AN ORGANISMIC THEORY OF LEARNING WITH SOME APPLICATIONS FOR THE TEACHING OF SCIENCE IN THE ELEMENTARY SCHOOL

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To the Graduate Council:

We are submitting herewith a thesis written by Miriam Hipple Rogers entitled "An Organismic Theory of Learning with Some Applications for the Teaching of Science in the Elementary School." We recommend that it be accepted for six quarter hours' credit in partial fulfillment of the requirements for the degree of Master of Arts with a major in education and a minor in distributive subjects.

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CHAPTER I

THE PROBLEM

Statement of the Problem

The purpose of this study is to make an analysis of an organismic theory of learning and to make some applications of the theory to the teaching of science in the elementary school.

In realizing this purpose the writer proposes to present a historical treatment of the Gestalt theory of psychology from the time of founding to the present day. An effort will be made to develop in detail the basic concepts and principles. Through the historical method of research, development of the theory both in Germany and the United States will be traced.

A philosophical study will then be made with the goal of establishing the principles in such form and organization that they may be readily and easily identified with accepted theories of teaching and learning. These principles are today the basis of present methods used in the teaching of elementary science.

A further purpose of this study will be concerned with making some application to the theory under consideration to actual teaching practice. For example, the principle

of integration should be revealed in the integrated activities of a science unit. The interaction and interrelations between the child and the factors of his environment should be clearly demonstrated as he "learns by doing."

The problem of this study becomes one of answering such questions: How can the theory be related to the practical methods and procedures of science teaching? What are the points of relation, and in what ways can these relationships be developed to give the child experiences which will result in desired changes of behavior?

A Survey of Principal Schools of Psychology

A study of the many different theories that have been held will show the influence of each on the teaching today. From early times man has been interested in himself and has attempted to understand his own mind. Descartes 1596-1650 made two important contributions:

1. He argued that animals are automats; they act like machines, and men do too in their irrational conduct.

2. Descartes argued that soul and body are quite separate, forming different worlds, and yet they react one on the other. This has given rise to dualism. It results in a common sense notion that the mind is a little extra person within the brain which is perpetually busy. This person collects the news as it comes in on one set of nerves and sends out orders along another.

John Lock in 1690 set the British up with a theory known as British empiricism or British associationism. Lock argued that all content of the mind comes from experience. Lock then made some attempt to say how learning takes place.

Dualism remained in vogue up to the end of the nineteenth century. Many guesses were made as to how the mind and body were related. In the middle of the nineteenth century the acceptance of the principle of conservation of energy led to the conception of parallelism. This theory looked upon man as a machine in which all conduct is to be explained by action of the sensory nerves, the spinal cord, the brain, and the motor nerves.[1]

In opposition to the dualistic-parallelistic view, the relation of the mind and body were put forward as various kinds of monism. While physiology was becoming a science, some of the physiologists became interested in what were really psychological problems. Johannes Muller may be called the father of experimental psychology. It was Wilhelm Wundt 1832-1920 who coined the phrase physiological psychology. He was a dualist and parallelist in his theory of mind and body. Darwin and his famous cousin Francis Galton 1822-1911 gave the idea that mental characteristics,

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1. Edwin Garrigues Boring, Herbert Sidney Langfeld, and Harry Porter Weld, Foundations of Psychology, pp. 7-11. New York: John Wiley and Sons, 1948.

especially emotional behavior, might be inherited from animal ancestors. Several American investigators, especially Thorndike, became interested in mental evolution and so in animal psychology. From these points of view it is easy to see how the various schools of psychology developed.

A look at four schools of psychology will give some basis for the choice of theory selected for this study.

Introspective Psychology.--This school of psychology was introduced by Wundt. It was a kind of introspective analysis of consciousness, a kind of mental chemistry. It regarded consciousness as an important object of study. Tichener 1867-1927 introduced it in America. Today, no one calls himself an introspectionist, or a behaviorist, but everyone needs to know about the older schools to understand the modern.

Functional Psychology.--Due to the influence of Darwin, it became natural to base psychological study on the idea of survival of the fittest. William James 1842-1910 first reacted against the introspectionists. He believed that psychology should deal primarily with human abilities and capabilities. John Dewey 1859-1952 established the school of functional psychology about 1896 and it was carried from there by James R. Angell. This school was dualistic, interpreting consciousness in terms of its use, and it provided a friendly background for both mental tests and

animal psychology. The school might have evaporated when behaviorism entered the picture, but the spirit of the school is still the dominating force in American psychology.

Behaviorism.--Behaviorism was founded in 1913 by John B. Watson who had been experimenting with rats under Angell. His early interest was animal psychology and he argued that you never know much about the consciousness of a rat although you can study his actions and responses. He laid down the law that psychology should deal only with behavior. Behavior was consistent with mental testing and animal psychology. The study of the consciousness was still further depreciated by the work of Freud 1856-1939. His doctrine began directing thinking toward unconsciousness.

Gestalt Psychology.--The success of behaviorism was declining somewhat with the appearance of the Gestalt theory in Germany about 1912. The new movement began to create interest in the United States by 1920. The leaders came to this country in 1930, giving Gestalt psychology its start. By the late 1930's this school had succeeded in getting the attention of the psychologists directed to larger systems of interrelated facts.

Modern psychology for the most part dropped the ism. One seldom hears a man spoken of as a behaviorist or an introspectionist. It has all become a part of modern psychology. Some behaviorism exists as such, as does

introspection. The Gestalt theory has had accepted the tenet that too much analysis gives false results, and that wholes are safer objects to study than parts. What is good and enduring of all these schools of psychology has stood the test of time and experiment, and it now becomes modern psychology.

The Need for the Study

In making a transition from one theory or school of psychology to another, there is bound to be corresponding changes in methods and the use of principles in the practice of teaching. Some systems and some individual teachers are still basing their practices on a strict behavioristic basis. Their use of other methods is limited because of the lack of understanding of other theories.

There is within the structure of the thinking of each student teacher always the question: "How can the theory which is taught be put to a practical use at the time the student himself becomes the teacher?" Is the theory only a mental exercise and a time consumer which is laid aside with the diploma? Surely, with the study of education, one should be able to reap some benefits which will continue to aid, direct, and guide him as the task of teaching continues. It was with this thought in mind that the study of the organismic theory of learning began and has continued

throughout the year as a directing and motivating force, binding together the experiences of the writer during the year devoted to the study of what and how to teach.

An examination of the materials and writings on the teaching of elementary science has led the writer to believe that much of the confusion or lack of understanding on the part of the classroom teachers may be attributed to the development of the procedures in an era when such procedures were conceived largely in terms of training teachers what to teach and how to teach.

The foregoing treatment of the schools of psychology indicates much disagreement about the nature of the learning process. Although these psychologies were treated in order of their evolution, many ideas, principles, and concepts from each remain with us today. The elementary teacher has found herself at the storm center of rapidly changing points of view regarding emerging concepts of child development, learning, choice of basic concepts to be taught, and how to teach them. It is as though all the elements of beliefs, actions, and understanding were heaped into one pile, out of relationship one with another.

While the need for science teaching is universally granted, there has been little critical analysis to bring it into the curriculum in a logical and practical way. It seems important at the present time that a systematic investigation

is needed to cut through the confusion and portray elementary science in its important role.

This study does not hold that a Gestalt or organismic theory is the answer to all problems, but the assumption is made that a good understanding of the principles of Gestalt and further carrying out of these principles as they apply in the so-called "field theory" will give the modern teacher a foundation of psychological principles which will enable her to understand the child, his interests, how he learns, and in what ways the materials should be presented for effective learning.

This is an opportune time in educational theory. These so-called schools are no longer trying to prove their good points and reject those of some other school, but all groups are uniting on the accepted, on the proved, and on the practical principles of all the schools. It is our purpose to clarify the principles of Gestalt and the organismic theory and to put them into a form which may be easily understood by the classroom teacher and to point out the relationships to present day teaching procedures with an attempt to demonstrate how they may be applied for more effective teaching.

The Scope of the Study

The scope of this study will be limited to the description and analysis of the organismic theory of

learning, of the theory of teaching of science, and the application of these principles and theory to teaching of science in the elementary school. An attempt will be made to obtain the best information available from research studies and from the opinions of educational authorities both in the educational psychology and science fields. This information will be carefully analyzed, and the rules of logic will be followed in bringing the various principles into a systematic relationship. Once aligned, these principles will be applied to the teaching of a specific unit in the area of science.

No claim is made that the theory presented is the only theory of general application to the teaching of science or that the science content selected is necessarily the only choice for the application of the theory. Several approaches to the integration of the theory with practice were considered; however, it was felt that the best demonstration of the principles could be secured by working out a specific unit.

At best, the conclusions reached will be tentative and further elaboration, testing, and evaluation will, no doubt, reveal discrepancies which would suggest further revision. No attempt will be made here to validate the study by experimental method. Under the circumstances no class is available for experimental purposes, and there is

a lack of time for this procedure. The study then represents merely an attempt to arrive at a dependability beyond that already reached.

In limiting the application of the theory to the teaching of science, the writer does not intend to suggest that such theoretical application might not be equally as effective in other areas of instruction. It is not suggested that application could not be made to the teaching of science at levels other than the elementary. Waters makes an application to secondary science.[2]

Definition of Terms

A definition of general terms will not be made here as it is thought best to define the terms as they are introduced in the text so that they may better be understood in their context. The professional use of such terms as are needed will be made by reference to Good's Dictionary of Education.[3] The two following terms will be defined because they are not in the average vocabulary and they are basic to this study:

1. Gestalt. The capitalized noun refers to the theory that all mental experience comes organized in the form

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2. Eugene A. Waters, Educational Theory and Science Instruction. New York: Bureau of Publication, Teachers College, Columbia University, 1942.

3. Carter Victor Good, Dictionary of Education. New York: McGraw-Hill Book Co., 1945.

of structures which, when relatively incomplete, possess an immanent tendency toward their own completion. It rejects the assumption that isolated local determination of psychic processes ever occurs and maintains all organic and inorganic stresses tend toward an end--the state of equilibrium. In its broadest sense, the doctrine of Gestalt is a philosophy of nature and holds for all sciences.... The external universe, life and mind are composed of gestalten.[4]

2. Organismic theory is the interpretation of behavior in terms of the structure and function of the organism as a whole; emphasizes the role of the anatomical and psychological backgrounds in the interpretation of conduct and assumes that the directive forces for all reactions follow generalized laws of energy system and that the organism and its environment constitute an integrated system.[5]

Organismic theory as a term comes to mean the same as Gestalt theory, and the terms will be used interchangeably. This point will be given a more detailed discussion in Chapter II.

Basic Assumptions

It is an experimental truism that research of any type must start from a base or foundation called an assumption. The investigator is not obligated to prove the assumptions upon which his study is based, but his entire study design is subject to challenge if the assumptions prove unacceptable. Consequently, a great deal of care has gone into the selection of what appears to be the basic

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4. George W. Hartmann, Gestalt Psychology, p. 173. New York: Ronald Press, 1935.

5. Good, op. cit., p. 319.

assumptions of this investigation. The following assumptions are accepted as true and basic to this study:

1. It is best to make the application in terms of a single consistent theory. This theory is defined in terms of accepted authorities.

2. Application of the theory for science instruction can be made through the unit method of teaching.

3. Problem-solving and scientific method share essential elements and are basic to science instruction.

4. Science instruction is a part of the general education core for all elementary pupils.

5. At the elementary level science includes many topics from safety, conservation, transportation and communication and lends itself to an integration or fusion with other instructional areas.

Sources of the Data

The chief sources of the data are six:

1. Texts of general psychology, the more recent of which contain references to original works of Max Wertheimer, Wolfgang Kohler, and Kurt Koffka.

