THE APPLICATION OF PIAGET'S THEORY OF INTELLECTUAL DEVELOPMENT TO BLOOM'S COGNITIVE DOMAIN TO STRUCTURE OBJECTIVES FOR KINDERGARTEN EDUCATION

THESIS

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CHAPTER I

INTRODUCTION

Statement of Purpose

The purpose of this thesis is to apply Piaget's theory of intellectual development to Bloom's Taxonomy of Educational Objectives: Cognitive Domain to structure cognitive objectives for the development of classification abilities in kindergarten education.

Importance of the Study

Jerome Bruner, Director of the Center for Cognitive Studies at Harvard University, stated in The Process of Education that "any subject can be taught effectively in some intellectually honest form at any stage of development."[1] For this dictum to be realized certain knowledge should exist. First, the developmental stage of the child should be determined; second, an effective method of teaching a subject should be established; and third, from the body of knowledge about a subject pertinent information should be selected. Piaget's theory of intellectual development delineates the stages of mental growth from birth to adulthood. The Taxonomy of Educational Objectives establishes a sequence for learning behavior. Through the use of Piaget's theory and Bloom's Taxonomy of Educational Objectives: Cognitive Domain, the subject knowledge that is within the child's ability to assimilate can be determined.

Piaget is the Co-director of the Institute of Educational Sciences in Geneva as well as Professor of Experimental Psychology at the University of

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[1]Jerome Bruner, The Process of Education, p. 33.

Geneva. He has been writing since 1923, with the publication of The Language and Thought of the Child, about the development of intelligence from birth to adult reasoning.[2] Jerome Bruner in the introduction to Studies in Cognitive Growth attributes the founding of modern developmental psychology to Piaget.[3]

John H. Flavell, Professor of Psychology at the Institute of Child Development at the University of Minnesota, stated that Piaget's studies can be applied to education. Using Piaget's sequential growth structures, learning concepts can be placed in the curriculum where they best benefit the child.[4]

In the 1950's a group of educators under the direction of Benjamin S. Bloom, Professor at the University of Chicago, began work on a structure that would facilitate curriculum designs. The Taxonomy of Educational Objectives is in three parts, the Cognitive Domain, the Affective Domain, and the Psycho-motor Domain. The first two parts have been published and the third is being written. The Cognitive Domain begins with the level of "Knowledge," specific facts and bits of information, and ends with "Evaluation," judgment using abstract thought; the other four areas develop the progression from concrete to abstract ideas.[5]

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[2]Herbert Ginsburg and Sylvia Opper, Piaget's Theory of Intellectual Development, p. 5.

[3]Jerome Bruner, Studies in Cognitive Growth, p. xv.

[4]John H. Flavell, The Developmental Psychology of Jean Piaget, p. 365.

[5]Benjamin S. Bloom (ed.), Taxonomy of Educational Objectives: Cognitive Domain, p. 19.

In kindergarten education there are many instructional areas that can be introduced to the child. One such area is classification. Celia Stendler Lavatelli, of the University of Illinois, stated her belief that kindergarten programs that have a cognitive development curriculum should include instruction in classification. She justified her hope for its inclusion in the curriculum for kindergarten because of the importance of being able to develop classes dealing with the environment.[6] Piaget found classification behaviors to begin in the sub-logical period of development and at five years of age a child is in the pre-logical stage of development of classification abilities. He believes that some classification behaviors are developed before the emergence of language. However, the development of true classification abilities is accomplished through the use of language.[7]

Flavell stated that The Early Growth of Logic in the Child is the record of Piaget's study of classification and seriation development from early to middle childhood. The Child's Conception of Number is the basic reference for Piaget's theory of numerical development.[8]

For each area included in the kindergarten curriculum there should be realistic objectives based on a careful study of the child's capabilities. In order to structure objectives, an understanding of the child's developmental stage as well as a logical sequence for promoting knowledge must be included in the curriculum.

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[6]Celia S. Lavatelli, Piaget's Theory Applied to an Early Childhood Curriculum, p. 81.

[7]Jean Piaget, The Early Growth of Logic in the Child, p. 282.

[8]John H. Flavell, The Developmental Psychology of Jean Piaget, p. 309.

Procedures

The Taxonomy of Educational Objectives: Cognitive Domain provides a systematic structure for developing learning objectives. The Cognitive Domain begins with the basic section of "Knowledge" and integrates each succeeding area into a logical learning sequence. The six areas of the Cognitive Domain are reviewed in the order found in the Taxonomy of Educational Objectives: Cognitive Domain to determine the outstanding characteristics of each section. These characteristics serve as a guide for determining the classification objectives for kindergarten education.

As the Taxonomy of Educational Objectives: Cognitive Domain is used to delineate the types of classification behavior, Piaget's theory of intellectual development is used to determine the level of classification abilities of the kindergarten child. The kindergartener's stage of classification development is determined by a careful study of selected works by Piaget. Classification involves the use of thought and language and is found in numerical concepts. These three areas of language, thought, and numbers, as they affect classification, are described in terms of the level of the kindergarten child.

Having determined the characteristics of each section of the Cognitive Domain and the level of classification development of the Piagetian five-year-old child, then Piaget's theory is applied to the Taxonomy of Educational Objectives. Using examples and documentation from the writings of Piaget, the performance level of each section of the Cognitive Domain can be stated for the kindergarten child.

Cognitive objectives are stated for classification behavior based on Piaget's growth sequence and the Cognitive Domain of the Taxonomy of Educational Objectives. These objectives are within the limits of the

Piagetian five-year-old child and are designed to encourage the logical growth sequence of classification ability.

Limitations

This thesis is limited to the intellectual theory of Piaget as found in Six Psychological Studies, The Thought and Language of the Child, The Early Growth of Logic in the Child, The Child's Conception of Number, and The Child's Conception of Geometry. The Taxonomy of Educational Objectives: Cognitive Domain is the source of the cognitive objectives structure.

Definitions

1. Classification is the grouping of objects, ideas, or concepts into logical class structures.

2. Cognitive objectives are intellectual abilities to be attained by the child.

3. Kindergarten child is a child who is five years of age and is in the pre-operational stage of Piaget's theory of intellectual development.

4. Piagetian child is a child described in terms of Piaget's theory of intellectual development.

CHAPTER II

BLOOM'S COGNITIVE DOMAIN

The Taxonomy of Education Objectives: Cognitive Domain is the work of many people done under the direction of Benjamin S. Bloom. The Taxonomy of Educational Objectives represents a way of structuring objectives for teaching and for learning. There are six general cognitive areas included in the Taxonomy of Educational Objectives: Cognitive Domain. These areas are "Knowledge," "Comprehension," "Application," "Analysis," "Synthesis," and "Evaluation." The categories begin with a basic cognitive area, and each of these areas is integrated into the next area. Because of the limited cognitive development of the kindergarten child, there will be some areas of the Taxonomy of Educational Objectives: Cognitive Domain that will be more pertinent than other areas to the child in the pre-operational stage of development.

