensory - what it looks like, sounds like, criteria for class recognition, lists of subspecies, individuals

(Bower, 1972, p. 84)
Paivio (1972) further discussed information and memory processing. He formulated a dual coding hypothesis. Paivio stated the following concerning this hypothesis:

High imagery conditions are so effective in learning and memory because they increase the probability that both imaginal and verbal processes will play a mediational role in item retrieval. . . . Assuming that the required verbal response can be retrieved from either code, such dual coding would enhance the probability of recall because one code could be forgotten during the retention interval without a complete loss of the nominal item. Concrete words similarly are more likely to arouse images during input than are abstract words, enhancing the possibility of dual coding and recall in the case of the former. (p. 263)

Kelly and Tomlinson-Keasey (1976) speculated that the hearing-impaired subjects might process most information through visual inputs, supplemented at best by a distorted, incomplete auditory input. Probably, then, storage primarily consists of the visual input. So when the normal-hearing person talks to a hearing-impaired person, the hearing-impaired person changes the oral-verbal messages he sees into a visual code of lip movements, facial expressions, and so on, for storage. These processing elements constitute speechreading, and speechreading is a process that "involves the ability to retain lip movements mentally while the speaker is speaking, the ability to sequentialize and properly group these movements, and then associating them with experience" (Myklebust, 1964, p. 247).
Kelly and Tomlinson-Keasey (1976) noted that this means that the hearing-impaired person must make at least two cognitive transformations, verbal to visual and then back, in order to achieve communication. The transformation problem, inherently more difficult than a dual input and output, may then be the source of difficulty in information and processing for deaf people. Odom and Blanton (1967) conducted such a study to determine whether the deaf group of subjects had learning rules of order comparable to the hearing group. Results indicated that the deaf subjects did not have a similar system, perhaps due to the lack of correspondence between sign language and written English, or that past language experience was more limited and not rule-ordered.

Results of the Kelly and Tomlinson-Keasey (1976) study indicated that both the hearing-impaired and normal-hearing subjects could more easily process pictorial stimuli rather than word stimuli. In view of the above information, this makes sense. In processing a picture, then indicating that same picture after the presentation of the stimulus ended, and doing the same procedure with words, the hearing-impaired and normal-hearing subjects did almost equally well, the normal-hearing group doing slightly better with the picture presentation. Unlike modes, such as input of picture and output of word, presented more difficulties for the hearing-impaired subjects, probably due to the difficulty noted in transformation of stimuli for them. Altogether, results indicated the possibility "that hearing-impaired children in their preschool years may not use their cognitive abilities in the same manner as their hearing peers" (p. 636). The authors add that most experienced educators in the field of deaf education would probably agree, citing a language deficit as the main reason for the
differences. Kelly and Tomlinson-Keasey, though, suggest that this is true because of a sensory input different from that of a normal-hearing child, which means that there is development of cognitive structures and means of information processing that are qualitatively different. They further suggest the construction of studies for the comparison of such subjects at all ages, to follow the normal development course of information processing.

The following two studies, which in themselves include and discuss complimentary research in the same area of study, offer contrasts in opinions concerning concept development, and serve to illustrate the difficulty in accurately assessing concept structure and development.

Initially Saltz, Soller, and Siegel (1972) tested groups of 24 children each in three groups—five to six-year-olds, eight to nine-year-olds, and 11 to 12 year-olds. The authors instructed the children to select pictures illustrating instances, or examples, of various language concepts. There were 72 pictures, encompassing six different concepts. Items used were designated either as core items, items most central to the concept, or as noncore items, items less commonly associated with the concept. Results indicated that "the youngest children consistently included the smallest number of items within each concept" (p. 1194). The youngest children also selected an appreciably fewer number of core and noncore items than the older children. "Concept names were often used in very narrow, limited fashions which suggested meanings quite different from adult usage. With development, these fragments tended to become integrated with newer, broader concepts" (p. 1200). The young children also showed strong dependence on attributes that were perceivable, the physical appearance of the stimulus apparently being a more critical factor in their conceptual behavior. An-
other developmental trend was also indicated in the results. Saltz et al. (1972) noted, "The dependence on perceptual attributes found in younger children is part of the general syndrome of concreteness and stimulus-boundedness already noted" (p. 1201). Functional and abstract attributes, however, apparently became more important in concept identification as the age of the children in the group increased.