2. Reading of available works of Wertheimer and Kohler.

3. Basic texts and teacher guides for elementary science.

4. Study of articles appearing in current periodicals and yearbooks of the National Education Association.

5. Books written for children dealing with science and related subjects.

6. Study of prepared courses of study of science.

Analysis of the Study

A number of plans and procedures have been worked out in the organization of the theory so that it might be studied and the principles evolved in this process be applied to a specific unit. It is the purpose in Chapter II to discuss the parts of the theory as it evolves from the writing of the founders, such as Kohler, Wertheimer, and Koffka, defining the terms and making it as understandable as possible. Their concern was not with putting it into a form useful to a teacher, but in establishing the principles based on experimental work. There is a certain amount of defining and clarification of terms, so that the accepted theory may be brought into harmony with the accepted procedures used today.

In order to show relationships which might exist, it has been necessary to examine the accepted teaching practices which are in vogue today. For this part of the study, the works of leading educational psychologists and writers of science texts have been studied. The comparison of

organismic theories and teaching principles will be the concern of Chapter III.

In view of the fact that no experimental work has been done in connection with this study, a telephone unit which has been developed in two different schools, at two different grade levels has been chosen for demonstration. It is hoped that it may be taught as a continuation of this study in order to determine how well the applied principles work out in actual practice. It may be of some interest to note that in one situation the selected unit topic was used as a social studies problem, and in another instance as a language arts problem. Here the topic will be used as a science problem with emphasis on preserving the benefits and applications from other fields of interest. The concern of Chapter IV will be the application of the principles developed to a unit on the telephone.

It is apparent that a study of this nature will give rise to objections that the methods used are not objective and that such a study is not scientific. It is conceded that in such an investigation, one cannot achieve a level of objectivity equal to that obtained in an experimental study; but the worth may be determined here in the interpretative quality of which, as has been stated, there is a different felt need.

Such conclusions as are reached will be in the nature of a hypothesis. Problem-solving procedures require testing and, as indicated in the scope of the study, the hypothesis may be tested in terms of its logical development, consistency, and comprehensiveness. All conclusions, whether scientific or philosophical, are necessarily tentative. The question is, "Does the student teacher find what she seeks, an understanding of the theories of learning which may find direct application in her classroom procedures?" It is hoped that until such a time as a practical application can be made and revisions undertaken that the tentative hypothesis as developed can serve as a valuable device in stimulating and indicating direction for further needed research efforts in this field.

Summary

The basic plan for this study has been described, and a discussion of the schools of psychology which have influenced the development of the organismic theory have been outlined. As the study continues, an application and comparison of the theory selected for consideration to the accepted theories of learning, which are the basis of teaching procedures, will be made. A historical background of the Gestalt theory will be given to insure proper setting for the development and analysis of the principles. Chapter II will be concerned with these aspects of the study.

CHAPTER II

DEVELOPMENT OF THE ORGANISMIC THEORY

The purpose of this chapter is to present a historical background of the Gestalt theory of learning, showing its dependence on the previous schools of psychology as well as the steps of its own evolution from a concept of perception to present day acceptance of its basic concepts. A statement and discussion of the accepted principles will be made from the point of view of their possible application to the theories of learning. Through tracing the development of the concepts it is hoped that an understanding and appreciation of the significant aspects of the theory will be established.

Historical Development

The Gestalt theory dates back to 1890, but because of the time necessary for translation from its German origin its general acceptance was slow in the United States. Visual perception was the basis of its early development. The general idea was that the object perceived is more than just the sum of its parts. From this idea of wholeness, the noun Gestalt was selected as there is no word in English which exactly expresses the idea. It has no exact translated meaning, but in general the term configuration may be used. The founder, Wolfgang Kohler, objects to this term because

of the fact it carries a connotation of putting elements together in a certain manner. True, Gestalt carries the idea that when the whole is considered first, the parts assume their proper relationships, and it is not as if the whole were merely the sum, for then each part would be individual in character and unrelated to other parts.

The stress of the whole was made by early Greek thinkers. In general, the Pythagorean answers were the most successful, and history shows that these answers were most closely followed by men of other eras. The mathematical approach has stood to be the most successful in the explanation, and the Platonists have taken this over as a clue to the explanation of structure. Platonism contains many passages which may reasonably be regarded as the foundation stones for a Gestalt theory.[1]

In modern times, it is noted that Hartley pointed out that tastes and smells may combine in such a way as to give entirely new qualities to the original elements. This may be illustrated in drinking of hot tea and iced tea, the temperature here being an influence. Von Ehrenfels' principle was an honest recognization that there is something lacking in the explanation of the whole by making a complete

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1. Gardner Murphy, Historical Introduction to Modern Psychology, pp. 284-285. New York: Harcourt, Brace and Co., 1951.

analysis of its parts. He used the term "Gestaltqualitat" to describe that which a melody, or a painting, or a sonnet possesses which is not given in the component tones, colors, or words. Kohler refers again and again to these illustrations in explanations of the Gestalt psychology.

In Germany, Max Wertheimer with Wolfgang Kohler and Kurt Koffka came upon a different way of viewing the problem. The problem was the perception of motion. This led to the founding of two laws which follow if the relation of the whole to the parts has been properly stated. The first was the law of membership character. The Gestaltist insists that the attributes or aspects of the component parts in so far as they can be defined are defined by their relationships to the system as a whole in which they are functioning. In place of saying only that the whole is more than the sum of its parts, Wertheimer notes that if unstable equilibrium and unstable structure are given, one can predict from the knowledge of the laws of structure what kind of organization must supervene. It will be that kind of organization which is most orderly, most stable, most comprehensive. Here he introduces Prananz.

The new doctrine formulated by Wertheimer was then set forth by Koffka and Kohler. Marooned in the Canary Islands during World War I, Kohler carried out a series of experiments to test the Thorndike hypothesis that animal

learning depends simply on trial and error. His work was with apes. With a true scientific approach he proved that the apes, no less than men, come to solutions all at once by a process of integration or insight in which not a series of separate clues taken in a series but an integrated system of clues is responded to all at once.

It was in 1922 that the "Gestalt-Theorie" appeared in the United States through a paper read by R. M. Ogden. The response was hesitant and uncertain. There were masses of experimental materials available. Koffka and Kohler were soon present and their theory began winning much interest.

By the mid-thirties Gestalt psychology had become a complete system. In the same period appeared J. R. Kantor's organismic psychology in which the interdependence and formal unity of all organic responses is noted, but with emphasis upon objectivism. In 1933 the movement became centered in the United States owing to the departure from Germany of Wertheimer and others. The information moved rapidly westward as the doctrines were published and distributed in American journals, and research was done by young research psychologists. It was the tendency of the Americans to regard the Gestalt psychology as an interesting and valuable but not a final or complete solution to primary problems.

The weakness of the theory is that in one part all the elements or component parts of a total need to be seen

in their interrelations in order to understand the structure. In another place one discovers that there are no elements or component parts. This issue has stood thus for about twenty years, yet Gestalt has invaded every phase of psychology and is to be reckoned with in any modern study. In general the trend is clearly in accord with general trends in the fields of physics and biology. While it is not a total explanation of facts, it certainly explains many factors which heretofore went without logical explanation.

The Gestaltists used a word which was not included in the views of Thorndike--insight. This word, which can be understood by psychologists, educators, and laymen, encourages the advancement of meaningful and functional learning. Hilgard expresses this part of the history thus:

> While the attack by Kohler and Koffka was chiefly upon Thorndike, it came at a time when American psychology was in the grips of a confident but somewhat sterile behaviorism.... Therefore the restoration to sanity represented by the insight experiments gave new hope to teachers and others who saw thinking and understanding return to respectability. Insight was not a new discovery--it was a return to a conception laymen had never abandoned. Nobody uninfluenced by particular doctrines would have denied insight as a fact--yet it took Kohler to restore it as a fact in American psychology. It was in some respects, time for a change, and Kohler's experiments dramatized release from the negatives of Thorndikian and Watsonian thinking.[2]

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2. E. R. Hilgard, Theories of Learning, p. 179. New York: Appleton-Century-Crofts, 1948.

The Gestalt theory provides for the acquisition of specific facts and also considers creative thought and expression. As the theory developed into this phase, it became fused with the organismic view. By the mid-thirties, with the work of J. R. Kantor, the terms Gestalt and organismic came to be accepted as one and the same. In this study the terms are used interchangeably. As the broader aspects of the applications came into being, there was added the concept of the "field theory," the origin of which Hartmann explains as follows:

> Field theory in its original and most universal meaning refers not primarily to a special system of psychology, but to a comprehensive world view that is essentially a physical philosophy of nature. Although many of the components of this thought pattern appear in the intellectual life of earlier centuries, this orientation did not mature in Europe, notably Germany, until the twentieth century and it has been effective in American psychological circles only since 1920-25. The 'frame of reference' (itself a field concept) which it employs is unfamiliar to most laymen and teachers in the United States at present, partly because the basic ideas themselves do not merge readily with their historically established and dominate 'appreciative' background and partly because genuine vocabulary or language conceptual difficulties have hampered every communication. Nevertheless, field theory in one form or another is being understood and applied by an increasing number of individuals.[3]

Raymond H. Wheeler places a strong biological flavor upon his Gestalt theory which justifies its being called an

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3. George W. Hartmann, "The Field Theory of Learning and Its Educational Consequences," Forty-First Yearbook, Part II, National Society for the Study of Education, The Psychology of Learning, Bloomington, Ill., 1942, p. 165.

organismic theory. As Hilgard suggests: "Wheeler became the spokesman for the embryological underpinnings for gestalt somewhat as Kohler was the spokesman for its support in the physical sciences."[4] It is this marriage, so to speak, of the basic concepts set forth by Gestalt, principles set forth by field theory, and use of the term organismic, which gives rise in this study to the use of the terms Gestalt or organismic in reference to the developed theory and its principles.

The historical discussion of the organismic theory of learning would be incomplete without the mention of the work and contribution of Kurt Lewin. He became a useful and intensely creative member of the Gestalt group at the University of Berlin. He carried out a series of studies of the dynamics of memory. He began to think more and more in terms of events occuring in a kind of space which had something to do with physical space. Both in Germany and in the United States, Lewin directed his attention to studies of child behavior, especially to nature of tensions and barriers. These studies led into the field of social psychology, giving a basis for work in group dynamics. Of this development, Murphy writes: "Lewin's influence on social psychology is

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4. Earnest R. Hilgard, Theories of Learning, p. 234. New York: Appleton-Century-Crofts, Inc., 1948.

huge, on child psychology large, and on general theoretical psychology considerable."[5]

The consideration of the background of the organismic theory justifies the purpose of this study--to come to an understanding of the principles which have been accepted over a period of years, through the experimental work as well as the personality impact of the founders. Of special interest are the world events and war situations which brought into the United States the leaders and founders. The results are far reaching and of great influence in our present day educational practices. An attempt to show these developments will be made as this study continues.

Discussion and Interpretation

There are four main principles accepted as basic in the study of Gestalt theory. It is again emphasized that in making such a division, it is done only for the purpose of explanation. The principles in action are in themselves acting in unison. A treatment of these principles follows.

Principle of Integration.--The principle of integration is the most general and inclusive of the four. In each situation, an individual responds as a total being to his

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5. Gardner Murphy, op. cit., p. 304.

total environment through a process of interaction of the two, resulting in a modification of each.

