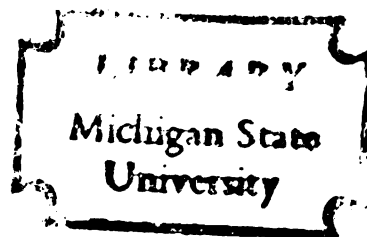


STRUCTURE OF A DISCIPLINE:
AN EXAMINATION OF THE CONCEPT
AND ITS IMPLICATIONS FOR
K-12 CURRICULUM PLANNING

Thesis for the Degree of Ph. D.
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ABSTRACT

STRUCTURE OF A DISCIPLINE: AN EXAMINATION OF THE CONCEPT AND ITS IMPLICATIONS FOR K-12 CURRICULUM PLANNING

by Robert Dale Taylor

The major purpose of this study is to determine the implications of the concept "structure of a discipline" for planning the precollegiate curriculum. A preliminary survey of the literature indicated that previous attempts to evaluate the concept of structure were inconclusive and to some extent misleading. An original group of writers proposed structure as a concept and developed general guidelines for implementation. A second group of curriculum planners interpreted and applied the concept in a variety of curriculum projects within specific subject areas in the K-12 curriculum. A third group of writers, in their turn, evaluated these applications of the concept of structure to practical curriculum problems. Such evaluations generally chose to ignore several important issues. In general, they failed to consider whether the various curriculum projects provided for an orderly development of the theory of structure. Moreover, much critical analysis failed

to distinguish between weaknesses resulting from poor theory and weaknesses growing out of operational problems of implementation. As a result, all criticisms were likely to be interpreted as indictments of the theory of structure.

The present study was carefully designed to discriminate between conceptual and operational levels of evaluation. First of all, the statements of the theorists who proposed the concept of structure were carefully analyzed for a consensus on the defining elements of structure, for recommended methods of application, and for a list of the claims made for structure as a curriculum tool. Next, the descriptions of the current applications of the concept in specific curriculum projects were evaluated to determine how carefully the projects developed the basic theory of structure and whether structure was used in the way the theorists recommended. Finally, the evaluations of project results were analyzed to determine if criticisms were legitimately directed at weaknesses in basic theory, at misinterpretations or misapplications of basic theory, or at operational mistakes of implementation.

From the data collected in this manner, it is possible to draw several important conclusions. In the first place, efforts to evaluate the concept of structure have seldom questioned the basic

theory of structure. Instead, such evaluation has been primarily concerned with alleged weaknesses of application and implementation. The only major theoretical premise that has come into any degree of contention is that there is a natural relationship between the logical and psychological ordering of data. The impact of this criticism is considerably weakened by the analysis of project descriptions which indicates that this premise received only superficial attention in project planning. The weight of evidence, therefore, is heavily in support of continued exploration of the concept of structure as curriculum theory.

Many of the alleged weaknesses of structure turn out to be problems of application and implementation. One typical criticism has been directed at the apparent lack of concern for balance in the curriculum. Yet a survey of the statements of the theorists reveals repeated warnings that the theory of structure does not by itself provide for a balanced curriculum. In their turn, the curriculum projects have almost ignored the problem of balance. In this case, the conclusion seems warranted that structure is a specialized tool designed to consider the content component of the curriculum and must be used and evaluated in this context. Again, continued and thorough exploration of the application and implementation of the concept of structure is indicated.

**STRUCTURE OF A DISCIPLINE: AN EXAMINATION
OF THE CONCEPT AND ITS IMPLICATIONS
FOR K-12 CURRICULUM PLANNING**

By

Robert Dale Taylor

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PREFACE

It is clear that the concept of structure has played some part as a rationale for current curriculum reform, and it seems likely that it will continue to exercise an influence on curricular developments. Since there is a considerable amount of confusion and debate concerning the concept, a study of the theory that proposes a structure for the disciplines for the purpose of exploring its possible uses in future curriculum work seems particularly appropriate at this time.

This study is designed to examine the implications of the concept "structure of a discipline" for curriculum planning in the schools of the nation. It will draw upon three main sources of information: statements developing the theory of structure; descriptions of current applications of the concept in specific curriculum projects; and evaluations of the concept and its implementation. Evidence collected is expected to generate conclusions about the merit of structure as a useful concept in curriculum development, about problems of implementation, and about the design and use of evaluative criteria.

It is the basic position of this study that current attempts to evaluate the effectiveness of the concept of structure have been inconclusive and to some extent misleading. A survey of the literature indicates a considerable amount of confusion over both the delineation of the concept and its effective use in curriculum planning. A study of the development of the concept reveals an initial group of writers primarily interested in developing a global theory of structure with only peripheral commitments to any specific curriculum projects charged with implementing the concept. With no substantial research or empirical evidence to guide them, a second group of curriculum planners used the concept of structure as a rationale for extensive curricular revision within specific subject areas in the K-12 curriculum. Finally, a third group of writers has evaluated the results of these first attempts to apply the concept in current curricular projects. Such critical analysis often fails to distinguish between what constitutes a weakness in theory and what represents an operational problem of implementation. As a result there is substantial reason to suspect that participants in the dialogue over structure often are speaking to different points and that subsequent evaluation often is indiscriminate in that it fails to specify the level to which it applies, conceptual or operational.

The debate over the usefulness of the concept of structure usually centers on two main issues: the merit of the concept as theory, and its proper and most effective use in curriculum planning. These basic issues may be explored in many ways but the present study will attempt answers after the examination of a logical series of subordinate questions:

1. What do proponents of structure say about its nature and use?
2. What do proponents claim is different and better about structure as a way of considering the content component of the curriculum?
3. To what extent has the concept of structure been utilized in current curriculum projects?
4. What do the major evaluations of structure or its use say about the strengths and weaknesses of the concept as curriculum theory?
5. Do such evaluations represent an indictment of the validity of the concept?
6. Does the evidence to date suggest testable modifications in the concept or its application?
7. Does the concept merit continued development and experimentation?

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CHAPTER I

THE PROBLEM IN PERSPECTIVE

Forces Shaping the Curriculum

Curriculum theorists usually agree that four basic forces combine to determine the content of the precollegiate curriculum in the schools of the United States: societal needs, the established academic disciplines, knowledge of the nature of the individual, and knowledge of the nature of learning. As a result, school curriculum represents a compromise of forces that are in perpetual contention for greater relative influence on the curriculum.¹

Historically the public and parochial school systems of the United States were established as a result of the need of the social order to perpetuate itself. The school as a social institution was developed to produce a particular kind of group member who would function in a particular type of society. Major changes in the

¹Hilda Taba, Curriculum Development (New York: Harcourt, Brace and World, Inc., 1962), p. 10.

structure of society have always, in the course of time, been followed by adaptive modifications in the school curriculum.¹

Much of the early content of the curriculum resulted from the fact that available knowledge had been collected within traditional academic frameworks based largely on the kinds of questions being asked about man and his environment. These established academic disciplines--i.e., logic, history, philosophy, language, and mathematics--served as a convenient source from which educators constructed the K-12 school "subjects." A collection of such subjects based on the scholarly disciplines of the time and organized into a series of experiences designed to train an acceptable social participant made up the typical school curriculum.²

As available knowledge increased, however, new disciplines were added to the classical ones of logic, history, philosophy, language, and mathematics. In the 1800's the various divisions of the physical sciences flourished as areas of investigation, and as the twentieth century opened such behavioral sciences as psychology

¹H. G. Good, A History of Western Education (2d ed., rev.; New York: Macmillan Co., 1960), p. 430.

²R. Freeman Butts and Lawrence Cremin, A History of Education in American Culture (New York: Holt, Rinehart and Winston, 1953), pp. 118-27.

and sociology won recognition as legitimate fields of inquiry. It was with the advent of the behavioral sciences that two additional sources of data became available to those responsible for planning the precollegiate curriculum, i.e., knowledge about the nature of the learner and the nature of learning.¹

The new knowledge resulting from the research into the psychology of learning and the growth and development of children probably reached its zenith in influence on the K-12 curriculum during the 1920's and 1930's, particularly in the elementary schools of the nation. Under the aegis of certain elements in the progressive movement, the so-called "child-centered" school viewed subject matter as a kind of informational reservoir from which could be drawn appropriate data for solving the personal and social problems growing out of the needs and interests of boys and girls, as these needs and interests were determined by the new behavioral sciences, particularly psychology. While this did not, as has often been charged, represent an attempt to eliminate subject matter from the curriculum, it did constitute a calculated change in the basis for content selection, and systematic study of the specific subject

¹Florence Stratemeyer et al., Developing a Curriculum for Modern Living (New York: Bureau of Publications, Teachers College, Columbia University, 1957), pp. 51-53.

matter areas was not always of first importance. The result was a new balance among the curricular forces, however temporary and uneasy it might prove to be.¹

The Changing Social Scene

Eleven years of preoccupation with the problems of depression followed by four years of frenetic involvement in World War II left the schools of the United States with serious problems that were only intensified by the uneasy postwar struggle for world influence that came to be known by the euphemism "cold war." The emerging situation precipitated another re-evaluation of the tentative balance among the curricular forces of subject matter, societal needs, the nature of the learner, and the nature of learning. A summary of the re-evaluation that occurred during the postwar years is pertinent to this investigation because it is at this time that the question of a structure for the disciplines becomes an issue among scholars in education and the academic disciplines.