Further, Saltz and Siegel (1967) investigated conceptual development in a similar study, and they suggested that younger children have trouble integrating large numbers of attributes into one concept. As previously mentioned, the child's early concepts are fragmented and consist of subconcepts. Saltz and Siegel added, "Young children are more likely to overdiscriminate, as opposed to overgeneralize, in judging whether or not two instances are from the same concept" (p. 7). The error of overgeneralization occurred when the given instance was incorrectly said to be the same as the standard, while overdiscrimination occurred when the instance was incorrectly identified as being different from the standard. Saltz and Siegel (1967) additionally noted that "while the tendency to overdiscriminate drops sharply with increased age, the tendency toward overgeneralization tends not to drop" (p. 7). The results of the study of concept overdiscrimination conducted by Saltz and Siegel revealed two relatively independent processes, one in which general inaccuracy concerning concepts was found in the younger children, and the tendency of overdiscrimination in the younger rather than the older subjects.

Neimark (1974) conducted a study that presented conflicting results and interpretations from that of the Saltz et al. (1972) study. She pointed out that "no adult group is included although adult concepts seem to be
implied as the normative base in their study" (p. 508). Neimark felt that specific concept labels such as "food" and "things to eat" might change interpretations by the subjects rather than the broader discriminations of Saltz et al. (1972), in which all concepts were different. Adults, for instance, might put the same objects in both categories of "food" and "things to eat", while children might put more objects conceptualized as something to eat under "things to eat".

Neimark (1974) used three groups of subjects, second and sixth graders, and college-age students. She presented 50 line drawings, each illustrating one of four concept categories—food, things to eat, clothing, things to wear. The subjects were asked to put the drawings into the categories in which they belonged. Neimark pointed out, "All the findings suggest that there were no general age trends in the size of natural language conceptual classes, but rather that class size is a function of class labels and items available for inclusion" (p. 510). She looked at the nature of the included items in her study, concluding that fragmentation of the concept classes by the younger child does not apply in this study. Neimark rather believed that the older subjects were more likely to fragment concepts, such as the dividing of "things to wear" into clothing and accessories, while the younger subjects treated "clothing" and "things to wear" as the same thing. She further noted, "We found that 'food' and 'things to eat' were functionally equivalent for second and sixth graders and college students, and the number of items so classified increased slightly with age" (p. 510).

In contrast to the Saltz et al. (1972) study, the younger child in the Neimark (1974) study did not exclude clothing coverings such as mittens
from "clothing", but these children were older than the kindergarteners in
the Saltz et al. (1972) study. The difference may be due to the factor of
that much more language and language experience brought into the situation
by the older child in the Neimark study.

The Neimark (1974) study concludes that second graders and college
students have quite similar natural language concepts and "the course of
development of natural language concepts is affected not only by age but
also by the label and specific nature of the instances provided for
classification" (p. 511).

In 1977 Saltz, Dixon, Klein, and Becker published further studies
concerning the nature of language concepts. The authors researched over-
discrimination of concepts through comparison of changes taking place be-
tween two and four years of age.

One of the bases for this research considered an earlier discussion
of two types of concept learning models, discrimination and concept growth
(Saltz, 1971). The discrimination model assumed that a subject learns a
concept by giving the critical response to successive stimuli, at times
correctly and at other times incorrectly. The learning was largely a case
of extinguishing the generalized response to the incorrect stimuli and
maintaining the correct stimuli response. Saltz believed that intelligence
did not seem strongly related to this learning.

Saltz's (1971) concept growth model, on the other hand, held that a
person's first exposure to a concept was typically a positive instance of
the concept. Then came the tendency to restrict use of the new concept
with new instances very similar to the initial one, with a final expansion
of its use. Saltz commented, "People are much more likely to err by failing
to use a concept when it is appropriate than by using the concept in a negative instance" (p. 56). He also noted that the greater the correlation between attribute dimensions of the concepts of a person, the fewer distinctions he can make between them, and the more limited his cognitive space.

Saltz (1977) did note, however, that overgeneralization could take place. He wrote, "If an attribute that is relevant to the concept is not perceptually salient in early concept instances, it will not be used criterially by the child in deciding if other instances are examples of the concept, and overgeneralization may occur" (p. 1682). Saltz (1977) gave an example of a wax apple which fulfilled enough of the person's criterial attributes to be mistaken for a real apple. Also, if a mother was considered a woman who took care of the needs of the child, the babysitter might likewise be considered a mother. But Saltz believed that overdiscrimination of concrete concepts in particular was a natural tendency of the young child, with less frequent errors of overgeneralization. But overdiscrimination appeared to decrease with age.

In the 1977 Saltz et al. study, the authors referred to the overextension of word labels by very young children. Clark (1973) elaborated on the acquisition of word meanings by children in a Semantic Feature Hypothesis. She wrote,

The Semantic Feature Hypothesis states that when the child first begins to use identifiable words, he does not know their full (adult) meaning. He only has partial entries for them in his lexicon. The child will begin by identifying the meaning of a word with only one or two features
rather than with the whole combination of meaning components or features that are used criterially by the adult. The acquisition of semantic knowledge... will consist of adding more features of meaning to the lexical entry of the word until the child's combination of features corresponds to the adult's. (p. 72)

Clark (1973) additionally noted that the young child had different referential categories too, since he had only partial characteristics of the adult word at his disposal.