The term situation applies to the exact moment when the organism reacts to a particular environment. It is the point at which the organism becomes conscious of a perplexing set of factors which stand in its way. A satisfactory reaction is necessary. Total being refers to man in his total personality, made up of his physique, mentality, emotions and so on. The term environment covers all the physical and phenomena which act upon the individual from without. Interaction is the relation between the individual and his environment when the activity of each is dependent upon that of the other. The result of this interaction is modification, its extent being determined by the degree that the environment has been changed for that individual. Hilgard explains such interaction as follows:

> In any case the relationship between wholes and parts is to be taken seriously as a relationship. It solves the problem no more to say that wholes have primacy over parts than to say wholes are composed of parts. There is an interaction between the whole and parts which constitutes the real problem, and whether one starts with wholes or starts with parts, there will undoubtly be some kind of meeting place as the essential interaction is recognized.[6]

In the preceding discussion, integration has been treated from a general point of view. Consideration will now be given to significant aspects of this principle.

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6. Earnest R. Hilgard, op. cit., p. 244.

Concept of the whole.--The most important notion of the Gestalt psychology is its insistence upon the concept of the whole. The basic urge of all mental life is toward a moving equilibrium in which the individual, as a whole, deals with the environment as a whole.

In teaching, the child must be considered as a whole. He is not just a seventh grader but an individual who has been reared on a farm, or in a small town, or in a city. He has a background of American forefathers of several generations, or he may have come recently from a foreign shore. He may be a child of parents who are willing and able to supply his every need, or he may be a child who has had little or no satisfaction in having his needs met--even those needs which are considered basic. The richer and more varied the child's experiences are, the greater response he will be able to give to the suggestions made by the teacher. Each individual, in order to build a unified life and personality, should live a life rich in depth and variety of experience and should learn to adjust himself to each situation as it arises. The teacher has no way to select the environment in which his student will find himself as the years go by, but he can in some measure give him rich and varied experiences which may aid him in making the adjustments.

The process of interaction.--There are two important factors within the process of integration--the individual and the environment. That the environment is ever changing must also be recognized. To bring about a condition of equilibrium, there are several things the individual may do if he has learned well how to meet a situation.

1. He asks to know all the factors which he can locate and which he thinks are necessary to his meeting the situation.

2. He takes account of their value to him considering what he thinks are of worth in his attempt to deal with the situation.

3. He formulates a plan of action.

4. He accepts the plan as his way of meeting the situation and decides to act in accord with it.

5. He acts upon this, the result of his own thinking.

6. He accepts the consequences and assumes the responsibility for what he has done. He tends to use it in other directions if other situations are sufficiently like the original one.

The concept of modification.--The individual is modified or changed each time he contrives to meet a situation. As he meets each new situation, his sensitivities become modified. This interaction brings about two types of

adjustment: the adjustment of the environment, or the adjustment of the person to his environment. The goal of all interaction is equilibrium.

The Principle of Adjustment.--Each situation and response are of incomplete structure tending toward one end--a state of equilibrium, the process of interaction being one of adjustment in order to achieve this dynamic equilibrium. The keynotes of its principles are the incompleteness of every situation and of every response, and the tendency toward the condition of equilibrium by means of adjustment.

Perfect equilibrium cannot be reached by a living person, but each temporary state of equilibrium attained is dynamic, being a step forward toward a greater or ultimate equilibrium. It would appear that part of the process of teaching would be to willfully bring about a situation which would break up this state of equilibrium within students. This would cause them to come out with effort to again bring about this state of equilibrium. In the process the student will be learning and gaining for himself new methods and ways of looking at things. These experiences will prove valuable in a situation which has like characteristics.

All adjustment is not unconscious. The initial step may be taken unconsciously, but before another level of adjustment can be reached, there occurs a period of integration. No matter how good the school may be, the student's

education is in his own hands. All education must, in this sense, be self-education. Conscious adjustment cannot take place without self-knowledge of one's own relation to the world and other people. Learning is creating new ways of adjustment. This adjustment is described by Ruch:

> The interaction between man and his environment is a continuing attempt on the man's part to adjust--to overcome inner and outer obstacles to the satisfaction of his biological and social needs. In the human organism, which is in contact with its normal environment, many activities are going on at the same time, yet man behaves as a whole in the sense that he does one main thing at a time. Under normal conditions our activities are integrated into a smoothly functioning whole. Behavior that represents good adjustment in one culture is often ineffective and out of place in another. "Good adjustment" must always be defined in terms of the particular demands an organism is meeting.[7]

There are some questions which may be asked when a study is made of the principle of adjustment. The incompleteness of every situation and every response produces conditions necessary for adjustment. The <u>situation</u> in this case may mean the point of activity at which there must be interaction between the individual and his environment. Situations, on the other hand, become experience only when the responses are completed and when equilibrium exists as a result of the interaction. Why must the equilibrium be of a dynamic nature? The importance of the "dynamic nature" is attested by Rees:

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7. Floyd I. Ruch, <u>Psychology and Life</u>, pp. 24-25. Chicago: Scott, Foresman and Co., 1953.

Life, to the one who lives, must mean a continuous search through the medium of experience for an even greater equilibrium. Perfect equilibrium cannot be reached by a living person, but each temporary state of equilibrium attained is dynamic, being a step forward toward a greater or ultimate equilibrium.[8]

The concept of equilibrium.--This concept in Gestalt assumes that all mental life is a continuous process and consists of a dynamic rhythm of disequilibrium-equilibrium, rather than being a simple affair of a response to the impact of external stimuli.

From Gestalt the conclusion may be drawn that it is through this dynamic rhythm of disequilibrium to equilibrium, of continuing adjustment, that the individuality or self emerges. Whenever the question of self enters into this study, it must be considered from the standpoint of adjustment. The individual does not adjust in a static but in a dynamic manner.

To prove of value, each step a person makes toward a new experience must be in self-discovery. This part of our learning is a factor which is not often considered. It may be that illusive thing which defies evaluation. It may be something a student gains in his pursuit of knowledge of which he himself may never be aware. It may even be carried

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8. Helen Evangeline Rees, A Psychology of Artistic Creation, p. 89. New York: Bureau of Publications, Teachers College, Columbia University, 1942.

a step further, the incompleteness of each situation and response and the tendency toward a state of equilibrium may lead toward an understanding of adjustment continuing to the means of attainment.

The concept of adjustment.--The individual may through the process of interaction gain adjustment which changes both himself and his environment. The question then arises as to how much of this adjustment is basic to the setting up of goals and desired outcomes. The process becomes conscious and the striving to attain the goals becomes a conscious effort toward equilibrium. The choice made by the individual as to what part he will choose or which phase of work he is most interested in is more often an unconscious adjustment. In conclusion, it might be said that major adjustments are made unconsciously with realization following as suggested by Rees:

> The purpose of all adjustment is greater integration of personality; the major adjustment results from raising the level of integration through many minor adjustments which work toward this condition of equilibrium. Further adjustment always depends on the quality of past integration.[9]

Every living person is faced with a continual process of adjustment which must be made in order that person may continue to live. As the individual faces a new situation, he finds an element of incompleteness but he also finds that

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9. Helen E. Rees, op. cit., p. 106.

it possesses the tendency toward completeness which has been called equilibrium. This process then of resolving equilibrium out of the condition of disequilibrium becomes adjustment.

The Principle of Purposive Differentiation.--A state of equilibrium is the result of the explication and realization of an intelligible goal of action with a tendency toward a resulting satisfactory feeling-tone.

James Russell Lowell once said, "A man may have ever ever so much in him, but ever so much depends on how he gets it out." Activity is pointed toward a goal real or apparent at which behavior is better coordinated. Four essentials in attaining equilibrium may be considered.

Interaction and goal-seeking.--The goal of any activity is not to gain and retain a state of constant equilibrium, but rather to reach toward an even greater dynamic equilibrium. The goal set up may be the same for several individuals, but ways which the goal may be realized and the interaction of each individual will be unique. It is necessary to have actual interaction before any adjustment realization of the goal may begin. Interaction is a universal activity--the basis for all behavior of all people and all ages. This interaction may serve as a means of finding one's self and set upon one's self the task or means of completing the task at hand. The interesting thing is that the

interaction may take place without the knowledge of the individual, in that not until later does he point out that this particular incident which started him, for example, making a stamp collection. The motivation and the function of self-motivation finds explanation in this part of Gestalt.

Explication of an intelligible goal of action.--There is a period of turmoil, a time of "struggling and toiling" in which a person develops or discovers the goal of action. In the steps of the thinking process it seems this might be represented by the identification and statement of the problem. The individual must link the person and his environment. The learner must meet reality; the dream leads only to maladjustment and disintegration unless it is translated into life experiences. This may mean frustration. Sometimes there is a waiting period before these goals become visual.

The realization of that intelligible goal. When the definite goal is identified, then there is an immediate beginning of process which seeks to realize the goal. The approach to the realization of a goal is synthetic in nature. The foundation was laid in interaction and explication, and from then on it becomes a matter of completing the framework. There are phases of activity present in the realization of the intelligible goal and they may be divided into several parts.

1. Purpose and goal. The purpose and the goal go hand in hand and may be realized only as the adjustment to the environment is realized. Some are too eager for the results, for example, the young girl eager to make a dress may try to put it together with haste and carelessness which would result in a dress which in no way would represent her purpose or first goal.

2. Form or composition. Form is necessary to express life. The command of form does not come easily. It may be this part of a work or study which takes an important role in the realization of the goal.

3. Elaboration. In the realization of the set goal, ideas must be added to ideas and gathered from all experiences as the process of elaboration takes place. It may be considered as a growth process. Examples of this may be readily observed in group work where a suggestion from one member of the committee may lead to a whole new development or elaboration of the plans used in working out a problem.

4. Procedure. There is perhaps a greater variation here than in any other place as the steps are made toward the realization of any goal. One person proceeds in one way; another finds another system or method. An examination of the procedures used in teaching, for example, will produce many varied means. Thus, the procedure toward realization of any goal will depend upon the individual. It may be said

that procedure is as unique as the individual is unique, is as variable as the individual is variable, and is as satisfactory as the personality adjustment of the individual is satisfactory.

5. The element of emotion and the resulting satisfaction feeling. There is little known of the actual emotions except in relation to experience, and Gestalt recognizes no emotion except in this connection. It might be stated that an emotion is not a separate mental state, but is rather an aspect of the total experience and behavior of each individual. John Dewey says, "An emotion is implicated in a situation...." The emotional attitude which is taken by a person as he works determines the extent to which his adjustment and integration take place. There is a pride and delight in work which certainly is a contributing factor and does foster the satisfaction feeling which is obtained by a completion or realization of the goal. This desired feeling of satisfaction may not come at the completion of one's first attempt but may be delayed, making repetition often necessary. The condition of maladjustment may bring about a feeling of dissatisfaction. This feeling of dissatisfaction may also result in postponing or even completely abandoning a project. That satisfaction comes at points of adjustment can be safely concluded.

The Principle of Pragnanz.--The on-going process of achieving equilibrium will always be as good and simple as prevailing conditions allow--depending upon the frame of reference of the individual.

Throughout the discussion of the principles of integration, adjustment, and purposive differentiation there has been a constant use of the terms environment, surroundings, and circumstances. All of these influences are so important psychologically that they justify separate treatment. They will be discussed as the principle of Pragnanz.

The term Pragnanz was first proposed by Wertheimer to denote the most characteristic form which a structure can assume and toward which, according to Kohler, every form or structure tends. Wertheimer used the word in German, and it is inadequately translated as "pregnancy." Its truer meaning is "compact but significant." It suggests the direction of events. Psychological organization tends to move in a given direction, always toward the "good." A "good" gestalt has such properties as regularity, closure, and good continuation.

The on-going process.--The adjusting process has been pointed out as an "on-going process" in search of a state of equilibrium demanding the interaction of the whole individual within the process. The process is only on-going if each level of adjustment achieves a dynamic equilibrium and serves

as a stepping-stone toward an ever forward moving goal of higher adjustment.