Depression and world war followed by international rivalry and a position of world leadership brought social upheaval in the

¹Dorothy M. Fraser, Current Curriculum Studies in Academic Subjects, A Report Prepared for the Project on Instruction, National Education Association (Washington: National Education Association, 1962), p. 2.

United States, and the schools were ill prepared to handle the problems thrust upon them. The low birth rates of the 1930's and the paramount concern for economic recovery, followed by the diversion of national resources into the war effort in the 1940's, turned attention away from a developing crisis in the schools of the nation. Building programs were postponed, budgets were generally inadequate and teachers' salaries low. The result was a substantial exodus of teachers into higher paying fields and a general disregard for teaching as a career opportunity.¹

Furthermore, the end of World War II saw the consummation of thousands of marriages postponed because of depression or war. When the predicted postwar slump failed to materialize, the general ebullience of the times was manifested in the soaring national birth rate, and it became fashionable to write about the "population explosion." Indeed, a veritable flood of so-called "war babies" did descend on the elementary schools in the early 1950's and the nation faced up to a real emergency in buildings, budgets, and supply of teachers.²

¹Lawrence A. Cremin, The Transformation of the School (New York: Knopf, 1961), p. 338.

²Ibid.

World war triggered still another type of social change in the United States--a technological one, that was to reach new proportions in the prosperous postwar years. War stimulated research into new technology and techniques at an unprecedented pace. National teams of scholars and industrial leaders produced the atom bomb and developed refinements in nearly every phase of communications, transportation, and production. As a result, "automation" and "cybernetics" became commonplace terms during these early postwar years.

The implications of this revolution for the schools of the nation were apparent to all and contributed greatly to the general concern for quality education. First of all, it was becoming obvious that from this time on the expanding industrial economy would create an almost insatiable demand for highly educated, skilled workers while the market for uneducated, unskilled workers would decline proportionately. Thus, education, particularly some form of education beyond high school, became the means to both national and individual well-being. Political leaders, the business community, and parents all extolled the virtues of education, with the result that more students applied for longer and longer periods of schooling. It was becoming plainly evident that a thorough and effective pre-collegiate curriculum was essential to the emerging social structure,

and the pressure on the schools caused by the population increase was intensified by the new value placed on education as a means to success.

Perhaps not so important to long-range curricular developments but with potentially explosive consequences of more immediate concern to the development of the schools was the general trend toward conservatism in politics and educational philosophy that was evident in the postwar years. Such conservatism might be explained in part by a desire to suspend at least temporarily the social legislation typical of the depression era or to a natural desire to return to a more stable peacetime economic and social order. Certainly communist expansionism in Europe and Asia sparked a general mistrust of liberal philosophies in both politics and education at the national, state, and local levels. At about this time, the progressive movement, which had successfully launched an attack on the formalism of the school curricula of the first half of the twentieth century, tried to extend its reforms through a program popularly labeled the "life adjustment" curriculum. Well conceived or not, it was met with a flood of vitriolic criticism and the schools came under close scrutiny from a variety of groups and individuals, many of whom had their own axe to grind and their own program to sell.¹

¹Ibid., pp. 328-53.

Groups searching for evidence to substantiate charges that the schools were not providing a uniformly effective program for all youth had little trouble in finding it. Some of the most damaging evidence was provided by statistics compiled by the armed services during World War II. Thousands of draftees had been turned away by the armed forces because they could not meet the required educational standards. This was a serious blow to the image of a country that prided itself on universal educational opportunity.¹

For many people, the final link in the chain of evidence indicating the general inadequacy of the K-12 curriculum was the announcement by the Russians in 1957 of the success of Sputnik I while the nation's own space effort sputtered on the launching pad. Suddenly the whole nation was aware that the Russians were not only catching up to the United States in the sophisticated use of technology but apparently had taken the lead in the very sensitive area of the exploration of space, an area with especially grave implications for national defense. The immediate and almost universal clamor for change in the precollegiate curriculum was

¹John I. Goodlad, The Changing School Curriculum, A Report Prepared for the Fund for the Advancement of Education (New York: The Fund, 1966), p. 12.

evidence of a growing acceptance of the idea that the schools were a legitimate instrument of national policy.¹

It is not to the purpose of this investigation to summarize the debate that followed or to determine the relative merit of the charges and countercharges centering on the effectiveness of the schools of the nation. It is germane to point out that societal pressures were building that demanded curricular change. One of the many options offered as a potential solution to the dilemma was the concept of structure for the disciplines.

Problems in Academia

Since the forces shaping school curriculum are in constant interrelationship, it is reasonable to expect that changes in one set of forces will very likely result in corresponding changes in the others. It is not surprising, therefore, to discover that the societal changes described above were accompanied by equally profound adjustments within the academic disciplines themselves. Certain of these changes must be considered as fundamental to the development of interest in the concept of structure for the disciplines.

¹Cremin, p. 347.

Perhaps the key to understanding the situation developing in the academic disciplines is technology. There had been a tremendous increase in all phases of human productivity as a result of the application of advanced technological techniques to problems in all areas of human endeavor, and substantial gains in the capacity to satisfy basic needs had released human energies for other purposes. An increase in the numbers of people engaged in basic research was a concomitant result. Knowledge in the various fields, particularly in the sciences, began to increase at a greater rate simply because more physical and human resources were being devoted to research.¹

The same sophisticated use of technology that had provided so adequately for all of man's basic needs was equally effective when applied to the problems of research in the individual disciplines, and the cumulative total of information grew accordingly. Similar amplification of the motor capacities of man in the storage, retrieval, and communication of knowledge being discovered represented an additional extension of the problem.² It became popular at this time to speak of the accelerating rate of discovery as a

¹Philip H. Phenix, Realms of Meaning: A Philosophy of the Curriculum for General Education (New York: McGraw-Hill Book Co., 1964), p. 304.

²Ibid.

factor in itself. Furthermore, the rapid rate at which new knowledge was being discovered created a related problem of obsolescence in the conceptual systems for organizing knowledge. Some systems were invalidated, others were raised in the hierarchy from parts to wholes, and the number of hypotheses being tested was legion.¹

The implications for the school curriculum were clear. The gap between what was being taught in the various subject-matter areas and what was being discovered in the parent academic disciplines was widening and would continue to be a troublesome factor in any future curriculum planning. It was equally clear that even if the precollegiate curriculum could be successfully updated, a basic problem would remain. The human mind would still be unequal to the task of learning, storing, and retrieving the vast amount of data becoming available.² The old conception of "covering" a field of study was not adequate to the conditions that were developing.

What were some of the possibilities for solving the dilemma? Increased specialization, improved administrative and organizational

¹Ronald C. Doll, Curriculum Improvement: Decision-Making and Process (Boston: Allyn and Bacon, 1964), p. 75.

²Phenix, p. 305.

procedures, the application of technology to instruction, and better understanding of learning were all explored as helpful alternatives that did not seem to attack the central issue. Scholars in the disciplines were finally realizing that unless they took an active role in curriculum planning, future development in their respective disciplines could be seriously threatened. Such scholars were concluding that a more judicious selection of materials to be taught was the only satisfactory general solution to the problem, and many were actively engaged in developing a new rationale for curriculum reform in their respective subject areas organized around the basic principles of the discipline and emphasizing the methods of inquiry used by the scholar. The theory of a structure for the disciplines was evolving out of a pressing need to come to terms with sweeping changes in the academic world.

Psychological Catalysis

It is evident from the preceding discussion that changes in the social structure of the United States, particularly the technological revolution, were generating great pressure for adaptive modifications in the precollegiate curriculum. These changes in society were reflected in the academic disciplines where, with the help of modern technology, researchers were producing a volume of new

data that threatened to inundate the school curriculum. As a result, the scholars in the various disciplines, particularly science and mathematics, were already considering new bases for selecting and organizing instructional materials. There was, therefore, a very receptive environment awaiting the introduction of the concept of structure for the disciplines. It was a psychologist, Jerome Bruner, who in 1959 developed in his book The Process of Education one of the first statements proposing that each discipline had a structure that should be the central focus of any revision within the school subjects.¹ It would aid understanding to describe briefly the kind of psychological research upon which his statement was based.