Saltz et al. (1977) made two possible interpretations in consideration of all this information, in an effort to answer why a two-year-old child has overly broad concepts, only to appreciably narrow these concepts at about four years of age, then to finally expand them to an appropriate understanding and correspondence with increasing age. The authors stated, first of all, that the scope of the function relating age to breadth of concepts may initially be broad, then narrow, then broad again, unlike the previous belief that concept understanding and development generally increased at a regular rate with increasing age (Saltz et al., 1972). Secondly, Saltz et al. (1977) indicated that a distinction between production and comprehension of concept labels was necessary, production being a part of comprehension. This led to further expectation that the use of labels for concepts by young children would be much more restricted when compared to the concept label use by older children. It was noted, though, that "spontaneous production of many concept labels may involve a further process" (1977, p. 1683).

The Saltz et al. (1972) study had investigated the acquisition of
concepts and recognition of instances as being examples of the concept.
The results indicated that systematic changes occurred in the size of con-
cepts or in the increase of instances recognized as being examples of the
concept; the changes involved a progression from fragmentation to integra-
tion in concept learning. Core items, items central to the concept, were
analyzed, and the analysis suggested that younger children used each of
the concepts they experienced as a primary referent to only one aspect of
the concept meaning as used by older children. So items in the core of a
concept as known to the older child were not always in the core of the
younger child. Analysis of noncore items, items not central to recogni-
tion of the concept, supported the idea that the young child used both
relevant and irrelevant characteristics to identify a concept in initial
contacts with the concept (Saltz, 1971). Summarily, the younger child
held fragmental concepts, consisting mainly of perceptual attributes.
Various objects were considered examples of the same concepts, perhaps
because they looked like or looked partially similar to another concept
instance. This tie, however, decreased with age (Saltz et al., 1972).

The "further process" noted in the Saltz et al. (1977) study in-
volved work carried out by Clark (1975). Clark suggested that overgener-
alization might be the result of "stretching" of limited vocabulary by a
child in an effort to effectively communicate. She emphasized that the
child overextends his vocabulary into several classes, depending on the
main basis for communication. Class examples might include shape, texture,
and color. Clark further explained, "When the child uses a word and over-
extends it, he appears to do so because he has identified only some of the
adult conditions of application for that word" (p. 79). Clark also believed
that possibly the child might overextend in his productions but not in his word comprehension, perhaps because of the limited vocabulary he possesses. The child might make only a partial overextension, picking out the object and using the best word available to him to label this object. This overgeneralization, then, might not occur as frequently as the child acquires fuller, more correct understanding of words and objects. Clark concluded, "With the entry of new words into the child's repertoire, other words become displaced. This displacement is most visible for words formerly overextended" (p. 82).

Previously in this paper some ideas about and definitions of concepts, symbols, and other components of the conceptual framework were presented. Saltz (1971) contributed further definitions of components of the conceptual system. He considered cognitive space to be "the characteristics of the set of dimensions on which a person can react to the stimuli (both internal and external) of his environment" (p. 33). A single instance of a concept was a point in this space, such as the size (point) of an apple (space). But Saltz qualified this statement, saying,

Concepts are described as regions, rather than points, because a concept may have a number of different attribute values on a given dimension (e.g. bananas may be green, yellow or black; they occupy a range of values on the length dimension)" (p. 33).

Concept development, therefore, was an expansion of the regions in the cognitive space.

In addition, the Saltz et al. (1972) study included a commentary on this area of concept development, specifically discussing concept integra-
tion. Concept integration, the culmination of processes involved in the development of the conceptual framework, was seen as being developmental in nature and concerned largely with core items. Since the core items in the study were those items most consistently picked as an instance of a concept, it can be noted that the young child was not consistent in his responses, fragmenting instances of concepts. For example, the child might correctly and consistently respond to items that are part of daily meals as being food, but he may not consider snack items outside of regular meal foods to also be food.

In concept integration Saltz et al. (1972) further proposed that "there were marked qualitative changes in bases for concept identification. Physical appearance was a more critical factor in the conceptual behavior of the younger than the older children" (p. 1201). Altogether, Saltz et al. (1972) felt the results of their study indicated that the main shift with increasing age was from overdiscrimination to integration of concepts, rather than overgeneralization to differentiation.