The direction which this organization takes is of primary importance. Gestaltists say that it always moves toward the most stable form of equilibrium, and that it is the tendency of every individual to follow the direction which demands the least amount of effort, energy, and activity. Max Wertheimer expresses this idea as a tendency to structural simplicity as follows:

> Such issues play an important role in the personal, social, and political field. Often in political discussions, in political views, one realizes the impact of the Pragnanz principle in the almost irresistible tendency, the strong desire to get at a simple, decisive structurization of the field, to get clear-cut orientation, to act sensibly, not to be blind, not to act fortunatusly. Men are unhappy if the complications of such features befogs the issue; they long for structurally clear views in which the items find their clear place, function and role, do not disturb the main lines and the resulting direction of views. This tendency to structural simplicity is deeply connected with the thirst to get at the true structure.[10]

Sensitivity. The principle of Pragnanz states that this on-going process will be as good and simple as the prevailing conditions allow. The first of these prevailing conditions then is the sensitivity of the individual. The individual becomes sensitive to the factors which will aid him in his search. This activity may begin in childhood. Environment may prove an important factor. Some forms of

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10. Max Wertheimer, Productive Thinking, pp. 199-200. New York: Harper and Brothers, 1945.

sensitivity may grow out of maladjustment. The role of guidance in our schools may be related to the fact that influence of individuals may strengthen sensitivity.

Environment as a control.--The environment is second only to the individual in determining the direction his efforts will take. Companionship is one of the most favorable factors in environment. Prevailing conditions are environmental. It affects the individual from early life, never ceasing as long as he lives. It is the aim of every teacher to create an environment in which learning can best take place. One of the chief factors in a child's development is understanding companionship by his teacher.

Frame of reference.--As the individual interacts with the prevailing conditions in his environment, he finds it necessary to make certain choices both in the light of his tendency toward equilibrium and of his values. The values have been called "frame of reference." Kilpatrick uses the term "Map of Values" and it is defined by McGauhby as "Combination of criteria that is to be accepted as a basis for judgment." Values, interests, concepts, habits, skills, and attitudes which a person possesses have a place in his frame of reference. Johnson expresses it thus: "The frame

of reference of an individual is his background or context of perception or judgment."[11]

Hartley and others make the following statement in regard to frame of reference:

Tendency to pattern the percept in terms of the individual's frame of reference may be observed. An experiment might give insight of the operation of attitude as well as give insight into the nature of the frame of reference and its state of development.[12]

Quoting from Johnson again:

All scoring schemes, whether phrased in inches, ohms, or IQ's, have the same function of supplying a standard frame of reference, which is a definite help in the evaluation of any object or thought.[13]

Judgment then like perception operates within a figure and ground pattern; the background then may be called the frame of reference. A line will be judged long or short in relation to other lines in the perceptual field, or perhaps memory. When a man says, "This is an excellent cigar," he is unconsciously comparing it with other cigars he has smoked.

Frame of reference then appears to be of significance when teaching methods and procedures are used. The same

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11. Donald Johnson, Essentials of Psychology, Glossary p. 462. New York: McGraw Hill Book Co., 1948.

12. Eugene Hartley, Herbert G. Birch, and Ruth E. Hartley, Outside Reading in Psychology, p. 196. New York: Thomas Y. Crowell Co., 1953.

13. Donald Johnson, op. cit., p. 229.

material presented to a group may be interpreted by the students in many different ways, depending upon the individual's frame of reference.

Summary

It has been the purpose in this chapter to present a historical background of the theory of Gestalt and to give evidence which justifies the use of the terms Gestalt theory and organismic theory interchangeably. The names of Max Wertheimer, Wolfgang Kohler, Kurt Koffka and their contributions to the development of the theory were introduced. The part of W. D. Ogden and Raymond Wheeler in bringing about the acceptance of the principles of the organismic theory in the United States was discussed. The work of Kurt Lewin and the results of his work which are today having great influence in the field of social psychology were introduced.

An understanding of the results of the development of the theory because of world events was discussed, such as Kohler's work during World War I and the banishment of the Gestalt leaders during World War II to the United States. These two events had great impact on the spread and understanding of the principles of this theory as applied to education and teaching.

In the second part of this chapter the basic concepts of the Gestalt theory were discussed in detail, showing

somewhat how the theory grew from a concept of perception to an application of principles to the entire field of psychology. These four principles were discussed:

The Principle of Integration

The Principle of Adjustment

The Principle of Purposive Differentiation

The Principle of Pragnanz

It is hoped that this chapter will serve as a foundation and reference for the remainder of the study. An attempt will then be made to relate these principles with the theories and practices used today in elementary teaching with special emphasis on the teaching of science.

CHAPTER III

SOME APPLICATIONS OF THE THEORY TO SCIENCE TEACHING

The purpose of this chapter is to present some accepted theories of learning and procedures used in the teaching of elementary science in order to compare them and define them in terms of the principles of the organismic theory. The second part of the chapter will deal with the relationships of the organismic theory to basic issues such as the nature of the child, the scientific method, motivation, problem-solving, objectives in science teaching, science activities, and evaluation procedures.

Science teaching resembles any other teaching in its application of the principles of learning. It is reasonable to suppose that the basic laws of learning, or at least the accepted theories of how learning takes place, would not differ from those of general education. It is then the purpose of this section of the study to examine the theories of learning and to seek out points of correlation with the organismic principles. The differences or non-agreements will also be considered.

There is no assumption made in this study that organismic theory is all inclusive and meets every need, solving every problem which might confront the teacher.

However, there is an increasing satisfaction with the theory as evolved and a feeling that it does give a basis for many present day methods in teaching of science as well as in other areas of instruction. There will be an attempt to develop the hypothesis that an understanding of the organismic theory will mean a better understanding of the principles of learning. This chapter then will be the application of the organismic principles to the principles of learning and to several important ideas involved in science instruction.

Some Principles of Learning

The statement of the principles of learning is not original. It is the purpose here to take the accepted principles of learning and compare them with the theory under consideration and not to evolve the principles from the theory itself. The four principles given are from Burnett.[1] They are essentially the same as those set forth by Blough.

The purposiveness of learning.--If the student is brought to understand the importance and value to him of proposed science learning, which of course can be done only if these actually do have importance and value to him as an individual, then he will have an insight into them and a

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1. R. Will Burnett, "How Good Teachers Teach Science," School Science and Mathematics, Vol. LV, No. 4, Whole 483, (April 1955), 245.

goal for learning that will produce understanding, attitudes, and skills that meet his proposed objectives and help him achieve his goals.

It is for this reason that the teacher plans and spends considerable time planning units of work and their evolution with students. Teachers must have time to learn the student's background, interests and present insights. Unless the teacher succeeds in this process of intrinsic motivation, he might as well move into other fields.

"We learn by doing" is quoted over and over, but the question "By doing what?" must come to mind. An activity to seem worthwhile to the student must actually be worthwhile. It should be shown how it can serve the present needs or the future needs of the student. Failure to do this often occurs on the part of the teacher.

In order to have a purpose in learning, problems are set up, the purpose being to solve the problem. The steps of solving give a direction to the learning and many times motivates the procedures used by the teacher and the activities carried out by the pupils.

That learning is purposive ties in closely with the discussed principle of Gestalt theory of psychology, the principle of purposive differentiation. To recall the four essentials in obtaining equilibrium gives a basis for

comparison. They are: (a) interaction and goal-seeking, (b) explication of an intelligible goal of action, (c) the realization of that intelligible goal of action, (d) a resulting satisfactory feeling-tone. Thus if the purpose is not felt or seen by the student it can be assumed that no learning takes place. The student who is not interested may be the one to whom the purpose of learning is not clear or perhaps does not make particular sense. The hypothesis which evolves at this point may be stated: Learning is purposive, and this purpose must be recognized as the learning proceeds.

The inductive process in generalization.--Generalization cannot be developed, except as empty verbalization, other than through the inductive process of studying concrete situations out of which the generalized insights may emerge.

The definition of generalization is that which comes out of concrete experiences, yet generalizations are often taught as verbalism. In other words, some teachers teach only the rules.

Insight may be defined as the sudden apprehension of meaning or as seeing one's way through, either suddenly like a flash or slowly and deliberately as a result of personal endeavor. This would lead to the realization of an intelligible goal of action. When the purpose has been made clear and the goal set up, the dynamic process for the solution of the problem swings into action. The realization of an

intelligible goal of action is not just a manipulation or a repetition of the instructor's words. This realization becomes a part of the student's thinking. It is at this point, in the opinion of the writer, that the learning takes place. It is here that the change in behavior becomes a reality.

The complexity of learning.--Learning is complex and the learner learns many things at one time, the learner acting as a complete organism.

This principle may have been lifted intact from the principle of organismic psychology which is stated as the principle of integration. In each situation the individual responds as a total being to his total environment through a process of interaction of the two resulting in a modification of each.

It may be useful at some time to break down an objective into knowledge, understandings, attitudes, and skills, but a student cannot just learn a fact, a concept, or a principle without certain changes in his total personality. The good teacher works for the optimum development of each child. Teachers are needed who have a good understanding of the principles of psychology and who have a knowledge of their subjects.

The transfer of learning.--Learning will transfer to the extent that the learner sees the possibility of the

transfer to the other situation where learning is applicable, to the extent that he has generalized from his learnings, that he understands the principles involved and to the extent that he has been given practice in making transfers.

Burnett expresses an important value of transfer of learning:

> Public education is provided at the expense of the patrons and other taxpayers so that children will mature into effective persons and citizens capable of controlling their affairs and those of a democratic society with a higher power and efficiency. This means that learning with the highest transfer worth has greatest value. Tests show that if a student cannot transfer, it is evidence that real learning has not taken place and further teaching is needed.[2]

There appears to be a wide variety of conclusions of the worth and value of transfer of learning, but consideration of the above statement will make clear that there cannot be a transfer of learning if the learning did not occur in the first place. It is accepted here as a hypothesis that learning will transfer.

This principle of learning finds its basis in the principle of pragnanz and deals directly with the frame of reference of the individual. The values, interests, concepts, habits, skills and attitudes change by virtue of the learning process. These values are dynamic and are controlled by the prevailing conditions within an individual's environment.

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2. R. Will Burnett, op. cit., p. 245.

The Nature of the Child

Education exists for two purposes: first to develop to the fullest extent the potentialities of the individual, and second to seek to promote the welfare of our society. The statement of philosophy for elementary education of the Louisville schools has this statement:

> These goals are not opposed but dependent upon each other. Understanding the child then implies knowledge of his potentialities, his needs, his interests, his desires, and his ambitions. It should also include a knowledge of his home, his background, and in short his heredity and environmental factors.[3]

This leads to the discussion of the nature of the child. The child may be characterized in the following ways: physical, intellectual, emotional, which includes moral and spiritual, and social. This is perfectly expressed in the Scriptures in Luke 2:52: "And Jesus advanced in wisdom and stature, and in favor with God and man."

Luke gives the idea of growth and development in all phases and gives them equal importance. This implies in no way that the child can in any actual way be divided, for each of the phases interacts with every other phase, but for the convenience of the study this division is established. It may be granted that a child may be overly developed in one of

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3. Frank H. Stallings, "A Philosophy for Elementary Education," Schools of Louisville, National Elementary Principal, Vol. 30-31, 1951-1952 (December 1950), 13.

these phases, perhaps to the detriment of some other side, and for a well-balanced and well-rounded person no phase should be neglected. Progress comes through growth and growth requires experience. The child must be furnished experiences and must think and act on these experiences to grow intellectually and emotionally toward maturity. Experiences must be real, varied, and significant. They must challenge observation, thinking, and evaluation.