Knowledge

"Knowledge," in the Taxonomy of Educational Objectives, refers to remembering, recalling, or recognizing information. There are sub-areas under the general title of "Knowledge" which are arranged from specific and concrete knowledge to abstract knowledge.[1]

The "Knowledge of Specifics" refers to bits of information that can be isolated from the whole. The sub-area of "Specifics" is separated into several smaller groupings. The "Knowledge of Terminology" refers to knowing the proper names of objects, ideas, or anything that has a name

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[1]Benjamin S. Bloom (ed.), Taxonomy of Educational Objectives: Cognitive Domain, p. 62.

or verbal symbol. The "Knowledge of Specific Facts" refers to bits of information that are attributed to any one particular field of study.[2]

The "Knowledge of Ways and Means of Dealing with Specific Facts" is based on a knowledge of specific facts and terminology. "This includes the method of inquiry, the chronological sequences, the standard of judgment within a field as well as the patterns of organization through which the areas of the field themselves are determined and internally organized."[3] This sub-area is divided into several categories. The "Knowledge of Conventions" concerns the way things are done. The "Knowledge of Trends and Sequences" concerns the inter-relationship between objects and time. The "Knowledge of Classification and Categories" concerns the set or arrangement of objects. Groupings are not always the same, but there are ways and means of setting boundaries. The "Knowledge of Criteria" implies the outstanding facts which are used to judge a certain classification. The "Knowledge of Methodology" implies knowing how something is done. This does not include the reason for doing something.[4]

The "Knowledge of the Universals and Abstractions' in a Field" is the third major sub-category in the area of "Knowledge." This sub-category refers to the "large structures, theories, and generalizations which dominate a subject field."[5] Included are many specific facts about a particular field. This sub-category is divided into two smaller areas.

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[2]Ibid., pp. 63-67.

[3]Ibid., p. 68.

[4]Ibid., pp. 68-74.

[5]Ibid., p. 75.

The first is the "Knowledge of Principles and Generalizations," which includes knowing the possibly non-related facts and ideas that govern or determine a principle or generalization. The second area is identified as the "Knowledge of Theory and Structures" and is the knowledge of the related facts combined to produce a theory or structure.[6]

Comprehension

The second major area included in the Cognitive Domain is "Comprehension," which includes the understanding and the use of knowledge. The three types of comprehension behavior are "Translation," "Interpretation," and "Extrapolation." "Translation" is the ability to change successfully from the original form of communication to a second form of communication. "Interpretation" goes beyond translation; it includes understanding of the task and the limits involved in the task. "Extrapolation" is extending translation and interpretation. Extrapolation is used to predict what goes on beyond the factual statement and is an inference.[7]

Application

The third major area of the Cognitive Domain is "Application." Transfer of training involves application.

> Given a problem new to the student, he will apply the appropriate abstraction without having to be prompted as to which abstraction is correct or without having to be shown how to use it in that situation... A demonstration of "Application" shows that he will use it (the abstraction) correctly, given an appropriate situation in which no mode of solution is specified.[8]

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[6] Ibid., p. 75.

[7] Ibid., pp. 89-98.

[8] Ibid., pp. 120-123.

Analysis

The fourth major category is "Analysis." This involves the breaking down of objects into basic parts. Once the whole is separated into its component parts it is then possible to examine the relationships among the parts. More complex than the analysis of relationships is the analysis of organized principles. This includes seeing the pattern involved, the purpose involved, and the techniques used in developing the whole.[9]

Synthesis

The fifth major area of the Cognitive Domain is that of "Synthesis." This is the putting together of related parts into a whole. There are sub-categories of "Synthesis." The first sub-category is the "Production of a Unique Communication." This involves the communication of ideas, feelings, and experiences. The success is based on the effects that the communication has. A second sub-category is the "Production of a Plan or Proposed Set of Operations." The plan is compiled, but it does not have to be carried out. The third sub-category includes starting with some concrete data and producing a plan, classification, or relationship; or starting with one concept and deducing a second concept.[10]

Evaluation

The last major area of the Taxonomy of Educational Objectives: Cognitive Domain is "Evaluation."

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[9] Ibid., pp. 144-151.

[10] Ibid., pp. 162-172.

> Evaluation is defined as the making of judgments about the value for some purpose of ideas, works, solutions, methods, materials, ect. It involves the use of criteria as well as standards for appraising the extent to which particulars are accurate, effective, economical, or satisfying. The judgments may be either quantitative or qualitative and the criteria may be either those determined by the student or those which are given to him.[11]

There are two sub-categories in the area of "Evaluation." The first is "Judgment in Terms of Internal Evidence" and the second is "Judgment in Terms of External Criteria."[12]

Summary

Six areas of cognition form the structure of the Cognitive Domain of the Taxonomy of Educational Objectives. "Knowledge" forms the first level of the structure and is defined as the knowing of facts and information. Knowledge is followed by "Comprehension," which represents understanding of information. "Application" combines knowing and understanding information in order to solve new problems. The fourth level of the structure, "Analysis," is the breaking down of an item into its component parts; while "Synthesis," the fifth level, is the combining of related parts into a whole. The last area of the structure is "Evaluation," the formation of judgments.

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[11] Ibid., p. 185

[12] Ibid., pp. 189-190.

CHAPTER III

PIAGET'S THEORY OF INTELLECTUAL DEVELOPMENT

Piaget's theory of intellectual development has evolved over years of observation and writings. David Elkind wrote in the introduction to Six Psychological Studies that:

> Piaget's theory, in the most general sense, is that of subject-object equilibration, the view that mental growth is governed by a continual activity aimed at balancing the intrusion of the social and physical environment with the organism's need to conserve its structural systems.[1]

This balancing process is present in each stage and sub-stage of cognitive development. Each area of mental growth undergoes equilibration. The development of classification reflects the interaction of the child and his environment. Included in the growth of classification is the growth of thought, language, and numerical behavior. While these three areas are pertinent to classification, they function at the same level and are not subordinate to classification.

Development of Classification

According to Piaget, the three stages in the development of classification conservation are the construction of graphic collections, the construction of non-graphic collections, and the construction of classifications. The stage of graphic collections takes place before the age of five and is based on spatial appearances. The third stage is that of conservation of classification and usually develops some time after the child's seventh year.

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[1]Jean Piaget, Six Psychological Studies, p. v.

The second stage is that of the non-graphic collection. The child begins the stage of non-graphic collections by grouping objects by similarities, and by the end of this stage the non-graphic collections resemble true classification except there is no class inclusion.