The phenomena of the rapid growth of knowledge that was occurring in all disciplines included within it the psychological research on cognitive learning, or that process by which the individual forms concepts, builds them into a classificatory framework, and uses this conceptual system to interpret and order the sense data constantly being channeled into the brain through the sensory organs. The study of how intellectual growth occurs caused Bruner and a number of other psychologists to conclude that there was a natural

¹Jerome S. Bruner, The Process of Education (New York: Random House, 1960).

congruence between the logical systems of representing reality as they occurred in the various disciplines and the psychological systems of representing reality as they developed in individuals. As a result, we find Bruner saying:

Every subject has a structure, a rightness, a beauty. It is this structure that provides the underlying simplicity of things, and it is by learning its nature that we come to appreciate the intrinsic meaning of a subject.¹

Piaget's work seems to be the foundation for Bruner's experimentation. Piaget, through his observation of the behavior of children, had decided that there were developmental stages in the ability to conceptualize. In later work he established four such stages: sensori-motor, preoperational, concrete operations, and formal operations. The stages describe cognitive growth from birth to about fifteen years of age and hypothesize a developmental increase in the ability to use symbolic representation of reality.²

Bruner's research on cognition supports the idea of developmental stages in conceptualization. He recognizes three such stages --the enactive, iconic, and symbolic--closely paralleling the stages

¹Jerome S. Bruner, "Structures in Learning," Readings in Curriculum, ed. Glen Hass and Kimball Wiles (Boston: Allyn and Bacon, Inc., 1965), p. 286.

²Jean Piaget, The Construction of Reality in the Child, trans. Margaret Cook (New York: Basic Books, Inc., 1954), pp. 3-96.

established by Piaget. Again the stages span the years from birth to age fifteen and describe cognitive growth from earliest formation of concepts through imagery to an increasingly complex symbolic mode of representing the real world. From such research Bruner concludes that a child must develop a system of representation for his environment. He must code and process these representations and be able to retrieve them to make them useful.¹ The structure of a discipline--i.e., its basic ideas, beliefs, and principles--provides the most effective route to such a coding system. The more basic the principle, the greater its breadth of applicability. Since each child builds an ideational background for himself, it is equally important that instruction based on the structure of a discipline include the methods of inquiry of that discipline. Such methods provide insight into discovery and are generative in that they provide for the transfer of learned principles to unique situations yet to be encountered.²

Bruner's marriage of the logical and the psychological within the theoretical concept of structure was greeted with both enthusiasm

¹Jerome S. Bruner, "The Course of Cognitive Growth," American Psychologist, XIX (January, 1964), 1-5.

²Bruner, The Process of Education, pp. 17-32.

and skepticism, and a new phrase was added to educational jargon. His proposals are certainly evidence of a new trend in psychological investigation which has implications for curriculum planning, an interest that emphasizes intellectual growth and development oriented around a view of readiness that makes learning conditional upon a certain optimum conceptual background in the individual student. In the interim, it may be that structure has been discussed more than it has received methodical exploration, but there is little doubt of its immediate and continuing influence on curriculum revision.

The Course of Reform

The relevant forces in the curricular reform movement of the 1950's and 1960's are now in focus. Society was demanding a different and more effective education for its children, the scholars in the academic disciplines were accepting the challenge of revitalizing the content and methodology of the precollegiate subject matter, and research into intellectual growth and development was leading some psychologists to lend support to a theory that many academicians had supported for years, i.e., that each academic discipline had a definable, teachable structure that should be a central feature of any revision undertaken. Such logical structure would supplement and enhance the parallel development of psychological structure

in the minds of individual students. Over the past ten years literally dozens of curriculum projects have taken form, most of them pledging a revision of content organized around the basic principles and methods of inquiry of the discipline under consideration.

The curriculum projects have developed a rather consistent pattern of operation. National committees of academicians and educators have met during the summer months to consider the problems of reorganizing a single school subject. These committees have revised content, planned a variety of instructional materials and aids, and have made arrangements for an initial testing of the revised programs in selected cooperating schools during the succeeding school year. Feedback from the actual use of the programs has formed a basis for additional revision before the programs have been offered for adoption. Summer workshops are then planned for teachers from school systems planning to adopt the program. The projects are usually financed rather liberally by the national government, national foundations, national professional societies, or some combination of the three.¹

Despite the fact that most curriculum projects of this period make some claim to revision on the basis of basic structure of the

¹Fraser, p. 5.

subject involved, it has been said that structure of the disciplines is actually a concept in search of a definition. It is true that a great deal of time, talent, and money has been devoted to the topic of structure in an attempt to refine and develop the concept as a curriculum tool. Four national conferences sponsored by universities or professional societies have been devoted exclusively to exploring the concept of structure and have been reported in some detail. The Association for Supervision and Curriculum Development has established a Commission on Current Curriculum Developments that has published regular reports on the various curriculum projects and their implications for curriculum construction. The concept has been a major focus of several books and numerous articles. Most curriculum specialists have reacted to the implications of the concept for curriculum development. The remaining chapters of this study will be devoted to an analysis of the volume of material written about the concept of structure and its possible uses in curriculum planning.

CHAPTER II

THEORY ON THE NATURE AND USE OF STRUCTURE

The content of this chapter is organized to accomplish three primary goals. The initial purpose is to formulate a generic definition for the concept of structure for the disciplines based on the statements of the scholars who have taken the leadership in promoting structure as a useful concept in revising and updating the curriculum. The second purpose is to identify the problems of definition, application, and implementation of the concept of structure as they were anticipated by these same theorists. The third and final purpose is to summarize the claims made for structure as a curriculum tool. In all cases, the discussion in this chapter is confined to what the leading theorists have said about structure in an attempt to establish a basis for determining the relationship between what has been advanced as theory, what has actually been done in the curriculum projects, and what the evaluations of the current curriculum reform movement say has been accomplished.

Definition of Structure

The concept of structure for the disciplines as it was developed in the 1950's and 1960's may seem at first glance to be characterized by broad generalization and oversimplification. On closer analysis, however, it is apparent that initial statements of structure were purposely global in nature, designed as general guides to a presumably profitable direction of inquiry for curriculum planners. Indeed, most theorists of the period called attention to the fact that the very nature of structure as defined meant that only the scholars and specialists in the respective disciplines could adequately establish the structural elements for each discipline. Similarly, early statements about structure noted problems of definition and application that would necessarily need exploration and experimentation before the concept of structure could be judged a very sophisticated or effective curriculum tool. For the purposes of this section of the present study, such statements will be accepted in the spirit they were offered and analyzed for the commonalities they may encompass. Problems of definition and application anticipated by these theorists will be considered in another section of this chapter.

To provide an accurate perspective from which to view the attempts to define structure, it is important to note that scholars in the academic disciplines had for many years insisted that the disciplines should be the basic source of instructional content for the K-12 curriculum. Furthermore, they had held that instruction should have the goal of developing an understanding of the basic principles and methods of discovery and verification of the discipline involved. Therefore, the theory of structure is not, from this viewpoint, a very new or revolutionary concept. Yet, it is generally accepted that school subjects were more often than not descriptive narration in treatment, and instruction often failed to distinguish between factual detail and key ideas. Nor was the student likely to get much insight into the scholar's method of inquiry since few teachers accepted responsibility for teaching such insight as an integral part of the subject matter they presented.

The concept of structure as it has been developing in the last ten years has had significantly different emphases and considerably broader origins. It reaffirms much of the traditional concept while extending the scope and basis of its theory. For the purposes of this investigation, therefore, the concept of structure will be treated as an expanded one with fresh implications for curriculum planning. An analysis of the statements of the various spokesmen

for structure should provide some insight into what these newer emphases and directions are.

Why the disciplines?

There is a rather consistent rationale running through the statements proposing a structure for the disciplines. Most theorists find it necessary to precede any discussion of structure with an explanation of their absorbing interest in the disciplines. Hass and Wiles, in introducing the subject of the nature of knowledge, have this to say:

Man seeks to maintain life. He interacts with his environment and forms an interpretation of the world about him and his own nature. The accumulated total of the product of these interactions, man's experience, is called knowledge.

Scholars have organized portions of this knowledge into disciplines. A discipline consists of a set of generalizations which explain the relationships among a body of facts. Moreover, workers in the discipline develop a method of inquiry which is useful in discovering new facts. Each discipline is man-made and is subject to revision if a different organization of the facts proves more functional.¹

The disciplines, then, represent the fund of acquired information of man, they supply the systems of logic that provide for the interpretation and use of specific knowledge, and they have had demonstrated success in generating new knowledge. As a result, discovering the

¹Glen Hass and Kimball Wiles (eds.), Readings in Curriculum (Boston: Allyn and Bacon, Inc., 1965), p. 267.

membership and organization of the disciplines is to identify the subject matter that constitutes the resources and obligations of education.¹

What is a discipline?