If the effectiveness of teaching is to be improved, it is essential that the teacher understand the child. It has been assumed that at the elementary level, a child has a natural curiosity which makes him a scientist in the sense that he wants to know why and is willing to test his hypotheses. The following are some accepted facts about the nature of the child and will give some aid in the analysis of his nature:

1. The child is an investigator. This trait should be kept alive and used in science study. The child should be encouraged and his interests directed into the channels of achievement.

2. The child reacts to aspects of his environment. This carries back once again to the concept of the whole of the Gestalt theory. A child is an organism responding in many ways at once. He sees, he hears, he feels, he is interested due to his previous experiences or he may lack

interest. If action verbs are considered, one may see in just how many ways a child may respond or react. Verbs such as weigh, pull, look, cook, drive, measure, press, or lift will illustrate this point. This list might be continued and used as a means of helping children receive a concept of ways in which they may react to their environment.

3. A child's imaginative activities contribute to his growth. Imagination has a significant use in science although science might be considered exact. The ability is useful in drawing conclusions and making applications of principles studied or learned. The child can see and often reveals ways of application which a less imaginative person or teacher may have entirely overlooked.

4. A child seeks to participate in planning and carrying out his activities. The teacher can use this characteristic of children in working out units. The child should be given an opportunity for planning and a chance to try out his plans.

5. A child follows his individual pattern in developing concepts. There is no reason to suppose that all children arrive at a concept in the same way or at the same time. In evaluation, this point should be considered.

6. The child learns by doing. This doing should be with purpose and the reason or purpose should be clear. It is understood by study of the organismic theory that no

learning would take place unless there is a change in behavior. For this to happen then, the experiences are necessary.

7. The child learns through seeking to achieve purposes. Again the principle of purposive differentiation is referred to as the explanation or basis of this assumption.

In conclusion, Blough and Huggett make this statement regarding these points, "These seven points--things we know about children--are important to consider as guideposts that point the way to teaching."[4]

The Scientific Method

The elements of the scientific method can be adapted to the level of children in such a way that the children will understand the steps used and the reason for doing the work in a specific way. The children will then have some control over the situation. In order for the child to see and understand how this material is presented, it is very essential that the teacher have a knowledge of the nature of the child as he adapts himself to the use of the scientific method. The following assumptions are taken from the Forty-Sixth Yearbook of the National Society for the Study of Education:

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4. Glenn O. Blough and Albert J. Huggett, Elementary School Science, p. 58. New York: The Dryden Press, 1951.

1. Children can orient themselves to problems. This may come about by means of play, observation, use of appropriate reading materials, and visual aids. The teacher may use discussion to give point to these activities. This is not "incidental learning" which some teachers may substitute for real science experiences.

2. Children can suggest and test hypotheses. There should be some kind of discussion which will lead all children to discuss solutions and deliberate in planning. There should be a place for initiative on the part of both the teacher and the pupils.

3. Children can draw conclusions.

4. Children can focus attention on scientific method. This does not mean that other methods should be excluded.

5. The attitude of the teacher is important. If the teacher is vague and uninformed on the elements of the scientific method, no benefit will be gained by the children when they attempt to use it. There must be a willingness on the part of the teacher to have some statements challenged and investigated. The teacher must display willingness to participate in intelligent planning.[5]

The organismic theory sets forth the principle that each situation and response are of incomplete structure tending toward one end--a state of equilibrium. The process of interaction is one of adjustment in order to achieve dynamic equilibrium. It appears, during this process of adjustment and seeking a state of equilibrium, that the elements of the scientific method take their form. The way in which a child defines his problem, supplies the several hypotheses, and then goes about seeking to prove or disprove

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5. Science Education in American Schools, pp. 93-95. Forty-Sixth Yearbook of the National Society for the Study of Education, Part I, Chicago: University of Chicago Press, 1947.

his ideas, his experimental efforts toward proof, and his final conclusions are the same steps he uses in the scientific method. It is also the same process he uses as he attempts to establish equilibrium. It may be said then that the scientific method is a form or means of adjustment. Conscious adjustment occurs as the result of the individual's effort to realize integration.

It is an assumption of this study that the use of the scientific method and the problem-solving method have many essential elements in common. Further discussion of this phase will be made under the topic of problem-solving.

Motivation in Teaching Science

This phase of teaching science is treated as a separate topic because it appears to be the one basic concept of the organismic theory which is perhaps given a more logical explanation than any one offered by other schools of psychology. The goal represents the end-situation. The goal modifies the learning process through the principle of closure.[6] A discussion of closure is not given as part of the discussion of Gestalt theory but is implied in pragnanz.

Hilgard suggests that all learning is goal seeking. If the rewards are to be effective, they must really be

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6. Earnest R. Hilgard, Theories of Learning, p. 205. New York: Appleton-Century-Crofts, Inc., 1948.

identified with the goal. Feelings are not to be interpreted as motives; they are symptoms. Pleasure and annoyances should be used as signs as to how the learning process is going, not as a method to promote learning.[7]

The true reward for learning should be found in the mastery of a task in an adequate and efficient fashion. The benefit the individual gains by the mastery of that task is also a reward for learning. For example, a child learns to ride a bicycle. This gives the child confidence, and he continues to use this knowledge for pleasure and for doing useful tasks. He finds true reward for his efforts when he learns to ride. Motivation can be achieved when the learner gains confidence. Assigning him a more difficult task the next time brings the learning process under proper control. Wheeler[8] is in accord with this view.

The principle of the organismic theory which embodies the principle of motivation may be stated as follows: A state of equilibrium is the result of the explication and realization of an intelligible goal of action with a tendency toward a resulting satisfactory feeling-tone. Motivation may be defined as the process of increasing tension under which

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7. Earnest R. Hilgard, op. cit., p. 257.

8. Raymond Holder Wheeler, The Science of Psychology, p. 225. New York: Thomas Y. Crowell, 1940.

the individual learns. It may be concluded that motivation is one of the most important conditions of learning. A discussion of problem-solving seems to be in order.

Problem-Solving

Norman R. F. Maier has treated the problem of problem-solving most extensively. He cites three major ways in which problem-solving proceeds. These are quoted from Hilgard:

1. Because the organism varies its behavior, learning appears to be by trial and error.

2. On the basis of previous learning, the organism may react to a new situation as equivalent to an old one in which case problem-solving is appropriately described as transfer.

3. The third method requires spontaneous integration of two or more separate experiences. Such experiences are usually described as detour or insight experience. Maier prefers to call the process reasoning.[9]

Reasoning has as its distinguishing characteristic the reorganization of two or more isolated experiences in such a manner that a goal is achieved.

The ways in which problem-solving takes place, as suggested by Maier, may be referred back to the principle of purposive differentiation. In this principle the goal is set up and achieved by linking the purpose with the goal and by seeking a solution. This solution will involve elaboration and reasoning to the extent that the goal is reached

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9. Earnest R. Hilgard, op. cit., p. 300.

and a satisfactory feeling-tone is attained. These methods may also be related to the principle of pragnanz in that the on-going process is not only influenced by the prevailing conditions but also by the frame of reference of the individual. A similarity may be seen to the assumption set forth by Maier in that problem-solving involves a spontaneous integration of two or more experiences.

Objectives in Science Teaching

Objectives should be selected in order to guide or direct the growth or development toward desired goals. From a practical point of view, the objectives should be stated in behavioral terms so that they may constitute a basis for measuring progress toward attainment. The criteria for selection of objectives are perhaps most completely given in the Forty-Sixth Year Book of the National Society for the Study of Education and are as follows:

1. The statement of the objectives should be usable, should lead from one step to the next logically, and should result in progress toward the objectives ultimately sought.

2. Statement should be psychologically sound and based on generally accepted theories of learning.

3. Should be possible of attainment under favorable circumstances and to a measurable degree.

4. Should be universal in a democratic society.

5. Statement and explanatory context should indicate directly or by clear implication the relationship of

the classroom activity to desired changes in human behavior.[10]

The statement of the problem is important in that it clarifies the problem and points out some of the ways which will be used in going about solving the problem. The statement of objectives leads the way and directs the activities. This does not imply that a problem will be completely solved nor that any objective will be completely realized. The learning process is held to be one of growth toward the objectives rather than one of sudden and complete attainment. The objectives constitute the basis for evaluation, a process which goes on at all times.

Blough and Huggett in suggesting that the objectives are the foundation of the course state:

> For teaching of elementary science the objectives are the foundation on which we build the course of study and they should guide the teaching methods, selection of activities and the evaluating process.... Science is terribly important. It can do so much for our boys and girls if we let it. If we keep both eyes on the objectives and then challenge the things we do to see that they are directed toward achieving these objectives.[11]

Heiss and others quote the following objectives from Blough:

1. Help children learn and understand fundamentals of scientific knowledge.

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10. Science Education in American Schools, pp. 24-25, Forty-Sixth Yearbook of the National Society for the Study of Education, Part I, Chicago: University of Chicago Press, 1947.

11. Glenn O. Blough and Albert J. Huggett, op. cit., pp. 10-22.

2. Help pupils to grow in ability to solve problems effectively.

3. Study of science should develop in children a scientific attitude.

4. To open new avenues of interest and satisfactions.

5. To aid in the development of certain appreciation for the environment.12

The objectives have value in that they give direction to the learning experience. It is felt that objectives are often carefully set up and then given little consideration. If so, the real purpose for formulating objectives has been defeated.

Science Activities

In science, instructional activities play a most important role. A careful and intelligent selection of these activities should be made. Any selected activity should contribute in the following ways:

1. It should bring about a more complete understanding of an important principle or generalization.

2. It should seem worthwhile to the student. The learner should be shown how it can serve present or future needs. Teachers often fail to do this in practice.

3. Having been properly motivated, it should involve some planning on the part of the learner.

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12. Elwood D. Heiss, Ellsworth S. Osbourn, and Charles W. Hoffman, Modern Science Teaching, p. 26, footnote 7. New York: The Macmillan Co., 1950.

Most people think primarily of experimentation when science is considered. Experimenting is an important science activity and should be considered from the following point of view:

1. Experimenting

a. Experimenting should be conducted in such a way as to make children think. (The teacher should not tell the answers.)

b. The pupils should be conscious of a reason or purpose in performing an experiment.

c. Careful planning is essential.

d. Children should perform the experiment in so far as possible.

e. Many times children can originate experiments to answer their questions.

f. Experiments should be performed carefully and according to direction.

g. A control should be used.

h. Simple apparatus is more appropriate.

i. Pupils should use great caution in drawing conclusions. They should not generalize on insufficient evidence.

Other important science activities are as follows:

2. Essential activities

a. Reading is a learning tool of which all science teachers should be aware, but it should not be over emphasized. In some situations, teachers use no other activity. This deprives the pupils of valuable experiences in learning.

b. Accurate and thorough observation is very essential to good results in science instruction. A scientist has a great respect for facts as they are observed by seeing, feeling, etc.

c. The making of excursions should be done only in the interest of solving problems. Awareness of the purpose of the trip is most essential. More time should be spent in the arrangement than in the actual taking of the trip.

d. Values are gained from collecting only when the collection serves a real purpose. It is doubtful if collecting by every member of a class is essential to the learning experiences of every individual.

e. The construction of such things as animal pens, feeding stations, and miniature solar systems must also serve a real need.

f. All such culminating activities as plays, exhibits, charts, and writing of books should be a form of evaluation and should help point out the gains made in the study.

8. In the matter of evaluation, the children should be given a part in setting up the evaluation of the various activities.

Blough and Huggett express the real worth of science activities in the following quotation:

> The activity should contribute toward attaining the objectives set up. This means that experimenting just for the sake of manipulating apparatus is not enough. Such experiments may be active physically but very static mentally. Children solve problems by doing a purposeful thing--something that will bring a realness to what they are trying to learn and to the attitudes, appreciations, and skills they wish to gain.[13]

Reading supplies much needed information in science, but it should not be the only means of obtaining information. Textbooks and other books are essential as guides. Science experience to be effective means that learning must leave the pages of the book. This point of view is consistent with teaching of other elementary school subjects.