Brown (1958) proposed contrarily that children learned differentiation of concept labels in their concept development. He explained, "Sometimes a name is supplied in order to bring forward an immediately important property of the referent" (p. 17). Brown gave an example, stating that while all coins are equivalent for the young child in that they are not to be put in the mouth or dropped down a sink, the term of money is adequate for this equivalency. More differentiated terminology can be supplied and used when the child actively participates in going to the store. Brown concluded, "Cognitive development is increasing differentiation" (p. 19). However, the Saltz et al. (1972) study indicated that even older children
do indeed practice more differentiation of concepts; they will consider regular meals and snacks to both be food. Generally, though, the younger child is more stimulus-bound in designating concepts, while the older child can overcome differences in place and activities in indicating instances of concepts.

Normative facts and valid tests of a deaf child's language competence and knowledge have not been found to be readily available or definitive enough in evaluation. Furth (1973) offered basic information about testing and its implications for deaf subjects, explaining some of the theories, methods, and groups used in testing. In general or standard testing procedures, first of all, normal distribution is the underlying notion. Two-thirds of the test scores fall around the mean score, one-third above it, and one-third below it. Smaller fractions then fall on either side of these groups and so on, until all scores are tallied. If the view, therefore, is limited to a small portion of a stable, similar society, then the normal distribution can be justified.

But Furth (1973) emphasizes that if the scope of the testing population is widened into the subcultures that naturally exist in the society, the standard environment of the assumption of normal distribution is lost. In considering the deaf population, for example, the population differs in qualitative measures of testing, since the people have no easily available language system, or one that is readily translatable. The crux of the matter of testing, as Furth sees it, largely concerns the fact that many tests require effective language communication.

The purpose of testing the deaf child, according to Furth (1973), is to measure the innate potential believed to be a part of every child,
whether deaf or normal-hearing. "Innate potential implies that every infant is born with the potential to develop according to alternatives that are limited in one sense but that are also quite undetermined and open-ended" (p. 88). To measure this potential in a deaf child, Furth continues, is to try to answer how well a child might score had he not been deaf. It is like matching a 12 year-old deaf child with a normal-hearing peer, asking whether or not the deaf child could be like the hearing child.

Furth (1973) stresses that intelligence tests also cannot truly be considered culture-free, or free from environmental factors. One of the problems in testing the deaf child is that he is often tested only for comparison with normal-hearing children. What then is a meaningful control group, and who should be in the deaf sample? These questions must necessarily be considered because deaf people, as in any diverse population, come from all backgrounds, attitudes, and abilities. Additionally, a large percentage of this population has handicaps above and beyond that of the deafness itself.

Considering testing situations, Furth (1973) continues, the problem of language is one of the most difficult areas when dealing with the deaf child. Nonverbal tests do not use words either as a stimulus or as a response, or as a success criterion, but testing situations do not necessarily exclude all language behavior in the subject (Furth, 1966). Even nonverbal tests often have oral instructions, and if these instructions cannot be understood, the remaining tasks, though nonverbal, suffer in performance from the misunderstanding or nonunderstanding. Naturally enough visual demonstration and examples in conjunction with the oral instructions can
inhibit error possibilities, but most likely misunderstanding or partial and distorted understanding between the testor and subject can cause anxiety and lessen motivation. Problems such as these cannot easily be solved, but some suggestions by Furth (1973) to alleviate anxiety and improve communication include a lack of a restricting time period for the test, minimal use of gestures, and use of games. Almost ironically, though, Furth adds, "The examiner must rely on gestures and examples or on the lucky chance that the deaf child will cleverly guess the meaning of the task" (p. 89).

Klausmeier and Ripple (1971) and Johnson (1964) make two interesting but conflicting comments concerning concept testing of deaf children. Klausmeier and Ripple point out, "Operationally, a concept may be defined as the level of mastery at which an individual has attained the concept. This level of mastery is inferred from observation, including performance on tests" (p. 402). Johnson, on the other hand, criticizes the testing situation, saying,

Concepts are used in communication and in solving problems; yet when we want to test anyone's mastery of a particular concept, we usually arrange a testing situation with standard materials and standard instructions leading to responses that can be scored right or wrong. (1964, p. 28)

Furth (1973) maintains, though, that generally nonverbal testing can be successful and result in good norms. Conclusions, however, possibly indicate that the deaf child may have "a kind of intelligence that is different from the intelligence that deals with language" (p. 91). Furth adds some justification to this possibility, though, commenting that
perhaps nonverbal intelligence is of a lower order, which suggests that
the deaf child may have normal concrete intelligence but not abstract
intelligence. This abstract intelligence, though, is considerably based
on verbal intelligence, verbalizations that more than likely will not be
as clear or effective for the deaf child as compared to the normal-hearing
child.