Most proponents of structure have tackled the definition of a discipline as a basic step in the task of developing the construct of structure. Foshay outlines a typical definition when he says that a discipline is a way of knowing and a way of learning. It has a domain or a body of data collected within carefully defined boundaries. The field of phenomena is not just a collection of facts, however, but is characterized by a conceptual framework that establishes the relationship and meaning of the data. Moreover, the scholars in a discipline decide upon a set of rules which are to apply in their attempts to discover new knowledge within the field of their inquiry. The domain considered and the unique methods of inquiry by which knowledge in the domain is discovered are the main defining characteristics of a discipline. The final component is the history of the development of the discipline, which provides the narrative of

¹ Joseph J. Schwab, "Structure of the Disciplines: Meanings and Significances," The Structure of Knowledge and the Curriculum, ed. G. W. Ford and Lawrence Pugno (Chicago: Rand McNally and Co., 1964), p. 11.

the accumulation of data and of the development of both the conceptual framework and the methods of inquiry.¹

Phenix has given a slightly different emphasis to the standard factors of definition by highlighting the participation in discovery. He describes a discipline as an association of specialized enquirers, joined by common rules of procedure that govern the scope and methods of inquiry. Only a relative few methods of inquiry and conceptual schemes have growth potential and these are to be found in the organized disciplines. A critical test of a discipline, then, is that it embodies conceptual schemes that have generative power.²

Phenix also emphasizes the dynamism of the disciplines, a point of rather common agreement among theorists. Since it is likely that many conceptual schemes await discovery, change may be expected within disciplines. New disciplines may rise, old ones fall, and new combinations appear.³

¹Arthur W. Foshay, "Knowledge and the Structure of the Disciplines," The Nature of Knowledge: Implications for the Education of Teachers, ed. William A. Jenkins (Milwaukee: University of Wisconsin-Milwaukee, University Bookstore, 1962), pp. 28-30.

²Philip H. Phenix, "The Architectonics of Knowledge," Education and the Structure of Knowledge, ed. Stanley Elam (Chicago: Rand McNally and Co., 1964), pp. 47-48.

³Phenix, Realms of Meaning, pp. 317-18.

What is structure?

The search for a definition of structure might properly start with the man who is most often credited with the first contemporary statement suggesting that the structure of a discipline should be the basis on which curriculum change within a subject-matter area should be predicated. The Woods Hole Conference on Cape Cod in 1959 was convened for the purpose of discussing how science education in the K-12 curriculum might be improved. It was an interdisciplinary conference of thirty-five scientists, academicians, and educators financed by the United States Office of Education, the Air Force, and the Rand Corporation. Bruner's book The Process of Education is what amounts to a chairman's report of the conference, and it is in this book that he outlines his initial views on structure.¹

Bruner's concept of structure is based upon the need of the individual to see the relatedness of data within a particular discipline. The student must have an idea of the general phenomenon with which he is dealing. Therefore, he needs to grasp the fundamental ideas of a subject, the general principles that tie the profusion of facts together into a pattern that establishes the meaning

¹ Bruner, The Process of Education, pp. vii-xv.

of the data. But equally important, the student must experience the excitement of discovery and learn the methods of inquiry common to the field. Bruner feels that any differences in intellectual activity as it is experienced by the scholar and student are differences in degree, not kind. The two elements of structure are, then, the fundamental principles of a discipline as they form a hierarchical and explanatory framework for data and the methods of inquiry that generate discovery and provide models for understanding in new situations.¹

Phenix describes structure in different words, but arrives at similar conclusions. Disciplines are public communities of scholars united by common standards of inquiry. A discipline is characterized by a pattern, or structure, or characteristic logic and is not just a collection of ideas. The basic unit in the structure is the representative idea. Representative ideas are both principles of growth and principles of simplification. Since representativeness is a matter of degree, there is usually a hierarchical order to representative ideas corresponding to a structural map for the discipline. However, there is no single "right" structural map for any discipline

¹Ibid., pp. 18-21.

and only the specialists in the field are capable of defining the map(s) that prevail.¹

Phenix then speaks of methods of inquiry. The methods of inquiry are the unifying elements that counteract the fragmentation of learning and preclude the need for a large store of accumulated knowledge. The methodology of a discipline is likely to be a more stable factor and will help the student past changes in the conceptual structure. Methods are also generative in that they are the way to new knowledge and are of two related kinds, i.e., methods of discovery and methods of validation.²

Schwab's definition of structure emphasizes that the scientific knowledge of any given era relies not on all the facts but on selected facts. Moreover, the conceptual principles of the inquiry control the selection of facts and direct the scientist to only a small part of the data available in a discipline. Therefore, scientific knowledge is the knowledge of facts interpreted through the use of appropriate conceptual principles. Since the conceptual framework is by nature experimental, it can change and, as a result, knowledge can change. Knowledge of a subject unfolds. Facts are

¹Phenix, Realms of Meaning, pp. 323-27.

²Ibid., pp. 333-37.

salvaged, reordered, and reused, but the knowledge is replaced. Thus, a body of concepts is an important component of the structure of a discipline.

Each discipline also has its own process of discovery and verification. Some subject matters answer when one set of questions is put while another answers to a second set. Therefore, the syntactical pattern of a discipline, its method, its mode of procedure, how it goes about using its conceptual framework to attain its goals, is the other component.¹

It seems apparent from the foregoing discussion that the defining characteristics of a discipline are in a very real sense the basic elements of structure. Each discipline has a domain of inquiry that includes the accumulated data of the field and a hierarchical framework of explanatory principles. Each is characterized by accepted modes or methods of discovery and recognized procedures of verification and validation of results. Some theorists would add the history of the development of the discipline as supplying necessary perspective and continuity in investigation. Defining the various component parts of the structure of any discipline requires a

¹Joseph J. Schwab, "The Concept of the Structure of a Discipline," Educational Record, XXXXIII (July, 1962), 197-205.

depth of knowledge that only the scholars in the field can supply. Since structure is a concept invented by a scholarly mind, it is entirely possible that different scholars may devise different structural maps for a discipline. It is also true that structure is a tentative hypothesis about reality and may change as new knowledge is discovered, leading to revisions in principle or method.

Problems of Definition and Use

Most theorists interested in promoting structure of the disciplines as a useful concept in curriculum revision do not present it as an educational panacea, although at times their enthusiasm for the concept might tempt the reader to this conclusion, nor are they blind to its rather rudimentary level of development as a curriculum tool. They have, in fact, foreseen a number of problems connected with the definition, application, and implementation of structure as a concept in curriculum planning. As the evaluations of structure and its use are considered in Chapter IV, it should be possible to determine if the theorists have anticipated some of the same problems that are identified in the evaluative statements.

For purposes of analysis it is useful to consider the problems at the level of concern that seems most characteristic of the statement in which the problem is considered. For example, some

problems at the time they were delineated were more clearly problems of definition than application or implementation. Yet such a plan of analysis is of necessity arbitrary and to some degree oversimplified. Problems of definition characteristically reduce to related complications of application and implementation. However, faced with the variety of purposes and organizational patterns in the numerous statements about structure, this plan of analysis may enhance understanding.

Problems of definition

Early dialogue over the definition of structure for the disciplines spent little effort in speculating over the possibility of a dual nature for structure, i.e., the logical and psychological. Even when the psychologist Bruner was writing, he devoted much of his effort to promoting the logical structure of the disciplines, using his research into cognitive growth and development as evidence of the need of individuals to structure or systematize sensory data about the environment. This psychological ordering or categorizing that occurred in the minds of individuals would be reinforced or enhanced by the logical ordering or categorizing within the disciplines. While hypothesizing a natural relationship between the individual's need to represent his environment by some conceptual

framework and the pattern of underlying principles represented in each of the disciplines, Bruner does not believe that all problems will be solved simply by having the scholars of a discipline lay out the structure of that discipline. A look at his model for the individual structuring of sensory data will provide insight into the problems he identifies as related to a blending of the psychological and logical.

Bruner's clinical studies of the cognitive processes of children convinced him of a number of things about the way the mind handles the sensory data impinging upon it from the time of birth. The profusion of such data would overwhelm the individual if he were forced to react to the stimuli singly and as fresh data at each encounter. Instead, it is the task of the human mind from birth to internalize an increasingly complex and comprehensive conceptual representation of the real world. In this view of learning as information processing, new input of sensory data is screened through and classified by the existing conceptual representations. One of the main jobs of youth, and hence the K-12 curriculum, is to facilitate the acquisition of an adequate conceptual background by each individual.