Children may be observant, but this characteristic can and should be trained in a child. Much of enjoyment of life depends on observation of things which surround the person, and an alert teacher will have great influence in aiding a student to become an accurate observer. It is through careful observation that a child becomes more aware of the things about him.

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13. Glenn O. Blough and Albert J. Huggett, Teaching Elementary Science, p. 24. New York: The Dryden Press, 1951.

Field trips become of value only as they have a purpose and become part of the solution to the problem under consideration. To take a trip just for a trip has no value. Specific responsibility of committees or small groups will add value to the field trip for the group. The "follow-up" conversation and the recording of activities with applications to the problem will be a very important part of the learning situation. Blough says that potentially the field trip is one of the most enjoyable and instructive ways to learn.

Although visual aids are among our most effective tools for learning, they do not fulfill this place without intelligent planning and use. A teacher should use rulers, compass, and other aids in chalkboard work. Chalk of various colors are useful to the alert teacher. It is important for the children to realize the specific purpose of a filmstrip or a motion picture. Still pictures are used to great advantage by many teachers.

In conclusion, all activities of the science program should have a purpose, be in keeping with the objectives, and should provide meaningful experiences which will assist in problem solving. In order to be of greatest value, careful evaluation should be made by teacher and student alike.

Evaluation Procedures

In the past evaluation has been based entirely on testing the pupil as to his grade on the subject matter studied. It is quite obvious--if the organismic theory is applied to learning and changes of attitudes, setting up of values, and other outcomes--that the means or ways of evaluation must be in accord. Evaluation is an important question, and one which so far has no completely satisfactory answer.

One way of evaluation is to observe the children. A teacher must train herself in this or some of the pupils will not receive fair evaluation. It takes time to jot down anecdotes, but they can be of great value to the teacher. To be of value they should be made over a long period of time. It should be remembered, too, that evaluation is done on an individual basis. If the child thinks through his problem, reaches conclusions, and forms opinions, he should have some recognition of his efforts and work.

It is assumed that children can help in evaluation. A group presenting a play will, after the play has been performed, sit down and talk over suggested changes for improvement. This is a form of natural evaluation. Time should be taken to talk over the results of tests and the answers expected. This evaluation process is sometimes neglected by the busy teacher. Through conversation with the teacher, individuals learn to evaluate their work.

Tests should be locally constructed. In order to relate the tests to the problems, activities, and interests of the children using them, it is necessary that each test be related specifically to the task at hand. Even in administration of tests the individual must be considered as he may have reached the objectives in other ways. He may be unable to give correct subject matter answers.

Some general criteria set up by Blough suggest some good points in the evaluation of a science lesson or unit. They follow:

> To what extent were the objectives I had in mind realized? Was there pupil interest? Did it grow? Was there sufficient pupil participation? Did I give attention to the individual needs of the pupil? Did the pupils think, and did I give them time to think? Was the lesson situation an enjoyable one for all concerned? Was there an opportunity for pupil planning? Was there good pupil-teacher relationship? Was the material adapted to the ability of the group?[14]

In unit work the culminating activity is usually an excellent place to make evaluation. Here, too, the child may play an important role in the evaluation program. Evaluation must be considered as an on-going process. The previous discussion of purpose will reveal that evaluation is part of the on-going process which leads to the reaching of the goal or to the solution of the problem.

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14. Glenn O. Blough and Albert J. Huggett, op. cit., pp. 80-84.

In science work some success has been realized by having pupils keep card records of each day's activities. This gives a view of the work and helps with the planning of the work for the next day. It has value in motivation in that it is necessary to do a certain amount of work before a record can be made. The writing up of experiments in a meaningful manner will be of assistance to the teacher and the pupil in evaluation.

In conclusion, it may be said that an evaluation program to be effective is based upon the objectives and the goals which are hoped to be achieved. True evaluation is an on-going process. Evaluation may be part of the steps in problem-solving and critical thinking.

Summary

In the study of the application of the organismic theory of psychology to the teaching of science, an attempt was made to set forth this accepted theory of learning as it relates to accepted principles and practices of teaching science. The assumption was made that these theories are basic and accepted. No attempt was made to prove their truth or worth. The four principles set forth for comparison are:

1. Learning is purposive.
2. Learning is complex and the learner learns many

things at one time, behaving as a complete organism.

3. Generalization cannot be developed except as empty verbalism, unless the inductive process is used in studying concrete situations. From such use of the process, generalized insights may emerge.

4. Learning will transfer to the extent that: (1) the learner sees the possibility of transfer to the other situation where learning is applicable, (2) he has generalized from his learning, (3) he understands the principles involved, (4) he is given practice in making transfer.

It is concluded that on all essential points these principles may find their foundation in and are compatible with the principles of the organismic theory.

In discussing the nature of the child, the assumption was made that the child has a natural curiosity which makes him a scientist in the sense that he wants to know why and is willing to test his hypotheses. The facts presented on the nature of the child seems to substantiate this assumption. The organismic theory appears to present further evidence that it is in harmony with accepted beliefs concerning the nature of the child.

It is concluded that the scientific method can be adapted in such a way as to become of value to children in their study of science. The attitude of the teacher is held an important contributing factor in this situation.

conscious adjustment occurs as the result of the individual's effort to realize integration.

In problem-solving a study was made showing three major ways in which problem-solving goes on. It, too, appears to be closely related to the principles of Gestalt.

Five main objectives of science teaching were listed and discussed in relation to organismic theory. It must be noted that throughout this discussion these various topics were chosen only for convenience of study. Each topic finds itself interwoven with the others; and each relates itself to the child responding as a whole being to a whole situation.

Selection of science activities and evaluation are closely related to the objectives and the means of attaining them. It is noted that no activity should be selected without consideration of the purpose it is serving; the activity selected becomes a part of the problem-solving effort.

Throughout this discussion, the feeling has been emerging that the unit approach may be the best means for presenting the theory in action. At this stage, it seems desirable to present a unit of work suitable for teaching in the elementary grades. It is hoped that such a unit will illustrate practical applications of the principles of organismic theory to the teaching of science at the elementary level.

CHAPTER IV

THE PRINCIPLES APPLIED IN A SELECTED INSTRUCTIONAL UNIT

The purpose of this chapter is to make more specific applications of the interrelated principles of the organismic theory and accepted principles of science teaching through the development of a selected unit of instruction. It has been assumed that a unit with problem-solving procedures offers a satisfactory instructional means for illustrating the organismic principles. It may be added, too, that the unit method of teaching is one that has found general acceptance in the area of science instruction. The selection of this method for illustration does not necessarily imply that other methods may not also work successfully.

Before presenting the unit illustrating such applications, the writer deems it advisable to give consideration to the methods of building a unit which will reflect the desired relationships.

Definition of the Unit

There are various terms used to define the unit. Some prefer the concept of "units of experience." Turning to Saylor and Alexander, the writer finds this meaning: "We ourselves prefer to deal with the concept as that of a

unitary organization of experience."[1] Of greater significance than the definition is the fact that the general idea of the unit work has caught on and has been used. It gives a broader base for the fundamental curriculum planning in contrast to the traditional subject-textbook, chapter-lesson, or read-recite concept in organization. For the teacher who is completing a change to unit teaching, knowledge of the structure of the unit is imperative. As many teachers do not have the advantage of resource units, the plan developed here will not be based on a resource unit.

Ruth G. Strickland gives seven suggestions for unit preparation:

1. Survey the needs and interests which justify and make it significant. Are there general needs and problems of life which make this study important? Are there community needs which might be helped?

2. List important objectives and goals which might be achieved through this study.

3. Make an overview of the subject matter which might enter into the study, the kinds of experiences which would be good, and any ways in which different subjects could be drawn into or integrated with this unit.

4. List books and other materials for the children as well as some teacher references.

5. Plan possible ways of introducing the study and getting children interested in it.

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1. J. Galen Saylor, William M. Alexander, Curriculum Planning, p. 397. New York: Rinehart and Company, 1954.

6. Plan the working periods, keeping in mind the fact that only part of the working plan can be arranged in advance because the children are to help plan it.

a. Carrying on discussion and other activities.

b. Listing of questions, making of charts, planning excursions, finding materials, arranging committees.

c. Gathering of information, reports and doing other things. Making excursions.

d. Organizing the ideas gathered, checking lists of problems and questions.

e. Summarizing the total learnings.

7. Plan the evaluation of the total unit of work. Final evaluation would cover two main points:

a. Growth and changes which have taken place in the children.

b. Individual strengths, weaknesses, and problems which need further attention.[2]

Here the principles of organismic theory can be emphasized. Is the study important to the child? Does it have significance? Does the child have a need for the study?

The objectives of unit teaching correspond closely with the general objectives of science teaching. These goals should be sufficient to motivate and should be considered in the evaluation. It will be seen that there is a wealth of reference to attitudes and values. This is in keeping with

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2. Ruth G. Strickland, "How to Build a Unit of Work," U. S. Office of Education Bulletin, No. 5, pp. 5-6. Washington, D. C.: Government Printing Office, 1946.

the principle of pragnanz. The final outcomes of experience are dealt with in terms of values and changes in the behavior and attitudes of the student.

The principle of integration is also of general application in unit work. A similar unit has been taught in two different schools. In one school it was treated as a social studies unit;[3] in the other school the material was used in the area of language arts.[4] As developed in this study, it will involve the teaching of some basic concepts of science in addition to its social and literary values.

The experiences afforded in a unit may become a series of adjustments which the individual child will make to the situation. It is anticipated that there will be a change in the environment of the children in that many will soon have telephones in their own homes.

The word unit suggests a oneness or a whole. The concept of the whole as the student makes a series of adjustments to new experiences may be stressed. In a unit the child should receive his learning experiences in many ways and from many points of view. He will then be responding to the stimuli in many ways at once. The use of audio-visual

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3. C. R. Burdett, "Telephones--8th Grade," Social Education, Vol. 19: (March, 1955), 25.

4. Ophelia K. Henderson, "Telephone Techniques," Clearing House, Vol, 28, No. 7 (March 1954), 25.

aids will add to and enrich his experiences. The following unit has been developed for demonstration purposes.

The Unit

The Telephone; Its Use and Benefits

Considerable care and thought was given to the choice of subject for this unit. As it appears here the unit does not necessarily provide for its use in a specific grade, but the elements of the unit might be selected for use in other local teaching situations. At the present time in Logan County, Kentucky, where the prepared unit will be taught, the people, with the cooperation of the Southern Bell Telephone Company, are launching a county-wide dial telephone system. The system at Russellville will change about the same time. Since many students will have dial telephones for the first time, this problem was selected for study. There is extensive community and public interest in the subject. The title, The Telephone; Its Use and Benefits, was selected.

Problems

1. How are we dependent on the telephone in relation to our basic needs of food, clothing, and shelter?

2. How has the use of the telephone changed and is now rapidly changing?

3. How can we use our telephone effectively?

4. How will the use of the telephone on a county-wide basis affect our lives and those of our families?

5. What are considered "good manners" in the use of the telephone?

6. Would it be possible to provide a telephone for a home-bound student in Logan County?

7. How is a telephone made and why does it work?

The problems listed above are only a tentative list and will probably be very different from those set up by a group of students. To be of value the problem studied must have significance for the student and be related to his own problems. All of the group would not be expected to have equal interest in each problem. Logan County does not provide a teacher for the home-bound student; consequently, the possibility of working out a school-to-home telephone plan does not appear to be impossible.