Nonverbal tests are probably most effective, continues Furth (1973),
when viewed as testing the general achievement of the deaf child. He ex-
plains,

Knowing that a deaf child compares favorably with a
hearing child on visual and manipulatory skills is
interesting, and this is primarily what nonverbal
test data supply. But to the educator who focuses on
the teaching of language, the results of intelligence
testing are not overly helpful and are of small im-
portance when evidence demonstrates that the deaf
child certainly has adequate logical intelligence.
All the teacher is left with is the fact that the
child is poor in language, which he knew before
administering the test. (Furth, 1973, p. 92)

Furth (1973) interestingly comments, however, that to view verbal behavior
as being of a higher order than visual skills and object manipulation may
be a mistake; verbal behavior can, in a way, be considered a more primitive
achievement measure, since the normal-hearing child hears and speaks long
before he is to do nonverbal tasks successfully.

The consequences of the testing procedure and overall situation
have also been dealt with by Furth (1973). "Certainly one of the reasons national reading tests are given to children who do not even master the rudiments of the English language is public pressure and the desire for conformity" (p. 95). The effects of test-taking on normal-hearing and deaf students also provides some interesting differences in attitudes and abilities. The normal-hearing child, Furth explains, may take a test with the idea that he will fail, and when he does poorly he thereby proves to himself that indeed he cannot succeed. This self-fulfilling prophecy can then greatly interfere with any future motivation or aptitude. The deaf child, however, seems to view the testing situation differently. "Fortunately deaf children seem to be much more immune to scholastic failure than hearing children, and they take the routine of testing and failing with good grace" (p. 95).

A standardized test of concepts from which a particular concept was chosen for teaching procedures will be discussed (see Appendix A for complete set of lesson plans). Then some of the many and varied aspects, opinions, and investigations of concept formation will be reviewed, and purposes and methods of concept instruction outlined and discussed.

The Boehm Test of Basic Concepts, created by Anna E. Boehm in 1969, serves as the source of a concept for teaching procedures. The test consists of two booklets of 50 items total, and it can be administered to kindergarteners and first and second graders in 15 to 20 minutes. Detailed directions for the testor are available in the booklet, given in boldface print, to be read aloud to the children. Key phrases are also read aloud to the children twice for emphasis, and sample items are given before actual testing begins. Boehm (1969) writes, "The Boehm Test of Basic Concepts
is designed to measure children's mastery of concepts considered necessary for achievement in the first years of school" (p. 3). The test is used to identify deficiencies in children, and to identify the individual concepts for which a child might need instruction for understanding and mastery. For instance, a child entering kindergarten may lack concepts often used in beginning curriculum work, such as locating the right end of a line, or identifying the object under the table in the picture.

Boehm (1969) selected concepts occurring with considerable frequency and lack of definition, or only a very simple definition. The more complex forms of these concepts were found to be used subsequently without an adequate transition from simple to complex definition and use. These concepts also represented relatively abstract basic concepts. After the concepts were chosen, they were translated into pictorial multiple-choice items, items tried twice on appropriately aged groups to correct any ambiguities.

These trials were more specifically conducted to designate items which the children found difficult for reasons other than lack of concept knowledge, such as unclear wording or poor pictures. The trials also checked for items that were answered correctly by 98% or more of the kindergarteners and first graders, in order to eliminate items that were too easy or known to cause no difficulty to the children. The actual items used in testing were further designed to identify the individual children whose overall level of concept mastery was low, requiring special attention. Also, individual concepts with which large numbers of children in a class might be unfamiliar could be identified.

Some qualifications concerning test items are necessary. All but three of the concepts are straightforward. Difficult concepts are not
combined in the same item, however. No items require distinguishing between comparatives and superlatives, and none require changes such that "top" becomes "bottom" if turned upside down. Items are selected for four areas of classification—space (location, orientation, direction, dimensions); quantity (and number); time, and miscellaneous. Boehm (1969) notes, "The classification of concepts into these four context categories is arbitrary to some extent, and other meaningful classification could... be suggested" (p. 11). These areas can represent areas of concept difficulty, though. For example, to ask, "What is between the spoons?" indicates a question of space, while, "What meal do we eat between morning and afternoon?" indicates time (examples, p. 11). So knowledge of the concept of "between"ness in one context cannot necessarily insure adequate knowledge in another context. Other items indicate that there may be "inherent difficulty with some concepts, where the specific label is not known or alternative concept labels are unfamiliar or pictorial representation that is ambiguous or out of the child's realm of experiences" (p. 11). A child's lack of response may be due to one of these problems, and in the deaf child's case the language difficulty may be the reason for problems in testing.