Bruner postulates the development of an adequate conceptual framework as proceeding in three observable but not necessarily

discrete phases. From birth to about six years of age, the child passes through the preoperative or enactive stage of development in which he is involved in direct interaction with the things of his environment. He is learning to discriminate the defining characteristics of a variety of stimuli, developing thereby a wealth of concepts which can then be generalized and used to identify other examples of the same thing. The individual concept developed is neither the stimulus nor the stimulus experience, but the mental representation or classification of the stimulus. In this manner, he gradually builds a rudimentary system of symbols for representing the real world.¹

During the second developmental period, extending from age six to ten years, the child enters the stage of concrete operations. In this stage the child learns to refine and extend his representation of the real world. He develops an ability to transform mentally data about the real world so that they can be organized and used selectively to solve problems. He is still limited, in this stage of development, primarily to the structuring of immediate and present reality.

¹ Bruner, The Process of Education, pp. 33-38.

From the age of ten to fourteen years the child enters the stage of formal operations. During this period the child is able to transform propositions about reality, identifying variables involved in such hypotheses and conjuring up the full range of alternative possibilities that could exist at any one time. He is no longer limited to immediate reality but can handle increasingly abstract ideas, remote in time and space from the immediate world about him.¹

In this way Bruner has developed a psychological model for the organized, internalized representation of knowledge by the individual. From this model he has constructed some hypotheses about how the individual or psychological structuring of knowledge will affect the selection and organization of instructional materials from the various disciplines. His first suggestion has been outlined in an earlier section of this chapter as follows. The structure of each of the various disciplines, the main components of basic principles and methods of inquiry, would supplement most effectively the need of each individual to order the data provided through sensory intake. Therefore, curriculum reform should take place discipline by discipline as the scholars within a discipline translate the basic principles and methods of inquiry into illustrative instructional materials.

¹Ibid.

Teaching organized around the structure of a discipline has several advantages. Since the disciplines represent the record of human experience (content), the means to understanding and interpreting that record (principles), and the means to understanding new experience (method), they are the chief resource of the curriculum. Moreover, the logical ordering of the content along basic principles augments the natural psychological process of structuring sensory intake. Understanding is enhanced through basic principles, remembering is improved through insight into explanatory structures, and transfer of learning is enhanced by insight into both the methods of discovery and basic principles.¹

But Bruner's now famous and often quoted hypothesis that "any subject can be taught effectively in some intellectually honest form to any child at any stage of development" implies as much hard work as it offers promise. The problem of teaching a subject to a child is one of representing the structure of the subject in terms of the child's way of viewing things. It is a task of translation. Apparently any ideas from the logical structure of a discipline as determined by the scholars in that discipline can be taught in some "intellectually honest form," but the form is going to depend on the

¹Ibid., pp. 17-32.

particular stage (preoperative, concrete operations, formal operations) of the development of the child and, perhaps with more staggering problems of translation, on his idiosyncratic position in that period of development. The developmental stages also account for Bruner's "spiral curriculum" in which the student meets the basic ideas and principles of a discipline in progressively more refined versions couched in the proper developmental mode.

From these same developmental stages Bruner develops his concept of readiness. While the mode of representing reality gradually changes from stage to stage and subject matter must be adjusted to the mode current to the child's developmental level, the effectiveness of presenting an idea or principle from a subject area is also dependent upon the ideational background of the individual child. Bruner is referring here to the amount and quality of related sensory experience that is available as background for new material presented. Presumably individuals may vary considerably in the appropriateness of conceptual preparation for specific learning tasks. Instruction must take into account both the mode of presentation and the existing conceptual background at the same time that it reveals the underlying structure of the discipline. The academician will not be able to develop a curriculum in isolation from knowledge of the

child nor from teaching method. Expertise in all three areas will be needed.¹

Later dialogue over the definition of structure for the disciplines raises more pointedly the possibility of a dual nature for structure. Another psychologist, Ausubel, speaking to an interdisciplinary symposium convened by Phi Delta Kappa in November of 1963, details a number of concerns that he has about the relationship of the logical and psychological ordering of data. He establishes his basic position when he says:

. . . in addition to organized bodies of knowledge that represent the collective recorded wisdom of recognized scholars in particular fields of inquiry, there are corresponding psychological structures of knowledge as represented by the organization of internalized ideas and information in the minds of individual students of varying degrees of both cognitive maturity and subject matter sophistication in these same disciplines. I am making a distinction, in other words, between the formal organization of the subject matter content of a given discipline, as set forth in authoritative statements in generally accepted textbooks and monographs, on the one hand, and the organized, internalized representation of this knowledge in the memory structures of particular individuals, especially students, on the other.²

¹Ibid., pp. 33-54.

²David P. Ausubel, "Some Psychological Aspects of the Structure of Knowledge," Education and the Structure of Knowledge, ed. Stanley Elam; Fifth Annual Phi Delta Kappa Symposium on Educational Research (Chicago: Rand McNally and Co., 1964), p. 222.

In analyzing the relationship between the logical and psychological structure of knowledge, he compares the two structures with respect to four attributes: meaning, process of organization, arrangement of component elements, and cognitive maturity of content.¹

Subject matter possesses logical or potential meaning, while psychological meaning is an idiosyncratic psychological experience. When an individual learns logically meaningful propositions, he does not learn their logical meaning but the meaning they have for him. Learning can only occur, therefore, when nonarbitrary, lucid, plausible material is presented to a cognitive structure sufficient in ideational background and cognitive maturity. The same logical meaning inherent in potentially meaningful propositions and the interindividual commonality of ideational environments result in general commonality in understanding and communication, making the translation of the logical order to the psychological order possible. Differences in ideational backgrounds preclude the possibility of developing a standard logical structure or a routinized method of presentation.

As to the process of organization, both structures rely on a logic of classification and depend on unifying, generally explanatory, and inclusive elements. However, the psychological structure, in

¹Ibid., p. 223.

contrast to the logical structure, is subject to systematic decrement. Learning and remembering is dependent on available relevant subsumers, their stability and clarity, and their discriminability from new learning material. Any translation of the logical into the psychological will have to account for the aforementioned systematic decrement especially as it is complicated by the idiosyncratic nature of the phenomena in children.

Finally, Ausubel points out that the cognitive maturity of the learner determines the cognitive maturity of the content of the psychological structure. The logical structure manifests no such developmental variability in cognitive maturity. Developmental variability in the cognitive maturity of logical structure will have to result from insightful curriculum planning based on principles arrived at through the careful study of the development of cognitive processes in children.¹

Problems of application

Bellack pinpoints one set of problems concerned with the application of the concept of structure to curriculum organization when he asks, "What general scheme of the curriculum can be

¹Ibid., pp. 223-26.

developed so that the autonomy of the parts does not result in anarchy in the program as a whole?"¹ While he emphasizes his support for the importance of an in-depth understanding of the structures of the various disciplines, he reviews several possibilities for developing the relationship between or among disciplines. One such possibility is to group the disciplines by the conventional categories of the natural sciences, the social sciences, the humanities, and mathematics. Each discipline within a major category such as social science has key concepts and methods. Yet no single discipline gives a complete picture of social reality. Only by combining disciplines can the coherence and relatedness of the social sciences be established. He does not speculate on the method of achieving a combination for each of the major categories or on the forms such combinations might conceivably take. His purpose is to stimulate exploratory discussion in an area of concern.²

¹ Arno A. Bellack, "Conceptions of Knowledge: Their Significance for the Curriculum," The Nature of Knowledge: Implications for the Education of Teachers, ed. William A. Jenkins (Milwaukee: University of Wisconsin-Milwaukee, University Bookstore, 1962), p. 44.

² Arno A. Bellack, "The Structure of Knowledge and the Structure of the Curriculum," A Reassessment of the Curriculum, ed. Dwayne Huebner (New York: Bureau of Publications, Teachers College, Columbia University, 1964), pp. 25-40.

Schwab also considers the problems of organizing the disciplines for instruction. He outlines Comte's hierarchy of the positive sciences as an example of one kind of plan to establish the relationship among one category of disciplines. This plan finds mathematics basic to physics which is, in its turn, basic to chemistry, etc., with a corresponding sequence in instruction. Yet certain experiments in chemistry precede related discoveries in the physical world so that there is much reason to argue that such a hierarchy could be supported in either a descending or ascending direction.¹

Schwab continues his illustrations with a description of Plato's hierarchy of image to idea and Aristotle's continuum of the productive, practical, and theoretical disciplines. He finds both organizational plans inadequate for establishing the important relationships among the disciplines. He cites the need for continued exploration of the issue.²

The question of whether there is an organization or combination of individual disciplines that will promote the relatedness of the disciplines and the development of a kind of metastructure among

¹ Schwab, in The Structure of Knowledge and the Curriculum, pp. 11-15.