Suggested Approaches

The local news items appearing could be collected by the students and used for discussion concerning the Logan County Telephone Cooperative. A debate may be arranged on such a subject as, "There Are Advantages in Having a Telephone in the Home." A committee may give a demonstration on how to dial a telephone. The two units which were taught in other schools were each introduced by having a telephone representative start it off with a talk and demonstration.

It is felt that perhaps a better method of introduction may be made by the teacher in the regular classroom situation.

Desired Outcomes

1. Understandings. The following are the scientific principles which are basic to construction of the telephone and its use:

a. Matter and energy cannot be created or destroyed, but may change from one to the other.

b. Chemical and physical changes are manifestations of energy changes.

c. Sound is carried by waves which are produced by a vibrating body, and which can affect the auditory nerve of the ear.

d. All matter is probably electrical in nature.

e. The application of electricity and magnetism in the home and industry have revolutionized the methods of living of many people.

f. Electricity is a form of energy that results from disturbing the position of the regular paths of electrons.[5]

g. A knowledge of some applications of the telephone principles to various fields should be

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5. Thirty-First Yearbook of the National Society for the Study of Education, Part I, A Program for Teaching Science, pp. 53-54. Bloomington, Illinois: Public School Publishing Co., 1932.

gained. Some suggested fields are: Loud speaker, two-way radio, home teaching, hearing aids, communication system of the United Nations Headquarters, and helpful telephone devices.

2. Values. The development of such values and appreciations as the following constitutes an objective of all teaching:

a. Development of appreciation for the telephone as a means of communication and for social purposes.

b. Appreciation of the life and work of Alexander Graham Bell, and some understanding of his use of the scientific method in problem solving.

3. Skills and techniques. In any unit in science these skills gained by a student in problem-solving are of primary importance:

a. Development of a set of manners and conduct in the use of the telephone.

b. The proper use of the dial for purposes of calling the number.

c. The intelligent use of the directory.

d. The proper use and care of the telephone.

e. Vocabulary development.

Study of the Problem

As the study progresses, many problems will develop as the result of the work and activities of the students. The following list selected from an article by Henderson may give suggestions to the students for interesting topics for investigation and study:

1. Care of the telephone
2. Telephone diction
3. The telephone voice
4. Telephone courtesy
5. Telephone listening
6. Effective opening and closing techniques
7. How to handle calls for others
8. How to use the telephone in emergencies
9. Mobile telephones
10. Interpretation of telephone techniques to the community through radio station.[6]

Topics of interest may be listed on the board by the students; selections may then be made for demonstrations, reports, or charts. The teacher may supply guide sheets for special studies and directions. The pupils may then organize materials for their projects.

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6. Ophelia Henderson, "Telephone Techniques," Clearing House, Vol. 28, No. 7 (March 1954), 405-411.

Suggested Activities

According to Blough and Huggett, "A detailed study of the mechanism of the telephone is generally not included in science in the first six grades."[7] If there are some children who are interested in making a telephone, they may do so as special projects. An introduction to the principles of magnetism, for example, can be easily demonstrated by an examination of the receiver and transmitter. The old type telephone (which in many cases is available at the telephone company) may be used for this instruction. There are several factors which still influence the activities of a specific group. The frame of reference of the pupil will be a controlling factor in the choice of any activity. If the pupils have received previous science instruction, the activities presented here may not interest them. On the other hand, the exploration of the relay switch and the possibilities of its use in building "thinking machines" might prove a challenge. These limited suggestions are listed only to give the unit plan some body so that the principles of the theory might find application.

The following experiments may be used, but they are only samples of the many which are carefully described in books of instruction for elementary science teaching. The

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7. Glenn O. Blough and Albert J. Huggett, Elementary School Science, p. 447. New York: The Dryden Press, 1954.

teacher will select experiments which have a purpose to use for demonstration and solution of problems. No attempt will be made here to give in full detail many of the experiments which may be used. It is suggested that general use be made of experiments dealing with electro-magnets as well as those dealing with sound.

1. The following experiments may help to give meaning to the experiences:

a. Demonstrating the lines of force. Place a magnet on the table and cover with a piece of paper. A definite pattern is formed, showing the lines of force and indicating how far the magnetism extends around the magnet. Iron filings may be obtained from a machine shop by a student.

b. Experimenting with an electro-magnet. The materials needed are a dry-cell battery, two or three feet of insulated wire, and a large nail. If suggestions for making magnets should arise from the class, more thinking might be provoked than could be had from following a book procedure for this experiment. There may also be some question about removing the insulation from the end of the wires. Pupils may carry out experiments to test various materials for conductivity. These experiences may be related to parts of the telephone, whenever possible. Pupils may attempt to make

a stronger electro-magnet. This may be done in either of two ways: (1) wrapping the nail with more turns of wire or (2) using more batteries. Examination of the receiver will reveal the electro-magnet. Pupils may try the experiments for themselves rather than observe a demonstration by the teacher. There is available at the ten-cent stores a tiny electric motor which can be set up and run from a dry cell; this demonstrates clearly the principles of the electro-magnet.

c. Direction for the construction of a home-made telephone set is given in "The World Book Encyclopedia."[8] It may be adapted to classroom use and might be a worthwhile project for interested students. Two discarded receivers may be used as a transmitter and a receiver.

d. Nelson and Lorbeer give directions for two experiments which deal with sound; How do sounds travel? How can sound be produced by friction?. The

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8. "How to Make a Simple Telephone," The World Book Encyclopedia, Vol. 16, pp. 6993-7343. Chicago: The Quarrie Corporation, 1943.

9. Leslie W. Nelson and George C. Lorbeer, Science Activities for Elementary Children, p. 58. Debuque, Iowa: Wm. C. Brown Co., 1952.

first experiment uses two tin cans connected by a piece of string which can be used as a telephone. The second experiment uses one can with a string through a hole in the bottom of the can. When the string is rubbed with resin and the hand is pulled over it, sound results because the vibrating string causes the air molecules to vibrate.

e. Experiments which use the tuning fork or use rubber bands may be used to illustrate how we hear. Material which gives a good description of the ear and how sound affects the ear is given by Blough and Huggett.[10] They also have an equally understandable description of the vocal cords and how we speak.[11] Crouse has a good explanation of the mechanism of the ear.

f. Each student may be asked to bring some type of noise maker to school and be ready to demonstrate how it makes noise.

g. In experimenting on how sounds are carried, a piece of paper may be held between the hands. The notes of the singing scale are sung and the sound is

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10. Glenn O. Blough and Albert J. Huggett, op. cit., pp. 456-457.

11. Ibid., p. 456 and p. 465.

12. William H. Crouse, Understanding Science, pp. 87-93. New York: McGraw Hill Book Co., 1948.

felt from the vibration of the paper. The fingers can feel the differences in the vibrations as the different notes are sounded.

h. A pupil outside may shout without using a megaphone and then repeat the shout using one. The megaphone may also be used for amplifying the tick of a watch.

i. The understanding of how teeth, tongue, and breathing are used in speech may be stressed. Pupils may find it of interest to pronounce each letter of the alphabet, pausing after each to see how the sound was made. In some classes charts are made of these positions in connection with study of regular phonetic sounds.

j. The use of a hearing aid and an explanation of its principles may be arranged by having a person who uses one demonstrate it to the class.

2. There are many other activities used in science study; some of which are discussed:

a. Excursions and trips. It may be of value to the class to visit the local switch board or dial sub-station. The repair crew may be invited to the school to explain their work.

b. An organized bulletin board should be kept up to date.

c. An assembly program may be prepared. This might include a demonstration of the use of the telephone, a skit on how to dial a telephone, or a play which illustrates "good manners."

d. In some cases a demonstration telephone has been set up in the classroom. This may be suggested by the telephone representative with the company lending the materials.

e. The telephone representative may be invited to speak to the class. In Logan County it might be worthwhile to have a representative of the telephone cooperative to speak.

f. Several up-to-date films are available through the local telephone office and may be arranged for by writing or calling the local office.

g. The pupil may prepare a demonstration, a report, or a chart in presenting his problem to the class.

h. A presentation of a radio skit may be arranged with the local station.

Integration with other Subjects

Throughout this unit, the subject may be integrated with other areas within the following framework:

1. Social studies

a. Use of the telephone

b. History of Alexander Graham Bell

c. Use of the telephone in the community

2. Science

a. Principle of magnetism

b. Construction of the telephone

c. How electricity is transmitted

d. Use in industry, home communication, and transportation

e. Use of the relay in dial system

3. Mathematics

a. Setting up telephone bill

b. Cost of service calls

c. Cost of installation, different types

d. Cost of installation and up-keep on home to school service for home-bound student

e. School telephone bill

f. Long distance tolls

4. Language Arts

a. Letters to the telephone company for booklets, bulletins, films, speakers, and equipment. All necessary thank-you letters.

b. Preparation of a play for assembly.

c. Vocabulary building and spelling.

d. Preparation of a radio program.

5. Safety

a. How to use the telephone in an emergency

Evaluation

While the unit is in progress there must be a continuous evaluation. The growth of each child must be observed; such observations are best recalled by the teacher if notes are kept by her from time to time. A list of each activity done by each pupil should be carefully recorded. Some written lessons may be prepared on phases of the science materials studied. There should be things of interest for all of the students, and a careful check would be made by the teacher to see that each child is actively engaged in the activities. This unit cannot be evaluated until it is taught, but when the evaluation is made, a careful check of objectives and problems should be made to see how many have been met or solved.

Culminating Activity

Some units may be concluded with the evaluation; in others the development of a culminating activity might bring the work to a more successful conclusion. One plan may be the presentation of a class display and program which would unite all the various activities and projects. Invitations to this display and program may be extended to the parents of the children and to another class. A display of charts and posters, use of film or film strip, demonstration of working

models, or performance of some of the more interesting experiments may be worked out. It would be the responsibility of the teacher to see that all important concepts receive stress and that a summation of the activities is made.

Other culminating activities for a unit might include an assembly program, creative stories or poems, dramatizations, drawings and charts, notebooks, reports by group or individuals, scrap-books, or presentation of a radio program. For the selected unit it may be desirable to hold open house for parents and for some other class. At this time, exhibits of the work of individuals and committees, and reports of the work might prove beneficial. Here again the final decision of the type of culminating activity used will be decided by the student group in the process of developing the unit.

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Summary

An attempt has been made to show through the development of an instructional unit how some of the relationships between the principles of an organismic theory of learning and accepted principles of science instruction may be applied. This unitary organization of experiences was shown to be related to the concept of the whole child responding to the total situation. The principle of integration was illustrated in its application to the integration of the child and the subject matter. A still broader application of the principle was made by showing the many ties of unity with other areas of instruction.

Some suggestions were advanced for the selection of experiments and other activities; it is felt that these, by no means, constitute all the possibilities or are necessarily

the best ones. The reader who may be interested in teaching a similar unit will find a wealth of suggestions in the bibliography of this unit.

No attempt has been made to trace all the applications revealed in this chapter. The writer, in the following chapter which is concerned with conclusions, will attempt a more complete summary of such applications.

CHAPTER V

CONCLUSIONS, LIMITATIONS, AND IMPLICATIONS

This study has been concerned with making an analysis of an organismic theory of learning with some applications of this theory for the teaching of science in the elementary school.

In attempting to realize the purpose of this study, the writer has directed the investigation into three phases, each of which was felt to be a significant and necessary sub-problem. They are identified as follows:

1. To make an analysis of the Gestalt (or organismic) theory to determine its basic characteristics and principles.
2. To investigate commonly accepted concepts or principles of science instruction and to determine their relationships to organismic principles.
3. To make some applications of the relationships found to the teaching of science through the unit method of instruction.