> The non-graphic collection itself is not a true classification. Its appearance points to the fact that the principle of similarity and difference tends, in time, to prevail over that of shape or belonging. But like the graphic collection, the non-graphic collection is bound by the condition of spatial proximity. That is why it is a "collection" and not a class. This condition constitutes a limiting factor throughout stage II because it cannot be outgrown until there is some alternative to proximity to provide a cohesive bond between the elements in a whole. The structure of class inclusion is such an alternative but it depends on the clear differentiation of "all" and "some" which is not elaborated before stage III.[2]

The child develops classification abilities through several stages of non-graphic collections. At first, the child lacks a plan of attack. With experience, the child gains hindsight and begins to have tentative criteria for grouping. As he gains in experience, he develops a trial-and-error method of attack caused by semi-anticipation. As the child develops his ability to anticipate, he also develops the concept of class inclusion, and from that, true classification behavior develops.

The aspects of seriation that are perceptual in nature are realized by the child before he has attained conservation of classification. However, the non-perceptual aspects, the actual construction, does not develop until after the child has reached the operational stage.

Some five-year-old children can visualize and construct series by trial and error. According to Piaget, over half of the five-year-old children

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[2]Jean Piaget, The Early Growth of Logic in the Child, p. 53.

tested could correctly anticipate the shape of the series while just under one-half of all five-year-old children tested could by trial and error construct a series. A few had operational seriation.[3]

Development of Numerical Concepts

Piaget stated, in the introduction to The Child's Conception of Number, his hypothesis that:

> . . . the construction of numbers goes hand-in-hand with the development of logic, and that a pre-numerical period corresponds to the pre-logical level. Our results do, in fact, show that number is organized, stage after stage, in close connection with the gradual elaboration of systems of inclusions (hierarchy of logical classes) and systems of symetrical relations (qualitative seriations), the sequence of numbers thus resulting from an operational synthesis of classification and seriation.[4]

Development of Thought and Language

The emergence of language allows the child to develop concepts that are dependent upon language. With language, the child is able to talk with others, to develop thought, and to change actions into words.[5]

According to Piaget, the two functions of language usage are ego-centric speech and socialized speech. The ego-centric speech patterns reflect the earliest usage of language. The basic ego-centric speech pattern is the simple repetition of words done by the child for his own pleasure. No one else is involved, and often the words are not understandable. The monologue speech patterns develop from the repetition of

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[3] Ibid., pp. 247-253.

[4] Jean Piaget, The Child's Conception of Number, p. viii.

[5] Ibid., p. 17.

words. Again the only person involved is the child. A second person becomes necessary toward the end of ego-centric speech usage for the collective monologue stage. For both stages of monologue the child talks to himself, with the second person serving as a stimulus for the collective monologue stage.

Socialized speech develops through advanced usage of language. A second person needs to be present, and the child begins to understand other points of view. Social speech patterns range from a simple interchange of ideas to asking and answering questions about specific information or a subject. Included in this spectrum of speech patterns is the ability to direct critical remarks and to make commands, threats, or requests to at least one other person.[6]

The kindergarten child's speech is composed of some ego-centric as well as some socialized speech patterns. According to Piaget, until about the age of five years the child tends to stay by himself and makes no attempt to socialize. Hence, he has no need for social speech. As he becomes interested in being understood, the kindergartener begins to form unstable social groups and to adapt social speech patterns.[7]

The structure of language involves the use of classification and seriation. The use of language accelerates the development of classification and seriation, but does not cause the development.[8]

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[6]Jean Piaget, The Language and Thought of the Child, pp. 32-34.

[7]Ibid., p. 62.

[8]Jean Piaget, The Early Growth of Logic in the Child, p. 4.

> . . . some kind of language is essential for the completion of the structures under discussion, i.e. classification and seriation. This is because the operations involve a symbolic, and therefore a representative, handling of objects, in as much as they go beyond what could be done in terms of overt behavior.[9]

The development of thought and the development of language seem to be closely related. Piaget claims there are two forms of thought. The earliest type of thought is undirected while advanced thought is directed. The undirected thought is autistic and is based on the child's internal actions. Directed thought works from ego-centric to communicated thought.

Piaget maintains that ego-centric thought is a form of logic and has several identifying characteristics. The formation of a judgment is intuitive, and once made it is permanent. The factors that influence judgment are visual perception, values of the object assigned by the child, and the child's past related or unrelated experiences.

Communicated thought is adult logic. Judgments are based on a logical recounting of events, and once a judgment is reached, it is subject to review and change. While visual perception lessens in importance, the influence of others becomes more prominent.

The kindergarten-aged child has predominantly ego-centric thought characteristics. However, there are some traces of communicated thought at this level.[10] "At every stage during the period from two to seven years, one finds all the transitions between two extreme forms of thought, but the second form gradually gains precedence over the first."[11]

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[9]Ibid., p. 293.

[10]Jean Piaget, The Language and Thought of the Child, pp. 66-68.

[11]Jean Piaget, Six Psychological Studies, p. 22.

Development of Geometric Concepts

The development of measurement conservation seems to follow the same pattern as the development of communicated thought. According to Piaget, the child from four years of age until about seven years of age is in the second stage of development of measurement conservation. This stage is characterized by the child's ego-centric view of space. The child believes himself to be the starting point of structures. He can see a relationship between each object within the structure and himself, but is unable to see any relationship among the objects. The child in the second stage lacks reversibility.

> So long as the subject's conception of space is ego-centric, it (measurement) remains a law unto itself, because it lacks references which are co-ordinated, and changes of position which are grouped. As a result, objects are directly assimilated to ego-centric notions rooted in the perceptual situation and measurement is impossible.[12]

Summary

Piaget's theory of intellectual development is based on equilibration, a continuous process of maintaining a balance between the child's present mental level and new concepts to develop stable and permanent knowledge. The Piagetian five-year-old child is in the pre-operational stage of development. This stage is characterized by the ego-centric thought of the child, his inability to reverse his thoughts, his intuitive judgment, his partially ego-centric and partially socialized speech patterns, his inability to conserve numbers or measurement, and his construction of non-graphic collections instead of true classifications.

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[12]Jean Piaget, The Child's Conception of Geometry, p. 26.

CHAPTER IV

THE APPLICATION OF PIAGET'S THEORY OF INTELLECTUAL DEVELOPMENT TO BLOOM'S TAXONOMY OF EDUCATIONAL OBJECTIVES: COGNITIVE DOMAIN

The Taxonomy of Educational Objectives: Cognitive Domain has a sequential structure for learning objectives, and Piaget's theory has a sequential structure for mental growth. Through the use of the Taxonomy of Educational Objectives: Cognitive Domain as the outline for cognitive objectives, the level of learning abilities can be determined for the Piagetian child. Included in the writings of Piaget are statements that allow the kindergartener's classification abilities to be established for each section of the Cognitive Domain. Within the three books, The Early Growth of Logic in the Child, The Thought and Language of the Child, and The Child's Conception of Number, are statements and records pertaining to the five-year-old child. Through study of the references to the five-year-old child, trends and sequences of classification growth can be developed. These trends and sequences applied to the relevant areas of the Taxonomy of Educational Objectives: Cognitive Domain then provide an overview of the kindergartener with respect to Piaget's theory of intellectual development and Bloom's Taxonomy of Educational Objectives: Cognitive Domain.