² Ibid., pp. 15-21.

groups of allied disciplines, is further complicated by the question of the relatedness among the broad fields of knowledge, whatever they turn out to be. Bellack holds that the progressives tried to reach such unity through the scientific method and problem-solving. He feels the weakness of this approach to be the lack of any real depth on the part of either the students or the teachers in the very disciplines they are attempting to use in the solution of a given problem. Instead, he offers modes of thought as a kind of meta-method that would identify the unity of intellectual activity, i.e., the analytic, the empirical, and the aesthetic. He would add these metamethods to the metastructure identified from a study of the allied fields mentioned above, with the end result being an overall unity in curriculum building.¹

Phenix has handled the problem of relatedness or unity of knowledge in a very different fashion. On the basic assumption that knowledge has discriminable patterns or structures that can be organized according to some intelligible master plan, he has developed his architectonics of knowledge, i.e., his principles for the ordering of knowledge into systematic categories. He believes such a categorization can serve as a valuable resource to curriculum

¹ Bellack, in A Reassessment of the Curriculum, pp. 25-40.

builders since it renders the profusion of cognitive experiences intelligible and provides as its main function a simplification of understanding.¹

With this goal in mind, Phenix has developed what he calls the "six realms of meaning." The following are the class names he has assigned: synoetics, aesthetics, symbolics, empirics, ethics, and synoptics. Epistemological meaning, he maintains, has two dimensions each of which may in turn be divided into three subdivisions as follows: extension (single, general, and comprehensive); intension (fact, form, and norm). The result is nine generic classes of knowledge with the six realms of meaning each serving as a resource of substantive material for certain of the classes. The disciplines, in turn, are the sources of content for the six realms of meaning. The disciplines would each supply characteristic methods and representative ideas, the six realms of meaning would supply organizational unity, while the nine generic classes would provide a logical way of organizing instructional materials around the range of cognitive function of which the individual is capable. According to this plan, ". . . substantive materials used in teaching should be

¹Phenix, in Education and the Structure of Knowledge, pp. 60-61.

chosen in such a way as to be paradigmatic or representative of the ways of knowing.”¹

Another set of problems result from the application of the concept of structure of the disciplines to the practical world of curriculum construction. The theorists are concerned with the possibility that the emphasis on structure will result in a preoccupation with theoretical knowledge and a corresponding neglect of the relationship of knowledge to human affairs.

Again Bellack delineates the problem with characteristic succinctness. The ultimate goal of education should be intelligent human behavior. Knowledge should be a useful guide for action. Human problems do not come neatly labeled but come as decisions to be made. The progressives tried to establish the practical applications of knowledge by using the personal and social problems of young people as an organizing center for selecting instructional materials. The disciplines were to be reservoirs of data to be used in varying amounts according to the demands of the problem being considered. Again a basic lack of in-depth understanding of the disciplines prevented their effective use in problem-solving. Some organization that emphasizes the systematic study of the various disciplines plus

¹Ibid., p. 71.

opportunities for developing competence in dealing with problems and issues that cross the lines of several disciplines is needed. An example of such an organization would be some form of coordinating seminar where students work on issues and problems current to their time.¹

Foshay also warns of the problems that will result from any overemphasis on the separate disciplines. Each discipline contains within its domain and methodology the best thought about reality in its own field. However, the problems of life do not come in neat packages. A problem has no discipline of its own. Yet the multidisciplinary approach runs the risk of being superficial. The way of intelligence, the problem-solving technique, is a metamethod. It must be predicated on an understanding of the methods of the disciplines used. Both ways must be honored.²

In the introduction to this chapter, the global nature of the attempts to define the concept of structure for the disciplines has been duly noted. Proponents of structure were establishing general guidelines or defining characteristics of structure which might indicate profitable directions for future study and research. Repeatedly

¹ Bellack, in The Nature of Knowledge, pp. 50-52.

² Foshay, pp. 33-34.

such theorists remind their readers that the scholars within a discipline must develop or define the structure for their discipline.

The logical-psychological dilemma described above is a representative problem area concerning the concept as an entity. The major components of the concept (conceptual framework, methods of discovery, history) may also be singled out for special attention.

Schwab offers some comments designed to extend and clarify one component part, the conceptual framework, or, as he calls it, the substantive structure of a discipline. He observes that by proposing to investigate a subject we indicate our mistrust of the present state of knowledge about the subject. In collecting data there must be some guide to relevance. The guide to inquiry is the substantive structure of the discipline which determines the questions asked, the kind of data sought, the experiments performed, and the interpretations made of the data collected. The revisionary character of scientific inquiry is apparent in the continual assessment and modification of substantive structures.¹

Different substantive structures tend to succeed one another in such disciplines as physics and chemistry. Other disciplines are

¹Schwab, in The Structure of Knowledge and the Curriculum, p. 25.

characterized by the concurrent utilization of several substantive structures. Pluralism of substantive structures is typical of such disciplines as sociology, psychology, and art. The implications for those who would define the global structure for a discipline are apparent. Provision must be made to indicate the tentativeness and changing composition of the existing substantive structure to the students of a subject area. Furthermore, some mechanism for continually updating the existing structural map(s) is imperative. In those disciplines where a number of structural patterns exist, provision must be made for communicating the limitations of any single structure to the student.¹

Schwab also raises some provocative questions about another structural component, the methods of discovery. He prefers to think of this component as the syntactical structure of the disciplines. The syntax of a discipline concerns itself with the concrete descriptions of the kinds of acceptable evidence, in what degree such evidence is acceptable, possible substitutions, and problems of interpretation. Furthermore, the syntax of a discipline is of two kinds: the short-term syntax of stable inquiry and the long-term syntax of fluid inquiry. Stable inquiry constitutes the bulk of scientific

¹Ibid., pp. 27-30.

inquiries. The authors of such inquiry accept the substantive structures of the discipline in question as eternal principles and are probing for refinements within these structures. Fluid inquiry investigates what the stable inquirer takes for granted, i.e., the very validity of the substantive structures themselves.¹

Schwab makes some additional comments about the evidence resulting from inquiry. In many scientific inquiries the data compiled often are not clear-cut evidence in support of nor in negation of a particular hypothesis. Moreover, there is considerable selectivity in searching for evidence, and the underlying data used as a base for research often are just as messy as the data collected. Discovery of positive evidence of a hypothesis seldom allows an unequivocal acceptance of the hypothesis, nor does lack of positive evidence indicate disproof. There is always the chance that the researcher has looked in the wrong place, in the wrong manner, or at the wrong time. Scientific inquiry is a process of constructing bodies of tentative knowledge and of discovering different ways of making data coherent.²

¹Joseph J. Schwab, "The Structure of the Natural Sciences," The Structure of Knowledge and the Curriculum, ed. G. W. Ford and Lawrence Pugno (Chicago: Rand McNally and Co., 1964), pp. 39-40.

²Ibid., p. 33.

The warning is clear. Those who would define the structure of a discipline must communicate to the student an attitude of suspended judgment. Schwab sums it up when he says, “. . . it is desirable, if not necessary, that we so teach that students understand the knowledge we impart may be incomplete, is relatively ephemeral, and is not mere literal, ‘factual’ truth.”¹

Problems of implementation

It is worth noting again that problems of implementation undoubtedly derive from decisions concerning the definition or application of the concept of structure for the disciplines. Nevertheless, certain features of structure have greater overtones for implementation than others. The problems considered below are of that nature.

Bruner emphasizes again and again that the methods of discovery and verification are a salient feature of structure for a discipline. He does so because he sees a number of positive results for the psychological structuring process occurring in the mind of the individual. In his analysis there are two kinds of teaching--the expository mode and the hypothetical mode. In the expository

¹Joseph J. Schwab, “Problems, Topics, and Issues,” Education and the Structure of Knowledge, ed. Stanley Elam (Chicago: Rand McNally and Co., 1964), p. 10.

mode the teacher organizes, plans, and manipulates the content and the listener, making extensive use of the lecture as a teaching tool. In the hypothetical mode the student shares in the organization, planning, and decision-making, and such teaching is characterized by discovery learning and inductive reasoning.

As a result of discovering relationships for himself, the learner receives several dividends. There are certain activities and attitudes that go with inquiry training. It is the process of imposing a workable puzzle form on various kinds of difficulties. As a result of practice, the student gains confidence in his own power to solve problems, to look for regularities and relatedness, and to persist. In other words, he learns the heuristics of discovery and the end result is an increase in intellectual potency.¹

Another major increment from discovery learning is the shift in the motivation of the learner from extrinsic to intrinsic reward. A growth in competency is the motivating force in discovery learning. The student is rewarded by the increasing ability to do things for himself. A reduction in the need for extrinsic rewards--i.e., grades, teacher approval, honor rolls, etc.--is a direct result.

¹Jerome S. Bruner, On Knowing: Essays for the Left Hand (Cambridge, Mass.: Harvard University Press, 1964), pp. 81-96.