Boehm (1969) emphasizes that the presentation of the concepts in this test format using pictures suggests some reasons for errors and correct responses. Concepts such as "big" and "small" can be adequately illustrated, but "near" and "far" present more difficulties. Errors indicated in this testing format involved polar opposites most often, perhaps a result of partial knowledge or confusion due to poor concept or label foundations. More than one choice was marked at times, perhaps showing a
confusion due to the verbal directions, unclear pictures, and so on. Responses to only part of the direction occurred too, or guessing occurred, most likely because the child had no notion of the concept in question.

The understanding of teaching methodologies requires background information about concepts and their relationship to learning processes. After all, what is a concept? Though it is one of the biggest areas of disagreement among educators, psychologists, and curriculum people, and countless others, it is necessary to at least attempt to define and discuss the various intricacies of concepts, concept development, and attainment of concepts.

Gagne (1970) states that concept learning is a process in which things are put into a class and responded to as a whole class. He stresses that concept learning is not necessarily a verbal process, since concepts can also be learned by animals, but verbalization makes the task easier because of the human mastery of other prerequisites. The verbalizations are not the type that give a formal definition, but are used in conjunction with prerequisites such as ability to receive and express language, form associations, have long-term memory storage of events and objects, and so on. Gagne believes that "the acquisition of concepts is what makes instruction possible" (p. 185). He feels that there is a necessary need for a variety and degree of concept introduction and acquisition in various subjects. Lastly, Gagne sees concepts as being valuable for every aspect of learning and living. "The great value of concepts as means for thinking and communication is the fact that they have concrete references" (p. 187). Learning can be oververbalized at times, though, and have inadequate references in actual situations, so the demonstration of the teacher and actual
manipulation and doing by the students is important.

The components of concepts are generally recognized by most authors in the field, though naturally the specific components and their definitions are varied. Some of these different views and their respective authors follow.

Klausmeier and Ripple (1971) offer a long definition of a concept, and further break its components down for better understanding of concepts. According to the authors,

A concept is a mental construct, or abstraction, characterized by psychological meaningfulness, structure, and transferability, that enables an individual (1) to cognize things and events as belonging to the same class and as different from things and events belonging to other classes; (2) to cognize other related superordinate, coordinate, and subordinate concepts in a hierarchy; (3) to form principles and to solve problems involving the concept; and (4) to learn other concepts of the same difficulty level in less time. (p. 430)

This definition had been presented earlier in this paper, but now it requires breakdown and definition of its various components. Klausmeier and Ripple (1971) state, "The individual's connotative meaning of a word corresponds to that attribute of a concept here called psychological meaningfulness" (p. 397). They add that this attribute may also be inferred by the changes that occur in the concepts held by one individual. Connotative meaning, first of all, encompasses the individual, personal associations of a person with a particular word, and the psychological
meaningfulness is based on verbal and nonverbal experiences, and changes with increasing experiences. These experiences will most likely mean additional experience with instances, or examples, of the concepts, and also meaningful additional verbal information about this concept. Added verbal information, though, is probably the best substitute.

Structure, Klausmeier and Ripple (1971) add, consists primarily of four parts. These four components "deal with the attributes that define the concepts, the rules by which the attributes are joined, the hierarchy in which the concept falls, and the instances of the concept" (p. 397). Attributes, the authors explain, are those things categorized and their related labels that can be defined as perceptible or easily measureable attributes. The attributes can also involve semantic meanings or logical statements, and can vary in number (one to an infinite number of differences, relevance, and discriminability). Discriminability is "the extent to which the attributes are attended to and cognized" (p. 398). For example, size is easier to discriminate in examples where the large and small illustrations of otherwise identical objects are used. Klausmeier and Ripple emphasize, "In general, as the discriminability of the attributes decreases, the concept attainment becomes more difficult" (p. 398). Associations are less clear, and what is relevant and irrelevant concerning a concept is not as easily seen, thereby hindering complete understanding.

DeCecco (1968) adds to the defining of attributes, stating, "An attribute is a distinctive feature of a concept, and thus varies from concept to concept" (p. 388). The number of attributes varies, then, and variations also occur in the values of these attributes. "Values are the particular variations an attribute may undergo" (p. 389), so the values of
the attribute of color may range from red to blue to maroon, and so on, while the attribute of form may have values of circle, square, or triangle, among others. DeCce (1968) also notes, as did Klausmeier and Ripple (1971), that some attributes have dominance over others, meaning that they are more obvious to the learner and probably more easily learned.