Knowledge

Knowledge is the ability to recall, remember, or recognize information. The first level is the "Knowledge of Specifics," which includes terminology

and specific facts. Terminology as expressed by verbal symbols can be developed by repetition and imitation by the pre-operational child.

> (Mlle. E. teaches My the word 'celluloid') Lev, busy with his drawing at another table: "Luloid...le... le...loid..."

also

> Jac says to Ez: "Look, Ez your pants are showing." Pic, who is in another part of the room, immediately repeats; "Look, my pants are showing, and my shirt, too."[1]

Terminology can be developed by the questions of the child, as in the Piagetian "why" questions of justification.

> "Why do you say 'strayed' when it means lost?"-
> "Why are there lots of names with several names...?"
> "Why 'black coffee,' all coffee is black?"[2]

The Piagetian child can also develop terminology in the classification questions that he asks.

There is a whole group of questions of classification and evaluation, relating to the names of objects, to their value, to the class to which they belong and to comparisons between them.[3]

The five-year-old child has some vocabulary describing quality words such as bigger, smaller, longer, shorter, and taller, but he does not have a fixed definition for these words. The descriptions and judgments are based on appearances rather than reality.[4]

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[1]Jean Piaget, The Language and Thought of the Child, p. 35.

[2]Ibid., p. 199.

[3]Ibid., p. 206.

[4]Jean Piaget, The Child's Conception of Number, p. 11.

For the important classification terminology of "all" and "some," the Piagetian five-year-old child has some familiarity with words. However, he seems to be unable to give the concise meanings of the words. For example, Kar (5:4) defined all as "a lot" and some as "one or two." In practice he gave all the objects when asked for some. Mar (5:6) constantly changed the criterion for all and some, while Cha (5:6) defined some as "half," and for him half of six was four.[5]

The terminology of complimentary classes is not fully developed in the Piagetian five-year-old child. Over fifty percent of the five-year-old children tested could find "the one that is different," but they could not explain why. An example of such a five-year-old child's response to "why" is Dom (5:6): "Because I know, I thought about it."[6]

The development of number terminology is incomplete and unstable at five years of age. When discussing a five-year-old child's response, Piaget stated

> . . . that at this level the correspondence between numerals and objects is still purely verbal and that the child has not yet acquired the notions necessary for the construction of number itself, i.e. permanence and equivalence of sets irrespective of the distribution of the elements of which they are composed.[7]

The correct names of the objects and specific information about the objects does not seem to be required of the five-year-old child. For example, Pie (5:0) in the original French referred to circles as "ronds" rather than "cercle."[8] However, when questioned the Piagetian

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[5]Jean Piaget, The Early Growth of Logic in the Child, p. 92.

[6]Ibid., p. 123.

[7]Jean Piaget, The Child's Conception of Numbers, p. 46.

[8]Ibid., p. 60.

five-year-old child seemed to know the names of the colors, geometric shapes and the objects that he was working with. At times, the terminology was supplied by the examiner. For example,

> Arl (5:0) Ex. "Look, are there a lot of flowers or a few in this field (a drawing representing 20 poppies and 3 bluebells)? - "A lot." Ex: "What color are they?" - "They are red and blue"- Ex: "The red ones are poppies and the blue ones are bluebells."[9]

In general, the Piagetian child's use of terminology is determined by his ability to assimilate. The internal structuring on the part of the child is more important than the verbal symbols that represent it.

The Piagetian child does not need to be able to list specific facts about a subject. For the five-year-old child, the specific facts are viewed from only one point of view and by only one factor that characterizes the object.

The Piagetian five-year-old child has some knowledge of classification and categories. He is able to determine some bounds or limits. These are basically intuitive limits. There is the pre-classification behavior of combining known objects into classes such as a class of furniture consisting of the child's known furniture or animals consisting of all the animals known to the child. This type of classification is based on the child's experiences and as such is not considered stable. There are other limits that the five-year-old child is bound by in classification abilities. Some limits the child has that prevent classification are his inability to accept the idea of an empty set, his tendency to ignore a singular set, his inability to accept a negative set, and his difficulty in accepting that two sets can be bound by the same number.

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[9] Ibid., p. 167.

According to Piaget:

> . . . children at stage II understand the need to class all the elements which they are given; they invariably divide them into two collections or more: each of these contains all the elements of a kind and no others. Not infrequently, there is a partial complimentarity; collections of the same rank are disjoint; finally there may be an attempt to find simplifications and symmetries. Yet that which distinguishes the non-graphic collections of stage II from classes in the strict sense always remains the fact that there are no class-inclusions.[10]

For most of Piaget's five-year-old children, the methods involved in classification are limited to the similarities and differences. The child is usually unable to understand a hierachy within a major class and would tend to ignore that area of methodology.

The last area in the "Knowledge" section is the "Knowledge of Universals and Abstractions in a Field." The Piagetian child is not capable of abstract thought until the formal operations stage. Therefore, even if the child could recite classification abstractions, he would not understand or have any knowledge of the universalities involved with classification except on an intuitive level.

Comprehension

The second level of Bloom's Taxonomy of Educational Objectives: Cognitive Domain is "Comprehension," which includes "Translation," "Interpretation," and "Extrapolation." As the Piagetian five-year-old is characterized by ego-centricity and intuitiveness, so is his level of comprehension. Comprehension behavior is evident in a child's ability to follow instructions or in the development of a structure by the child.

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[10]Jean Piaget, The Early Growth of Logic in the Child, p. 49.

Translation ability implies being able to give a literal restatement of an idea, part for part. This restatement could be in actions, words, or a combination of both. The success of translation can be affected by the child's knowledge. If a child believes a concept to be true regardless of reality, the resulting translation will reflect that understanding.

An example of such a change in knowledge concept that effects the translation of instruction into action is the change of behavior from stage I of classification to stage II. The child who is in stage I is bound by spatial proximity and his collections resemble objects. A child who is in stage II, given the same instructions, will produce a non-graphic collection. This collection will have some spatial proximity but is constructed using the criteria of similar objects.

For numeration purposes, the five-year-old child, according to Piaget, is unable to translate an object's position on a line into a number. The only exception to this is in dealing with the numbers one to five. These are intuitive numbers for the five-year-old child.[11]

For the five-year-old child, the results of translation are visible in his interpretation. While he may be able to copy a line of objects, object for object, his understanding of his actions is interpretive. Following instructions requires the child to translate words into actions, and the end product is the result of the child's interpretation of the instructions.