The discovery approach to learning is also an aid to conserving memory. The principal problem for human memory is retrieval, not storage. The key to retrieval is organization--knowing where to find information. Students do best in recovering materials tied together by the form of mediation they most often use. "The most uniquely personal of all man knows is that which he discovers for himself" is Bruner's way of saying it. Allowing the child to discover principles and basic ideas for himself is the most effective means to conserving memory.¹

Through his support of discovery learning and emphasis on the methods of discovery as a prominent feature of the structure of any discipline, Bruner is raising, at least by implication, substantial questions of implementation. Structure is not just lineal, visual representation of the domain, methods, and history of a discipline that can be conveniently confined within the covers of a textbook and teacher's guide or manual. He suggests that there must be a new style of teacher behavior in which the student is allowed, even expected, to learn on his own. The new teaching style will emphasize independent study and self-direction. Materials will be selected and organized to make the student an active participant in his own

¹Bruner, in Readings in Curriculum, p. 288.

education rather than a passive listener or consumer of verbal teacher input. It is obvious that such curriculum revision will necessarily have to provide for the retraining of in-service teachers and for the revision of preservice education for teachers. It is likely that buildings and materials will reflect different designs and forms.

The emphasis on intrinsic reward also has implications for school policy. It may well be that school systems will have to review carefully the way in which they evaluate children, which could result in a de-emphasis of extrinsic rewards such as letter grades, particularly as such grades represent the recall of factual detail only.

One other kind of problem of implementation created by the use of the concept of structure in the revision of the K-12 curriculum is anticipated by Hanna when he notes that local control of the public school may be eroded away by the enticement of federal money. He feels that such local control has been an admirable device for involving people in the finest democratic tradition. However, curriculum revision that makes use of nationally recognized scholars for extended periods of time, allows for development of whole programs of materials, provides for the widespread testing of these programs prior to additional revision, and includes provisions

for extensive retraining of teachers in the proper use of the new materials and methods is much too expensive a program to be financed locally or even with state participation. This is particularly evident when it is understood that such curriculum research and design should be a continuous program if the changing structural elements are to be kept current with the newest knowledge available.¹

The Case for Structure

In the preceding pages of this chapter, the statements of scholars who support the concept of a structure for the disciplines have been screened to determine just what they say the defining characteristics of structure are. The statements have then been analyzed a second time for a view of the difficulties that the theorists have anticipated in the definition and use of the concept. Now it is useful to review the statements another time to determine what the theorists say makes the concept of structure a different and better way to approach curriculum revision.

¹Paul Hanna, "Structure of Knowledge: The Interrelationship of Ideas," The Nature of Knowledge: Implications for the Education of Teachers, ed. William A. Jenkins (Milwaukee: University of Wisconsin-Milwaukee, University Bookstore, 1962), p. 10.

One of the most gratifying effects produced by curriculum revision based on the concept of structure for the disciplines would be in the treatment of subject-matter content. The traditional subject in the K-12 curriculum was descriptive in nature, a veritable catalogue of data organized around separate and sometimes remotely related topics. The search for conceptual frameworks and instruction based on the methods of discovery of the discipline add a whole new element to content and call for new methods of instruction as well as new methods of learning. It avoids the pitfalls of an approach that often treated subject matter in bits and pieces.

A brief review of the defining characteristics of structure as a concept highlights several additional reasons why the proponents of structure say that this is different and better than any past attempt to build a theory for curriculum revision. The structure of a discipline provides a conceptual framework, methods of inquiry, and a developmental history that provides the shortest and most effective route for understanding in the discipline. Thus, the structure of a discipline is illustrative of the underlying simplicity of things.

The structure of a discipline supplies an equally powerful tool for learning. In-depth understanding of the structure of a discipline allows a teacher to anticipate many of the problems of instruction. Moreover, the conceptual framework and methods of

inquiry of a discipline are basic systems for learning the subject and parallel to a great extent the individual's need to order and categorize cognitively the sensory input from his environment.

Teaching the structure of a discipline using the discovery method will enhance transfer of knowledge to new situations, increase individual ability to retrieve information, emphasize the search for meaning and competency as the chief motivating forces in learning, and develop greater intellectual potency in each individual.

There has been increasing pressure on the K-12 curriculum to produce greater numbers of highly educated and skilled workers to meet the demands of a highly industrialized economy. Yet there is a continuing need for an informed citizenry capable of intelligent community action. The two needs, appearing at first glance to be somewhat paradoxical in nature, may be harmonized most effectively through instructional procedures organized around the structure of a discipline. Structure equips the individual for the task of humanizing the knowledge of a discipline.

One of the single most perplexing problems faced by curriculum specialists is the problem of the accelerating rate of discovery of new information. The individual may be inundated, overwhelmed by the accumulation of data in any one field. Structure provides an effective tool by which this proliferation of fact may be managed.

Structure emphasizes underlying principles that help order and categorize fact, thereby avoiding the need of remembering the large number of details that would otherwise be necessary.

A related problem is the gap that appears between the subjects as taught in the K-12 curriculum and the new information being discovered in the academic disciplines. Research will continue to push back the frontiers of knowledge but there is an equal need to provide for the diffusion of new knowledge as it is discovered. Constant re-examination of material taught for its basic patterns of organization will narrow this gap between advanced and elementary knowledge and serve as a guarantee against a reopening of the gap in the future.

The theorists insist that the search for structure must be led by scholars in the various disciplines, and therein lies another benefit for the K-12 curriculum. For far too long the academicians have limited their interest in the precollegiate curriculum to a more-or-less carping complaint that instruction in the individual subjects was inadequate, weak, or "watered down." The search for structure in the current curriculum projects has drawn leading academicians into the work of updating and reorganizing the curriculum and should require continued participation by the topmost scholars of the various disciplines. A certain amount of status and professional

recognition will accompany work on the precollegiate curriculum, a situation resulting from the search for structure in the disciplines.

The discussion above outlines a composite list of the claims made for structure as a concept in curriculum revision by the scholars who support the concept. It is only fair to remind the reader again that most proponents of structure do not support it as another educational panacea. Isolating the claims for structure from the reservations they express about the application of structure to curriculum projects fits the purposes of this study but may tempt the reader to just such an interpretation.

The preceding analysis has provided three kinds of information essential to the successful conclusion of this study. It is now possible to talk about what the proponents of structure say it is, what reservations they have about it as a concept, and what claims they make for it as theory. The next chapters will describe how structure has figured in the curriculum projects of the last few years and what educators are saying about the effects of this application of the concept to the practical world of curriculum reform.

CHAPTER III

STRUCTURE AND CURRENT CURRICULUM PROJECTS

The curriculum-reform movement initiated in the 1950's and continuing in full swing during the 1960's has brought about substantial changes in the K-12 curriculum. The forces which shaped and directed the reform movement have been outlined in Chapter I and need not be reviewed in any detail here. It is pertinent at this point, however, to examine in somewhat greater detail the pattern of curricular revision that was developing in response to these forces, since this pattern provides insight into the way the concept of structure has been defined and used in specific curriculum projects.

The number and variety of curriculum projects now under way precludes a project-by-project analysis even in a single field of development such as science. Moreover, it is not in the scope of this study to identify or verify the discrete elements of structure as they have been defined for specific subjects. Curriculum construction based on the theory of structure delegates this responsibility to the academician. Rather, the problem is one of deciding

if the concept of structure as it has actually been developed and used in specific curriculum projects represents in any way an orderly development of the theory outlined in Chapter II. To this purpose, descriptions of curriculum revision in the four broad fields of science, mathematics, social science, and the humanities will be examined for the degree of commitment to the concept of structure and for the general pattern of definition and implementation.

Progress in Revision

It was suggested in the introduction to this study that structure as a concept has had a rather unique pattern of development when compared to the standard procedures of scientific investigation. While the precision of the analogy may be challenged, it is useful in illustrating the rather casual way in which structure has been applied and used in the curriculum projects.

Normally the theorist develops a hypothesis that explains the relationships among observed data and then designs a controlled test situation in which relevant and measurable variables are observed in relation to established evaluative criteria. Data collected in the test situation are then interpreted as support for or disproof of the hypothesis. In the development of the concept of structure, the various theorists proposed some defining characteristics of the concept

and raised some questions related to refining and applying the defining characteristics to the academic disciplines. The next logical step based on the accepted methods of research would have been for theorists to plan in cooperation with the academicians dialogue in which the structure for individual disciplines was developed and refined prior to the development of instructional methods and materials. In the main, the theorists have to this point in time engaged only peripherally in the colloquy over structure for the disciplines. Instead, the task of determining structure for the various academic disciplines and of prescribing instructional methods and content for the school subjects on the basis of the structural elements so determined has been left almost exclusively to the academician and his partner, the in-service teacher. Definition of structure and instructional prescription have proceeded almost simultaneously. The dispatch with which theory has been translated into instructional practice, while necessary and commendable in many respects, has not allowed for extensive research on the structure of any of the disciplines.