Secondly, in further defining concept components, there are several rules concerning the joining of attributes. The following are examples: 1) "Red" is a simple affirmative concept comprised of one property or dimension (Bourne, 1966); 2) "Mammal" designates three attributes conjunctively, or simultaneously—warm-blooded, possesses mammary glands, bears live offspring; 3) "Older" denotes a relational rule. A five-year-old child is older than a four-year-old, but younger than a six-year-old; and 4) "Strike" in baseball represents a disjunctive rule of attribute joining, a type of and/or relationship. The strike may be a ball thrown in the strike zone and called by the umpire, or a pitch swung at and missed, or a foul ball. (Bruner, Goodnow, and Austin, 1956)

In terms of ease of concept attainment using these rules, Bruner et al. (1956) believe that disjunctive rules are difficult because these rules are arbitrary, subject to the degree of complexity with which a person might choose to define them. Neisser and Weene (1962) conducted a study about the hierarchies involved in concept attainment. They used 10 types of bivariate attributes (more than two features were never relevant), falling into three natural levels of difficulty. The 10 types fell into five complementary pairs, in which the positive instance of one member of the pair was a negative instance of the other. Neisser and Weene further explained, "The univariate attributes are evidently the simplest" (p. 640).
An example of presence would be that a vertebrate must have a backbone, while an example of absence is that an invertebrate must not have a backbone. (The examples are from Neisser and Weene, 1962, p. 641.) These univariate examples were followed by increasingly complex types of junctures. Neisser and Weene continued, "Next are a group of six bivariate attributes, made up directly from the univariate one by negating, conjoining, or dis Joining them. Finally, the two most complex attributes are formed by dis Joining certain conjunctive pairs" (p. 640). In other words, the authors derived their three levels of attributes by combining attributes of Level I to get Level II, and using the components of Level II, then, to create Level III attributes. Neisser and Weene noted that the selection of the operations they used was probably primitive, but their results indicated that concept attainment was more difficult at Level II than at Level I, but easier than at Level III. The subjects had had to try to discover attributes by indicating whether a stimulus example was a positive or negative instance of the attribute, and "the results indicate that the difficulty of a concept varies directly with its complexity" (p. 645). The authors even ran a computer program to investigate its problem-solving ability in the same sort of procedure. The program was written to establish rates of concept attainment resulting from the logical elimination process used by the computer, and Neisser and Weene emphasized that this additional work was not a simulation of the human processing rates or abilities. Overall, Neisser and Weene believed that the results of difficulties with hierarchies in concept attainment "reflect a hierarchical organization of conceptual processes in the Ss themselves" (p. 645). So apparently human beings do not use a definite system of elimination or even processing in the learning
of concepts, a further possible indication of the complex, paradoxical functioning of the brain.

As an added note, Klausmeier and Ripple (1971) explain that most school subjects teach concepts in conjunctive or relational ways. Perhaps one reason, then, for poor achievement and understanding in school work is that the higher levels of conceptual attribute joining are being called for while a concept and attributes are still being assimilated at lower, easier levels.

Klausmeier, Ghatala, and Frayer (1974) propose a conceptual learning and development model. The model describes four successively higher and different levels in attainment of the same concept. There are also specifications of cognitive operations involved in the concept attainment at each level. Some operations are common to all levels, but at each attainment level the operations are carried out on the more abstract and highly differentiated properties of actual instances of the concept or verbal descriptions of concept instances and/or attributes.

The four levels of concept attainment are concrete, identity, classificatory, and formal. A concept becomes increasingly usable, helping the person in direction, identification of objects, reduction of environmental complexity, and so on, and the concept also becomes valid, or in agreement with definitions by experts, as it is attained at each level.

At the concrete and identity levels an individual can solve simple problems by relating obvious sensory perceptions. For example, crossing a street before one gets to the corner rather than walking to the corner across the street and back down the other side to the store involves a line, the shortest distance, angles, and other mathematical considerations,
but these concept names and ideas are not necessarily present when this person chooses to jaywalk.

At the classificatory and formal levels, generalization of new instances, problem-solving, and relating of the concept to other concepts are among operations carried out by the person. Transfer of learning and concept use in thinking are major considerations at this level.

In all cases at these four levels, the common operation of attending to and discriminating objects, then remembering these discriminations, is of primary importance. At the higher levels of concept attainment this operation, however, is supplemented with further operations of generalization, hypothesis formation, and evaluation. Acquisition of the concept name may occur at any level, but the names of concept attributes are essential for formal level concept attainment.

The postulation by Klausmeier et al. (1974) continues with the presentation of the idea that concept attainment at these four levels by a large number of people follows a normative pattern under two conditions. The first condition states that "the concept is of the kind for which there are actual perceptible instances or readily constructed representations" (p. 14). Secondly, "the individual has experiences with the instances or representations starting in early childhood" (p. 14). As stated before, though, the individual must have labels for the concept and its attributes before continuing to the formal level.

The four levels involve differing and increasingly complex cognitions and operations for the person. At the concrete level, for example, the individual must recognize an object as one which has been previously encountered. He attends to this object and represents it internally,
making finer and finer discriminations of attributes with each encounter. At this point, the concept name may or may not also be encountered.