There are limitations to the child's interpretative abilities. The

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[11]Jean Piaget, The Child's Conception of Number, p. 154.

dominance of visual perception limits the child's abilities to interpret with adult correctness. For example, with one-to-one correspondence problems, a five-year-old child usually loses any conservation. His interpretations of the correspondence are based on the visual appearances rather than on reality.[12]

The five-year-old child's ability to see only one aspect of a construction also limits the interpretative abilities. According to Piaget, a five-year-old child will usually respond to the largest single part of a structure. His response will reflect that single largest aspect. In addition, the child's responses will be governed by his answering the question which he wants to answer and not by the question that was asked. Other concepts that limit the Piagetian five-year-old child are concerned with his ability to classify. If he is unable to recognize an empty set, single set, or negative set his answers will reflect this limit.

The last area of "Comprehension" is "Extrapolation." The Piagetian five-year-old child is usually unable to co-ordinate two ideas or concepts. For extrapolation to be successful, the child needs to be able to co-ordinate concepts. For example, some of Piaget's five-year-old children are unable to clearly differentiate between the meaning of all and some. Because of this lack of co-ordination of these two terms, the child also lacks the conservation of classification. As a result, most extrapolation attempts of the child are intuitive guesses.

Comprehension skills for the Piagetian child are limited by his mental abilities. If the child makes intuitive non-graphic collections,

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[12] Ibid., p. 48.

exhibits an inability to reverse his thoughts, or lacks understanding of any necessary concepts, his comprehension will reflect his abilities.

Application

"Application" is the ability to apply previous learning to new situations without being prompted. The Piagetian five-year-old child has various levels of success with application. According to Piaget, some five-year-old children's behavior is based on sensori-motor learning. Seriation and the construction of singular classes are two examples of sensori-motor learning behavior. For some five-year-old children, application is based on appearances. For some, application is intuitive, while other five-year-old children use trial and error methods of application.

Many five-year-old children do not have a plan when they begin a problem. As each selection or advance is made on an individual basis, so is each application of previous knowledge. According to Piaget, the applications that the five-year-old child makes are based on his past personal experiences and not on deductive reasoning.[13]

Application is limited because the five-year-old child is not able to apply two criteria at the same time. As a result, a collection is usually constructed on only one aspect at a time and there is an absence of an intended hierachy structure.[14]

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[13]Jean Piaget, The Language and Thought of the Child, p. 66.

[14]Jean Piaget, The Child's Conception of Number, p. 166.

Analysis

"Analysis" is separating the whole into its several parts and then examining the relationships among the various parts. The Piagetian five-year-old child lacks reversibility and is unable to realize that a part-whole relationship exists. To accomplish analysis, the child needs to be able to construct and follow a plan and that requires foresight which the five-year-old child does not have.[15]

The kindergarten child has trouble with analysis of numbers. The quantity of the whole for a given number does not always remain the same for the five-year-old child. He does not consider the whole as being composed of parts. The only exception is with halves; often the child realizes that the whole can contain two equal parts.

Synthesis

"Synthesis" is the combining of parts into a whole. For the Piagetian child, this area is developed before analysis. The child is able to combine objects into a whole. Beginning with the pre-classification stage, the child has been doing a form of synthesis. The development of oral language which is revealed by the random selection of words to which he has been exposed, is a form of synthesis. Likewise, in his classification development, his unconscious grouping of objects into classes such as animals or furniture has been a limited use of synthesis.[16]

The major element missing for a true synthesis is the lack of an

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[15]Jean Piaget, The Early Growth of Logic in the Child, p. 224.

[16]Ibid., p. 4.

overall plan. The five-year-old child begins non-graphic collections as successive assimilations based on similarities and differences. He usually does not begin by looking at a group of objects and deciding the criteria before beginning a classification. Eventually the child may review his collection and revise his immediate criteria, but this revision will not be based on a comprehensive overall plan.[17]

There are other factors that affect the child's ability to synthesize. The visual appearance has a great influence on the Piagetian child. In the case of single sets, he will tend to ignore the exception. According to Piaget, the forgetting of the old criteria or the setting aside of the old criteria has some effect on the final outcome of the collection.

The child may be given a group of objects to classify several times and each time he will probably reach a different conclusion. However, according to Piaget, eventually his choices of criteria will become co-ordinated, and a true classification behavior will exist.[18]

Piaget stated that "all children of stage II use the ascending method"[19] to classify. Therefore, synthesis is more likely to occur in the Piagetian child before analysis.

Evaluation

"Evaluation" is the making of judgments based on some criteria. The Piagetian five-year-old child usually makes intuitive judgments which

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[17] Ibid., p. 203.

[18] Jean Piaget, The Child's Conception of Number, p. 87.

[19] Jean Piaget, The Early Growth of Logic in the Child, p. 212.

are based on some single criterion that appeals to the child. The child, according to Piaget, uses only one criterion at a time; any evaluation which requires the child to co-ordinate two concepts is beyond the ability of most five-year-old children.[20]

According to Piaget, the child is usually unable to evaluate size on the basis of the numbers included because he lacks the ability to conserve numbers. The five-year-old child may be able to evaluate or compare shapes of two arrangements as long as the shapes remain the same.[21]

The evaluations concerning classes or numbers by the five-year-old child are often determined by the visual appearances. For most five-year-old children, the judgments are made intuitively and, once made, unlikely to change.

Summary

The intellectual development theory of Piaget may be applied to the Taxonomy of Educational Objectives: Cognitive Domain to determine the five-year-old child's level of classification abilities. The Piagetian child can have success in the area of "Knowledge" because very little abstract thought is required. The early areas of "Comprehension" are within the level of the child's abilities; however, the last area of "Extrapolation" requires more sophisticated abilities. "Application" is done by the five-year-old child, but on an intuitive basis rather than by reasoning.

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[20] Ibid., p. 209.

[21] Jean Piaget, The Child's Conception of Number, p. 88.

The Piagetian five-year-old child is not capable of "Analysis" because he is unable to divide the whole into parts. He is capable of "Synthesis" on a limited basis. The combining of parts into a whole is done intuitively and without knowing what the outcome should be. "Evaluation" done by the five-year-old child is intuitive.

CHAPTER V

COGNITIVE OBJECTIVES FOR CLASSIFICATION DEVELOPMENT APPLIED TO KINDERGARTEN EDUCATION

Cognitive objectives for classification development for kindergarten education can be stated, based on the level of the Piagetian five-year-old child. The structure of the Taxonomy of Educational Objectives: Cognitive Domain provides a framework for the objectives. The classification abilities of the kindergarten child, as developed in the last chapter, provide the basis for cognitive expectations for the five-year-old child.

The theory of Piaget is based on an interaction between the child and his environment. To accomplish this for classification objectives some equipment is necessary. The materials are simple to make or are available in stores. Before beginning the teaching-learning structure of the Cognitive Domain, the child is allowed free time to manipulate the materials and encourage the internalization process of equilibration for classification abilities.

Each area of the Cognitive Domain has objectives stated for classification abilities development. The early areas of "Knowledge" and "Comprehension" are more relevant than the last four areas for the kindergarten child. The more advanced levels of the Cognitive Domain are primarily concerned with encouraging the systematic growth process of the kindergarten child.