No hypothesis, as such, has been advanced in this study. Instead, an endeavor was made to relate the many facets of the problem and to present them in such a form as will enhance their value in instruction. In a sense, the

unit presented constitutes a tentative hypothesis which may or may not be experimentally verified by its being taught. For obvious reasons, experimental validation is beyond the intent and scope of this investigation.

A basic plan or design for achieving the purposes of this study has been utilized. It is felt that the plan used is basically sound and is consistent with accepted canons of logic. Consequently, it is felt that the conclusions to be presented here have a relatively high degree of objectivity.

Conclusions

From the careful and detailed investigation of the organismic theory of learning, it was found to rest on these four basic principles:

1. Principle of integration. In each situation, an individual responds as a total being to his total environment through a process of interaction of the two, resulting in a modification of both.
2. Principle of adjustment. Each situation and response are of incomplete structure tending toward one end--a state of equilibrium, the process of interaction being one of adjustment in order to achieve this dynamic equilibrium.
3. Principle of purposive differentiation. A state of equilibrium is the result of explication and

realization of an intelligible goal of action with a tendency toward a resulting satisfactory feeling-tone.

4. Principle of pragnanz. The on-going process of achieving equilibrium will always be as good and simple as prevailing conditions allow, depending upon the frame of reference of the individual.

A survey was made of the accepted principles and practices of science instruction in the elementary school. The following principles of learning were accepted as basic to this study: The purposiveness of learning, the inductive process in generalization, the complexity of learning, and the transfer of learning. From the group of practices which were studied the following conclusions are made:

1. The principles of learning, previously listed, are basic in all areas of instruction.
2. The effectiveness of instruction is increased by improving the teacher's understanding of the nature of the child.
3. That a child can orient himself to problems, that he can suggest and test hypotheses, and that he can draw conclusions are elements of the scientific method which have found general acceptance among leading educators.

4. Motivation, an essential aspect of successful science teaching, may lead to increased self-confidence on the part of the learner.
5. Problem-solving is closely related in its steps to those of the scientific method.
6. The objectives in science teaching direct the growth and development of the pupil toward desired goals.
7. Each science activity is selected for a specific purpose and makes its own contribution to science instruction.

When the principles of learning were studied in view of their relationships to the principles of the organismic theory, the following points of likeness were noted:

1. The principle of integration represents the general and inclusive process of living and learning. It includes the life process from purpose to goal. When the principles of learning are compared with the organismic principle of integration, the following points of likeness are noted:
    a. Purposiveness of learning is identified with the interaction which an individual has with his environment. In teaching, an attempt is made to provide an environment

which will motivate and cause the learning to take place. Teaching provides a student with a place, a time, and materials with which to work. The teacher guides the process of integration which must take place if desirable objectives are realized.

b. Integration is the foundation for the inductive process which takes place in generalization. The experience which a pupil has provides the understanding and concepts from which generalizations are built.

c. The principle of integration is closely related to the complexity of learning and reveals itself as one of the factors which make learning complex.

d. Integration becomes in reality a transfer of learning when understandings from one experience are used in the mastery of another task or in the solution of a problem. It may be concluded that the organismic theory with its principle of integration gives a more complete and a more logical explanation of how transfer of learning

takes place than does any other theory of learning.

2. The principle of adjustment is equally important to the principles of learning and is compared to the organismic theory in the following ways:

   a. The purposiveness of learning finds its expression in the part of the principle of adjustment which is identified as the state of equilibrium. In order to achieve a state of equilibrium, a series of adjustments are made. Only when the purpose of learning is determined does the child become aware of having met or solved his problem. He thus reaches a state of dynamic equilibrium.

   b. The making of a generalization was found to be identical with the reaching of a state of equilibrium.

   c. The complexity of learning may be identified in the language of the principle as the process of interaction in which a situation and response of incomplete structure tend toward a state of equilibrium. This process of adjustment offers some explanation of the complexity of learning.

d. In the transfer of learning, the situation to which the transfer is made must have characteristics which are like the situation of the first learning. The principle of adjustment was found to operate as the pupil makes a comparison of the two situations and selects points where the experiences are alike. From this point the transfer of learning is identical to any other form of adjustment.

3. The principle of purposive differentiation is closely related to all the accepted principles of learning. It is only when the goal is identified and understood by the pupil that he can direct his work toward a given goal or objective.

4. The principle of pragnanz gives meaning to the ability of a child to achieve equilibrium which will be as good and simple as prevailing conditions allow. The concept of closure operates here as the child begins to pick up new ideas and to integrate these ideas with his previous concepts and understandings. In teaching, the principle of learning which makes great use of this part of the theory is the inductive process in generalization. If only part of a situation is revealed, the pupil

tends to furnish the missing parts in order to achieve a whole or to reach the desired state of equilibrium.

As a result of making a comparison of the principles of the organismic theory to the second phase of the study, the following conclusions were made:

1. A study of the nature of the child reveals relationships which involve the principle of integration. A child responds as a total being to his total environment through a process of interaction of the two, resulting in a modification of both.
2. Integration has been found to be related to the scientific method in that the latter provides logical steps whereby a hypothesis may be tested and conclusions may be drawn. Thus, the actual drawing of conclusions is an act of integration.
3. In science instruction, motivation may result from a change in the environment which causes a pupil to seek solutions to his problems which have resulted from the change. Integration was found to be operating as the pupil relates his past experiences with the new experience in the selection of a new response.
4. Integration is implied in the objectives set up for teaching of science. Each objective will

reflect integration to the degree that it directs and influences the final outcome. This outcome finds expression in a more complete and a better integration of the individual with his environment. It may be concluded that to the degree there is integration, there is learning.

5. All activities selected for science instruction serve a purpose and help the pupil reach the objectives. Each activity finds integration with all other activities and with the subject under study. The activities serve as a means of integration among the areas of instruction.
6. A child learns by doing and this activity is in reality a series of adjustments to a situation.
7. The pupil in using the scientific method employs a process of adjustment in attaining a state of dynamic equilibrium.
8. Problem-solving is a process of adjustment to a situation and precedes the reaching of a state of equilibrium.
9. The pupil in reaching a state of equilibrium gains added confidence which can be used by the teacher for further motivation.
10. The selection of objectives and their use in science instruction involves the principle of

adjustment in that the objectives direct the pupil as he establishes equilibrium.

11. Science activities provide the means of gaining facts which furnish the basis for conclusions and solutions of problems. The activities are the situations to which the child adjusts in order to learn.

12. The principle of purposive differentiation is closely related to the way a child learns in his own way. A selection of purpose for this learning is important to the child in that he may see the worth of his efforts.

13. The scientific method has as its goal the proof or disproof of hypotheses, and in this aim it may be easily identified with purposive differentiation.

14. The principle of purposive differentiation is closely related to the selection of objectives and the carrying out of activities which result in a satisfactory feeling. The procedures of evaluation find expression in this part of the organismic theory.

15. The principle of pragnanz gives meaning to the ability of a child to achieve equilibrium which will be as good and simple as the prevailing

conditions allow. The background and past experiences of the child give him his values and form his frame of reference. In teaching, the principle of learning which makes great use of this part of the theory is the inductive process in generalization. Just how well a child learns and just how well he will use facts which he learns depends upon his frame of reference and the background with which he meets his learning situation. The accepted idea of going from the concrete to the abstract finds a substantial foundation in this principle.

16. The fact that difficulty is experienced in analyzing the organismic theory into stated principles is in itself representative of the oneness which is expressed in Gestalt. The real test of the application of the organismic theory to the teaching of science does not rest upon any one principle; rather, it is dependent upon the interaction of all four principles as they find their expression in the various phases of science instruction.

The above relationships between the organismic theory and the various phases of science instruction do not, by any means, constitute all the conclusions that might be drawn. However, it is felt that the ones selected represent ample

evidence that significant relationships do exist. In general, it may be concluded that education from an organismic viewpoint is an expression of the broader concepts of learning. It offers a means of providing the child an enriched environment, a meaningful experience, an opportunity for personality adjustment, and increased confidence through understanding.

For further application of the relationships established a unit was presented. In the development and presentation of the unit, the writer found the four principles of the theory to be operative. The following conclusions are representative of those which may be established:

1. The principle of integration is basic to the unit; without its operation, there is no unit. Integration gives the unit its wholeness or oneness, making it an effective means of instruction and of providing for multiple learnings.
2. The principle of adjustment is encountered in planning and formulating the problem of the unit, in the work of the committees, and in the selection of the activities. Likewise, it operates in evaluation, the process by which the effectiveness of these steps are appraised.
3. The principle of purposive differentiation was found to be closely related to the selection of objectives. If the objectives are capable of

realization and truly represent the goals which the pupils set up, they will guide, direct and give purpose and meaning to the entire project; this principle governs the setting up and selection of goals which initiates activity for their realization.

4. Knowledge and understanding of the pupil's background is essential to the teacher in planning a unit of instruction; this implies that the subject or problem selected will be in harmony with the thinking and experiences of the pupils involved. Motivation and real learning are dependent upon the pupil's interest. These conclusions reflect the operation of the principle of pragnanz.

In conclusion, it may be said that the unit method owes its effectiveness as an instructional vehicle to the applications of the principles of the organismic theory. A science unit was presented; but in order to show even broader implications of the theory, the writer indicated possible fusions or integrations with other areas of instruction. It must be conceded that many of the possible applications of the theory are dependent upon the effectiveness with which the unit is taught.

The Limitations of the Study

The writer feels that the limitations of the study are easily recognized by the reader. An attempt has been made to arrive at a usable plan of instruction based upon the principles of the organismic theory. It is felt that the procedure used is sound. However, it is conceded that the procedures that have been used may give rise to objections that the methods used were not objective and the study is not scientific. Definite limitations and difficulties are encountered in the use of the philosophical method. The effectiveness of such a method is conditioned by the mastery of the canons of logic. While logical development has been the objective of the writer, she recognizes that the reader may be able to find inconsistencies in the logic used.

Effort has been made to maintain a critical and impartial view in the handling of the data; however, objectivity in this investigation has not been a matter of detached interest and manipulation. The felt need of the writer to produce applications of the principles to practical teaching may have given the treatment of the subject an element of subjectivity. The reason for the lack of factual information is fairly obvious; the applications of theory to practical teaching do not lend themselves to quantitative measurement.

It is further conceded that an experimental testing of the tentative conclusions reached in this study should, no

doubt, result in a higher level of validity. Future studies based on this problem might be made with control groups and experimental groups. However, the plan and procedures that have been employed in this study represent an approach which would be essential in planning and projecting an experimental study.

Implications for Further Research

Examination of available materials reveals that there are many references to organismic theory and that many of today's procedures are based upon its principles; however, there appears to be little organized material which reveals to the teacher how to apply these accepted principles in the classroom. Further studies are needed to build the bridge between theory and practice. It is suggested that such a synthesis might be done for other areas of instruction.

The research for this study reveals that there is a limited amount of practical application of the problem-solving technique. The psychological explanation of this process does not appear to be clear to all who attempt to use it in unit instruction. It appears that a study of the relationships of the organismic theory as they are involved in the process of problem-solving would bring about some very helpful suggestions for the teacher. The actual use of problem-solving and scientific method needs to be clarified and evaluated for the teacher.

Several studies have been made of the organismic theory as it offers explanation for creative work. A study to reveal how the theory might be used in motivation of creative work among school children appears to have possibilities. The relationships between organismic principles and the thinking process are attracting the attention of research students.

From this study the most significant aspect of application of the theory is that which may be made to the transfer of learning. Although some ideas about transfer of learning have been accepted superficially by the schools, little scientific research has been performed in this area. Accepted authorities in the field of psychology do not agree on how transfer takes place. Further investigations might reveal more significant relationships between organismic principles and transfer of learning.

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