When the person moves to the identity level, he recognizes an object as being the same one previously encountered, even when seen from a different perspective or experienced in a different sense modality. Klausmeier et al. (1974) add, however, that identity attainment is usually a temporary step only, leading to classificatory attainment.

At the classificatory level there can be two levels of concept mastery. The person at the lower level treats at least two different concept instances as being equivalent, which is correct, but he cannot necessarily explain why the instances are equivalent. Likewise, but at the higher mastery level, the individual can take a large group of examples and nonexamples of the concept and classify them accordingly and correctly, but he cannot describe the basis for the defining attributes that designate examples and nonexamples.

Finally, at the formal level, the person can give the name of the concept, name its intrinsic or societally-based defining attributes, designate instances as belonging or not belonging to the set for the concept, and describe a basis for the inclusion or exclusion of these instances in terms of defining attributes. Hypothesis-testing or notation of commonalities among attributes and instances are usually two methods of fulfilling the above operations for concept attainment at this highest, or formal, level.

Lastly, "instances of concepts may vary from one to an indefinite number" (Klausmeier and Ripple, 1971, p. 401). Klausmeier and Ripple provide the following example, saying that an inch is always an inch, while
drops of water vary constantly. Instances of the concept may also vary accordingly, depending upon their openness to experience through the senses. Some instances are more easily available to all senses, while others are limited; an orange is easily perceived while an atom of hydrogen is extremely difficult to conceptualize.

Martorella (1972) explains, "Concepts, for instructional purposes, may be thought of as a category of experience having a rule which defines the relevant category, a set of positive instances or exemplars with attributes and a name (though this latter element is sometimes missing)" (p. 7). Carroll (1971) adds,

One necessary condition for the formation of a concept is that the individual must have a series of experiences that are in one or more respects similar; the constellation of "respects" in which they are similar constitutes the "concept" that underlies them. Experiences that embody this concept are "positive instances" of it; experiences that do not embody it may be called "negative instances". The series of experiences embodying the concept must be preceded, interspersed, or followed by other experiences that constitute negative instances of the concept. (p. 342)

Transferability of concepts involves a part of the learning, and it can occur after a concept is acquired (Klausmeier and Ripple, 1971). Klausmeier and Ripple add,

There are four possibilities for use in, or transfer to, other situations: 1) one categorizes other instances
when first encountered as not belonging to the concept; 2) one can more readily cognize other concepts as superordinate, coordinate, or subordinate; 3) one can use the concept in forming and understanding a principle and in solving problems where the concept is applicable; 4) the learning of one concept facilitates the learning of other concepts. (p. 401)

Klausmeier and Ripple (1971) probe further into concepts, providing information about concept analysis. Concept analysis is an important aspect of concept learning. This probe highlights some ideas by Carroll (1971). Carroll sees concepts as products of experiences learned by people in their lives. Words for concepts, and the language for the concepts themselves, is even similar across languages of the world. "Because of the continuity of the physical, biological, and social environment... in which human beings live, their concepts will show a high degree of similarity" (p. 341). The common language of a people makes it possible for them to have a great deal of verbal diffusion and sharing of information, on all of which concepts are based. This common language naturally consists of many words and meanings. Carroll points out that words, meanings, and concepts are independent of one another to a degree, but there are some interrelationships. He explains,

The words in a language can be thought of as a series of physical entities—either spoken or written. A meaning can be thought of as a standard of communicative behavior that is shared by those who speak a language. (p. 347)

Concepts are classes of experiences that are a part of an individual,
either independently of language processes or closely dependent on language processes.

Carroll (1971) also adds to the meaning of the meaning of words, explaining that the meaning of a word is "a societally standardized concept, and when we say that a word stands for or names a concept it is understood that we are speaking of concepts that are shared among the members of a speech community" (p. 347).

Concepts involve denotative and connotative meanings for people. Carroll (1971) indicates that the denotative meaning of a word, and thus that concept it represents, is the meaning(s) found in a standard dictionary. The dictionary entry will give verbal equivalents or synonyms of the word, examples of use, and a formal definition. Carroll emphasizes, The use of a formal definition... literally "marks off the boundaries of" the concept by first indicating what it has in common with other experiences and then indicating in what respects or attributes it differs from other experiences. (p. 348)

The verbal equivalent in the entry is used to evoke a previously known concept to which the defined and defining word stand in the same relationship. It might also evoke a series of hopefully previously known concepts, in which are common elements that the person can use to derive the concept to which the defined word stands in the relationship. The denotative meaning indicates what the concept being represented has in common with other concepts, and also how it is different (Klausmeier and Ripple, 1971). Klausmeier and Ripple add, "The unique meanings and associations that the individual possesses constitute his concept and correspond to the connotative