Equipment

According to Piaget's theory, mental growth is developed through

an inter-action between the child and his environment. In order for the child to develop and demonstrate his classification abilities he should have some materials that are classifiable. The choice of materials or equipment is based on Piaget's experiments in The Early Growth of Logic in the Child, and The Child's Conception of Number. The applicability to Piagetian tasks and the availability of such materials are the criteria used to determine the selection of the equipment. Most of the equipment used in the development of classification abilities can be made by the teacher. The materials that can not be made are flexible enough in content that the teacher can decide, based on availability, what to include.

There should be sufficient materials to allow the child to have a variety of experiences with classes. The equipment should include two sets of geometrical shapes with at least four squares, rectangles, triangles, and circles in each set. One set should have shapes with smaller areas than the second set. In each set, with four or more items, at least two of each shape should be one color with the remaining, a minimum of two, being a second color. Through the manipulation of the equipment, the child can develop complimentary classes, as well as the concepts of singular, negative, and empty sets. To aid in counting, there should be series consisting of ten rods in each series. Using the shortest rod as having the length of one unit, the lengths of the other rods should be multiples of one. For example, rod number two should be two units, rod number five should be five units and rod number ten should be ten units. Such a series would allow the child to visualize the relative sizes of numbers.

To aid in the development of classification abilities, the teacher

should have a set of figures or pictures representing objects. These collections would allow the child to have a wider range of experiences with classes. The contents of these sets should be flexible enough to enable the teacher to determine the objects to be included. There should be enough variety within the sets and enough sets to encourage classification abilities. Among the collections of sets could be a set of figures or pictures representing people that could include sub-sets of different types of people, i.e., policemen, firemen, mothers, daddies, brothers, Chinese or any other variety that can be classified; a set of pictures or figures representing different types of animals, domesticated or wild; or a set or figures representing objects, i.e., balls, bats, tables, hats, or any other types of object that can be classified.

Pre-Bloom Structure Objectives

Before beginning with the structure of the Cognitive Domain the child needs to become familiar with the objects and to start an internal assimilation. Each child should have as many free play times with the different sections of equipment as he desires. During this time there should not be any planned introduction of information concerning the materials.

Knowledge

After the child has become familiar with the objects through physical contact, he can begin to assimilate knowledge concerning the collections. The first section of "Knowledge" is that of terminology. The objectives for this section include familiarizing the child with the names of the objects and other terms that are necessary for

classification abilities. Using geometrical shapes, the child should be taught the names assigned to each shape. Using the rods, the child should become familiar with the numbers assigned to the rods. For the collection of objects, the child should be taught the names of the items in the sets.

After the names of the items are developed, then the child should be introduced to quantity and quality words describing classes. Examples of such words are more, less, part, whole, some, all, tall, short, big, same, and difference, and any other word that is descriptive. To accompany these descriptive words, there are operational words such as add and subtract.

For each geometrical shape there are specific facts the child can learn during his assimilation processes. These facts should be presented with the actual shape to encourage identification of similar objects. A circle is a round object and is made by one continuous line segment. The three multi-segmented shapes are the square, the rectangle, and the triangle. The square has four sides that are equal and four equal corners; the rectangle has one set of parallel sides longer than the second set of parallel lines and has four equal corners; the triangle has three straight sides and can be of any length so long as the sides are joined together.

The child should be introduced to the quantity for which each number stands. Other specific facts about numbers to be introduced are that there is a sequence in counting and that each number has its own position based on the other numbers. Whole numbers can be separated into parts and each part has a name; for example, a whole can be separated into two parts and each part is called one-half.

For words that are useful for classification, there are specific facts about each. All is a total amount; some is a section of the total amount. Whole is an entire unit and part is a section of the unit. More is the numerically larger of two quantities and less is the smaller amount. Same represents concurrent quantities, while different represents dissimilar quantities. A set is a total amount or unit and a sub-set is one portion of the total unit. For operational words there are specific facts that can be introduced to kindergarteners. Add is the combining of two or more quantities, while subtract is the separating of at least one section from the whole. There are other specific facts concerning geometric shapes, numbers, or words relating to classification that can be developed.

In the "Knowledge" area following the "Knowledge of Specific Facts" is the "Knowledge of Ways and Means of Dealing with Specifics." For each geometric shape there are characteristics that should allow the child to generalize about each family of shapes. For example, all circles are round, can be various sizes, and are not bound by any one color or material. Only objects that fit such a description are included in the family of circles. Some of these objects are rings, halos, crowns, spheres, or records. To belong to the family of squares, an object must have four equal sides and four equal corners and the area is not important. Windows, cubes, or tiles may have a square shape. Rectangles have four equal corners and four sides with the areas lacking importance. Only those objects that fit can be generalized into the family of rectangles. Examples of rectangular-shaped objects would be doors, beds, or tables. The family of triangles contains three sides of any size, and three angles

of any size. A musical instrument, the triangle, is included in the family of triangles. Using the specific facts about each shape allows the child to generalize and apply his knowledge to other objects.

Once the numbers, both ordinal and cardinal, are familiar to the child, he can begin to use the number names and the specific facts about the numbers. Some applications of the names and facts would be used to generalize about numbers. For cardinal numbers, there is a specific order of counting; there is a predictable size difference between numbers, and each number represents a specific quantity. When using these numbers to count a set of objects, each member can be represented by only one number. For ordinal numbers, the specific facts that each ordinal number represents a relative position and that its name indicates its place, can be used to construct a classification based on objects having the same relative position within their individual sets.

The child, through familiarity with specific facts about quantity and quality words, can begin to develop ways of using the terms. Any collection that represents the total amount can be termed all while any collection that represents some portion can be termed some. A whole is a total amount and can be equated with the concept of all. A part represents a section or a fraction of the whole; at least one characteristic or section is excluded from consideration. The concept of more represents the larger of at least two quantities. It may be the largest of two or more sections of the whole, or it may be the largest of two or more classes. The concept of less represents a smaller amount than the concept of more. Thus the concept of less is characterized by the smaller physical quantity or the smaller numerical quantity. A set is defined as a group

of objects including all its parts. A sub-set is represented by a fractional part of a set and may be combined with other sub-sets to constitute a complete set.

The term same applies to objects that are equal in characteristics, quality or quantity. Different applies to non-concurrent physical characteristics of trait or quantity in one set not found in a second set; that is, an unbalanced numerical distribution. To add is to combine two or more sub-sets or to increase the size of one sub-set. To subtract is to separate one set into at least two sub-sets, or to decrease the size of one set.

The objective for the "Knowledge of Conventions" is to develop the accepted terminology for geometric shapes, objects, and operations. This is done through the co-ordination of the terms with the objects. Some examples would be the co-ordination of the term circle with various circles, or the term red circle with various red circles or the term a class of blue circles with various classes of blue circles. Quantities of objects can be co-ordinated with their number names. Words describing classes can be identified with physical representation.

The "Knowledge of Classification and Categories" objective is the realization that more than one object can have the same characteristic and those similar objects can be considered to be a class. For example, with geometric shapes all objects having three sides can be considered to be in the classification of triangles even though the objects may be called something other than a triangle. For objects, all types of dogs are in the classification of dogs. For numerical units, all sets that contain any two items can be considered in the classification of two.

An advanced objective for classification and categories is that in most major classifications there are sub-classes. Each sub-class has some property which permits an object to belong to the sub-class, and there is some uniting characteristic of the sub-class that permits the existence of the major class. For example, sub-class of rings, of hoops, of balls and of dishes have characteristics that allow the total group to be a class of circles.

Objectives for "Knowledge of Criteria" include knowing the outstanding characteristics of the geometrical shapes and the objects used for classification. Such knowledge is demonstrated through action or by verbalization. For example, a child when asked about a circle should be able to draw, select, or describe a circle. For the terminology connected with classification the child should be able to define, demonstrate, or do both.

The "Knowledge of Methodology" is the most advanced level of "Knowledge" in which the kindergartener is able to operate. The child's ability to verbalize the classification process is one objective for this area. For early classification behavior, the child should be able to verbalize concerning the similarities and differences of the class structure as he is classifying, and as he advances, he should begin to be able to verbalize how he goes about classifying objects before he begins.

Comprehension

After a child has sufficient internal knowledge to understand an oral transmission, he is able to begin comprehension skills. The

Piagetian child is able to react before he is able to verbalize his behavior. Objectives for comprehension skills start with the child's actions before his spoken transmissions.

The first stage of "Comprehension" is "Translation." As previously defined, translation is the ability to understand a communication part for part; the objectives are designed to facilitate such an understanding. For behavior identified as classification ability, the early translation tasks should be limited to simple one-to-one ideas or communications that can be responded to by actions on the part of the child. For example, a simple statement as "draw a circle" should be within the comprehension skills of the kindergartener who has an understanding of the terms draw and circle. As the child improves his abilities in action translations, then higher or more advanced translation tasks can be required of the child; for example, "draw six blue circles."

A second objective for translation is to aid the child in developing verbal responses; for example, being presented with a circle and the child's being able to say that it is a circle. As the abilities of the child increase, so should the difficulty of the tasks. For example, naming a class of various circles is more difficult than recognizing and naming a circle.

A third objective for translation is to rephrase one verbal transmission to a second but equal verbal form. An example would be the ability to change and classify those objects, and to arrange the objects into families.

The second area of "Comprehension" is "Interpretation." "Interpretation" by the Piagetian five-year-old child is based on the child's ego-centric thought and the results are intuitive actions. The

early objective for interpretation is to develop simple interpretive behavior in the child. An example of such a task would consist of an arrangement of objects such as a red square, a blue circle, and a red square and ask the child to duplicate the arrangement. As the level of the child's ability increases, such tasks can become more difficult. For classification, the interpretive skills are an indication of the child's cognitive level. When asked to put together the things that belong together, the child who is in stage I will make a graphic collection, the child who is in stage II will make an non-graphic collection, and the child who is in stage III will make a true classification. As the child has experiences with interpreting instructions, he should begin to co-ordinate the various concepts involved with classification. The major objective for this area of "Comprehension" is to give the child sufficient experiences in interpretative tasks to aid him in his assimilation of classification abilities.

"Extrapolation" is the last section of "Comprehension." This requires the child to predict what happens next on the basis of what has already happened. The Piagetian kindergarten child does not usually see a relation between what has happened and what will happen. To extrapolate, the child needs to be able to anticipate, and the five-year-old child is unable to do so.

Application

"Application" involves the use of previous knowledge to solve new problems. The Piagetian kindergartener applies his previous experiences to new problems, and usually the result is an intuitive guess that is often illogical. The learning objective for this area is to provide

the child with sufficient meaningful experiences to allow him to assimilate the relevant structures of classification. Until the child is able to coordinate the various aspects of class structures, his application will remain intuitive.

Analysis

The majority of the Piagetian kindergarten children are unable to accept the fact that the whole can be separated into parts. For the Piagetian child such an ability can not exist structurally until the child has reached this operational stage of mental development. Thus, until the child has reached Piaget's stage III, he is unable to see a relationship among sub-classes. Any development of analysis skills for the child who is in stage II would be superficial, since the child does not have the mental structure to analyze classes.

Synthesis

The pre-operational child is able to demonstrate some synthesis skills. However, such synthesis is intuitive, and does not usually follow a plan. In the early classification stages, the child puts together those things which look as though they belong. As his skills increase, he becomes able to verbalize a plan, but is not necessarily able to follow his plan. The cognitive objectives for this area include giving the child sufficient experiences in classification to allow him to assimilate the process. He should then be given the opportunities to explain what he intends to do before he begins a task. With experience, the plans should become more elaborate and take the form of a detailed plan.

Further objectives for synthesis allow the child to develop through

experiences a scheme for classification. The natural tendency of the child is to build up classes, starting with the simplest form and adding members. As the child reaches the operational stage, he begins to co-ordinate his verbal plans with his actions.

Evaluation

Just as the judgment of the five-year-old child is intuitive, his ability to evaluate is also intuitive. Until the child reaches the operational stage of mental development, his evaluations will be based on some criterion usually known only to himself. The cognitive objective is to present him with patterns of evaluation. Adult patterns should not be imposed upon the child but should serve as a guide when the child has the necessary mental structure to assimilate them.

Summary

Cognitive objectives based on Piaget's theory of intellectual development can be established for each area of the Cognitive Domain of the Taxonomy of Educational Objectives. The objectives for the development of classification abilities can be used to establish some abilities that are within the five-year-old child's mental capacity to assimilate and to encourage the growth of advanced classification abilities.

These objectives can be reached through the use of equipment and through the verbal abilities of the child. The equipment allows the child to see the classification structures and to manipulate the materials. Through the association of an object with its name, verbal abilities can be established. This verbal ability, according to Piaget, aids the classification abilities development but does not cause development.

CHAPTER VI

SUMMARY AND CONCLUSION

This thesis has considered the classification abilities growth structure of Piaget's theory of intellectual development and Bloom's Taxonomy of Educational Objectives: Cognitive Domain for the purpose of developing classification objectives for kindergarten education. The written results of Piaget's studies were used to determine the stage and the sequence of classification growth of the five-year-old child. Once this stage was established, the Taxonomy of Educational Objectives: Cognitive Domain was used to give a structure for stating objectives. Through the use of both Piaget's theory and the Cognitive Domain some cognitive objectives have been set up for classification behavior development.

Piaget's findings should be used to establish the level of abilities of the student in areas other than classification. In each area that Piaget studied he has recorded the growth sequences, and not just a general theory about how growth should happen.

Summary

The intellectual growth of the child, as evidenced in Piaget's theory, is an orderly equilibration process. Assimilation of information takes place if the child has the necessary background structure. Accommodation occurs when the introduced information has become internalized or "makes sense" to the child. These two, assimilation and accommodation, form the process of equilibration.

For classification, as for all concepts, the most basic behavior

needs to exist first if the process is to have stability. The classification ability, according to Piaget, has its origins in the sensorimotor stage of development. By the time the child has attained the age of five years and the pre-operational stage, he has displayed some forms of classification ability. In his language usage he has some ability with sentences and word groupings. More than likely, he has some form of ability for combining objects into groups, as a retriever, bulldog, and beagle are thought of as classes of dogs. Such groupings of the child indicate a basis for building behavior rather than true classification. On this foundation, the equilibration process can exist. When the child begins collecting and acknowledges that he is collecting, he constructs graphic collections based on visual perception. This stage gives way to non-graphic collections based on similarities and differences. Finally the child is able to construct true classes.

The Piagetian five-year-old child has several intellectual characteristics that affect his classification abilities. The child of this age has an ego-centric attitude; he believes himself to be the center of all things. His perception is limited to one way and one facet at a time. He is unable to reverse his thought processes; thus he considers an opposite direction to be totally different from and unrelated to the original direction.

Decisions made by the child are intuitive and without an overall plan. On occasions when the child does verbalize plans, he is usually unable to follow them. His choices of criteria are done on an immediate basis. His belief as to what is right dictates his choice

rather than choosing on a deductive reasoning basis. Thus his collections are constructed on a one-to-one choice criterium without any concept of what the end product will look like or even should look like.

For the purpose of this thesis, the Taxonomy of Educational Objectives: Cognitive Domain delineates a method of determining objectives for education. The structure begins with the basic level of learning, and through the systematic integration of levels, the abstract level may be obtained. For the Piagetian five-year-old child, the first two levels of "Knowledge" and "Comprehension" are the most useful. These two levels require the least amount of abstract thought. The third level is that of "Application" and is done by the five-year-old child but reflects his ego-centric thought processes. The next area of "Analysis" is beyond the kindergartener's ability because he is unable to visualize a whole first and then the parts of the whole. "Synthesis," the fifth area, is achieved by the kindergartener before analysis. However, both areas are done with ease by the child as he approaches and reaches the stage of conservation of classification. The last area of "Evaluation" requires more sophisticated thought processes than the Piagetian five-year-old child is capable of producing.

The levels of cognitive growth (Taxonomy of Educational Objectives: Cognitive Domain) which the five-year-old child has not attained, will be attained as the child develops his mental abilities. The objectives outlined in the more advanced levels are not designed to impose behavior on the child but to encourage his logical systematic growth sequence.

Conclusion

It is possible to use Piaget's theory of intellectual development

and the Taxonomy of Educational Objectives: Cognitive Domain to develop learning objectives for kindergarten education. The Taxonomy of Educational Objectives: Cognitive Domain is designed to be used at all levels of education, and Piaget's theory includes all mental growth from birth to adult reasoning. Although the normal five-year-old child has not attained adult logic or mental abilities, he will attain them through the process of equilibration. The Taxonomy of Educational Objectives: Cognitive Domain presents a guideline for establishing a learning procedure. It takes both present abilities and future growth into account. However, for kindergarten education, in light of the studies done by Piaget, the areas of "Analysis" and "Synthesis" should be reversed to present a continuum more in line with the child's methods of intellectual approach.

The objectives which have been developed from the application of Piaget's theory of intellectual development and Bloom's Taxonomy of Educational Objectives: Cognitive Domain are as follows:

The "Knowledge" objectives are these:

1. to know the terms circle, square, rectangle and triangle.

2. to know the number names of zero through ten and the ordinal number names of first through tenth.

3. to know the names of all the objects included in the sets of the equipment.

4. to know the classification terms of all, some, part, whole, set, more, less, tall, short, big, subset, last, and different.

5. to know the operational words add and subtract.

6. to know that a circle is round, a square has four equal sides, a rectangle has two pairs of equal sides, and a triangle has three straight sides.

7. to know how to count from one to ten.

8. to know that the whole can be divided into parts.

9. to know the specific meanings for all, some, part, whole, more, less, tall, short, big, set and subset.

10. to know that the outstanding characteristics of a circle which allow other objects to be included in the family of circles are that circles are round, can be various sizes, and are not bound by any one color or material.

11. to know that the outstanding characteristics of a square which allow other objects to be included in the family of squares are that squares have four equal sides and four equal corners, that the areas are not important, and that squares are not bound by any one color or material.

12. to know that the outstanding characteristics of a triangle which allow other objects to be included in the family of triangles are that triangles have three sides of any length and three angles, that the areas are not important, and that triangles are not bound by any one color or material.

13. to know that the outstanding characteristics of a rectangle which allow other objects to be included in the family of rectangles are that rectangles have four equal corners and four sides, that the areas are not important and that rectangles are not bound by any one color or material.

14. to know that each cardinal number represents a specific quantity.

15. to know that each ordinal number represents a relative position.

16. to know and co-ordinate the names of geometrical shapes with the proper shapes.

17. to know and co-ordinate the numbers one to ten with the proper quantities.

18. to know that objects with identical characteristics can be considered to be a class.

19. to know that more than one object can have the same characteristics.

20. to know that a major class can have at least two subsets.

21. to know the similarities and differences of geometrical shapes.

22. to know how to sort objects based on similarities and differences.

The "Comprehension" objectives are these:

1. to translate a simple spoken request or instruction into action.

2. to translate a visual stimulus into a verbal symbol, such as naming the object or shape when presented an object or shape.

3. to translate one verbal transmission into a second but equal verbal transmission; for example, having been given the name hoop, being able to call the name circle for the same object.

4. to translate and to interpret instructions accurately.

5. to translate and to interpret a variety of experiences.

6. to begin to predict "what happens next."

The "Application" objective is this:

to provide the child with sufficient meaningful experiences to aid in the assimilation of classification structures; for example, having developed the concept of chairs, to determine whether or not an ottoman can be classified as a chair.

The "Analysis" objective is this:

to provide the child with visual evidence that the whole can be separated into parts.

The "Synthesis" objectives are these:

1. to verbalize a plan.

2. to have meaningful experiences in constructing the whole from its parts, such as putting together a puzzle.

3. to follow verbal plans with action.

The "Evaluation" objective is this:

to produce for the child correct patterns for evaluation.

Intellectual areas other than classification development may be studied, and objectives may be designed that would best benefit the child. If education is to be responsive to the needs of the child, then educators need to be able to anticipate the needs and the growth sequences of the child. This thesis, through the use of Piaget's theory of intellectual development and the Taxonomy of Educational Objectives: Cognitive Domain, has established some objectives for the development of classification abilities for kindergarten education that are within the five-year-old child's ability to assimilate and has anticipated higher levels of mental growth. Similar objectives may be and should be established for all other areas of kindergarten education.

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