Woodring has suggested that change in the schools does not proceed at a steady pace. He maintains that "educational reform, like all social reform, comes in waves, with long periods between waves in which the reforms are re-examined, re-evaluated and

sometimes modified and rejected.”¹ It seems to be true that pressures for change build up slowly and that educational institutions, like other social institutions, have a tendency to maintain and even defend the status quo until such pressures can no longer be denied. This may account for the wavelike, crisis-reaction syndrome that is often discernible in both educational change and in changes in society as a whole.

At any rate, curriculum change in the 1950's and 1960's was definitely a reaction to intense criticism of the precollegiate curriculum. As a result, the most pressing needs have been given some priority in attention. Certainly one of the main aims of the curriculum planners was to correct for the explosion of knowledge and the accompanying lag between what was being discovered in the various disciplines and what was being taught in the school subjects. There was a pressing need to update both the content and methods of instruction of the subject matter taught in the typical school. A second major aim was to contribute effective foundational preparation for an expanded supply of highly educated, highly trained workers to man and direct the increasingly complex technology that was

¹Paul Woodring, New Curricula (New York: Harper and Row, 1964), p. 2.

becoming so vital to national welfare. Both were particularly sensitive issues with educators and the general public alike, and concern for them undoubtedly influenced the general allocation of effort and the pattern of change that has resulted.

One of the first disciplines to benefit from the reawakened national concern with the K-12 curriculum was mathematics. Curriculum reform in mathematics began as early as 1951 with the University of Illinois Committee on School Mathematics. Its genesis was in the discontent with the attitudes and skills of students of mathematics graduating from the K-12 curriculum and with the obsolescence of the content and methods of most mathematics courses. The latter discrepancy could be attributed at least in part to the general disinclination of professional mathematicians to involve themselves in precollegiate curriculum planning. By 1950, however, pressures from society and from within the academic community had reached a point where scholars from the field of mathematics not only were assuming the leadership in calling for reform but were even expressing a willingness to participate in the necessary work of planning.

While the UICSM project marked the beginning of reform in mathematics, most projects started in 1957 or later, receiving substantial impetus from the generous financial support of the National

Science Foundation. On the whole, curriculum builders in mathematics started earlier and have struggled longer with the problems of curriculum revision than the planners in most disciplines. Curriculum revision in the field of mathematics is now well into its second decade and follows a rather standard pattern of development.

Professional mathematicians working with in-service teachers have concentrated on developing new instructional methods and materials based on the structural elements of mathematics as these elements have been determined by the professional mathematician. Most projects have focused initially on the able secondary student, but since mathematics extends from kindergarten through grade twelve, several projects have completed sample programs for all levels of the precollegiate curriculum. Most projects provide for re-education of the in-service teacher. The end result has been a number of available programs and materials, elementary and secondary, from which the local schools could choose, and many local schools have experienced thorough revision of their mathematics curricula.¹

The impression that the "new math" has swept traditional programs out of the K-12 curriculum is in error, however. The

¹Goodlad, pp. 22-38.

very number and variety of materials and programs produced have created problems of selection for the local schools and have accentuated problems of articulation. Moreover, teachers are still relatively untrained in the newer programs and often are found teaching in a conventional manner even when using the newer materials. The appearance of change has in many cases been accepted in lieu of a vigorous and cohesive program making full use of the new materials, ideas, and services.¹

The physical and biological sciences were equally fortunate in receiving the early spotlight of national concern and the accompanying munificence of the National Science Foundation. Again the objective was to update content and methodology, and initial attention was given to the high school triumvirate of physics, chemistry, and biology as separate entities. Revision was to emphasize the structures of the disciplines with instruction in the methods, procedures, and skills of scientific investigation as a paramount purpose. Scholars in each discipline offered leadership and in-depth knowledge of content and method. In-service teachers provided practical experience and knowledge of children. Instructional

¹Robert B. Davis, "Mathematics," New Curriculum Developments, ed. Glenys G. Unruh (Washington: Association for Supervision and Curriculum Development, 1965), pp. 48-50.

materials were the chief products, and a diversity of materials packages was encouraged.

As programs for the secondary schools were completed, the projects in the natural sciences broadened their interest to include neglected science areas such as ecology, geology, astronomy and meteorology, and science instruction in the elementary schools. These later efforts were much more likely to consider science as a broad field and to concentrate on a synthesis of the separate disciplines. All projects emphasized supplementary teaching aids and some form of re-education for the teachers in the new methods and materials.¹

The social sciences did not have the good fortune to be singled out as immediately vital to national welfare in the initial stages of the current reform movement and were denied early access to the largess of the public purse as doled out by the National Science Foundation. As a result, the social sciences are about ten years behind mathematics and the natural sciences in projects started and revisions accomplished. In 1962, Fraser reviewed six projects

¹Paul E. Blackwood, "Science," New Curriculum Developments, ed. Glenys G. Unruh (Washington: Association for Supervision and Curriculum Development, 1965), pp. 57-67.

under way in the social studies.¹ In 1965, after the advent of Project Social Studies funded by the United States Office of Education and contributions by various foundations and associations, Michaelis reviewed thirty-two projects in social studies.²

Early projects in the social sciences were typical of curriculum projects in other disciplines in that they emphasized revision in the secondary school and were discipline-centered. The social sciences presented a unique problem in this respect since history was the only discipline of seven that was ordinarily guaranteed a substantial place in both the elementary and secondary curriculum. The other social sciences were faced with developing complete programs in competition with history or with developing materials that could be integrated with another discipline already represented in the curriculum. The social sciences have shown the same tendency as mathematics and the natural sciences to shift toward an interdisciplinary orientation as the projects mature, particularly in the elementary schools. Area studies and studies of contemporary problems are the organizing centers for some projects

¹Fraser, pp. 72-85.

²John U. Michaelis, "Social Studies," New Curriculum Developments, ed. Glenys G. Unruh (Washington: Association for Supervision and Curriculum Development, 1965), pp. 68-84.

that stress an eclectic and unified approach to curricular reform in the social sciences. Most projects are also typical in that they are now concentrating on the production of instructional materials.

Emphasis within the projects has centered on key concepts and general themes. The methods of inquiry of the disciplines and the use of inductive approaches to the development of generalizations have been featured. The overall emphasis has been on solid grounding in the social sciences and on the intellectual development of the student.

The pattern of development has also been typical of other disciplines. Scholars representing the various social sciences have provided insight into organizing principles and methods. Classroom teachers have tried out the materials and offered critical feedback. Planners have generally started with substantive content rather than a consideration of psychological or social foundations. They have shown great interest in the cognitive processes. Much remains to be done before materials will be ready for use in a quantity and variety conducive to comparison. Predictions about future revisions in the social sciences will be easier to make upon completion of some of the studies now under way.¹

¹Ibid.

Curriculum revision in the humanities, with the marked exception of the foreign languages, parallels somewhat the social sciences in its level of development. Compared to mathematics and the natural sciences, which experienced pressures for change as early as 1950 and were completing substantial revisions by 1960, the humanities only began to share in the interest and support of the federal government in the early 1960's. As a result, many of the humanities are just now entering a period of extensive revision.

With the establishment of the English Program of the United States Office of Education in 1961, the discipline of English began to share in the finances that seem to be a basic ingredient in the descriptions of the projects throughout the curriculum. By 1966, the English Program had sponsored 120 research studies primarily concerned with the problems of teaching reading, language, and composition. Twenty-five curriculum study and demonstration centers have been established. Most projects developed in the centers have dealt with the secondary school except for two that are planning a K-12 sequence. Most emphasize an integrated, sequential, cumulative approach. The products are likely to be characterized by carefully structured curricula taught inductively.

The now venerable summer institute for in-service teachers has lately become a part of the extended plans for change.¹

Curriculum revision in modern foreign languages has progressed much farther than revision in the other humanities. World War II graphically illustrated how improved transportation and communication had reduced the distances between other cultures and our own, and consequent involvement in world affairs had resulted in an increased need to interact with a world community. It became apparent that language instruction in the precollegiate curriculum was inadequate to the job of preparing a sizable number of citizens equipped to participate in such interaction in the native language of the countries involved.

By 1950, the Modern Language Association supported by the Rockefeller Foundation was already investigating the place of foreign languages in the K-12 curriculum. Its recommendations resulted in the inclusion of a Language Development Program in the National Defense Education Act of 1958. The succeeding years have seen extensive changes in instruction in foreign languages in the precollegiate curriculum.²

¹Goodlad, pp. 72-77.

²Ibid., pp. 79-81.

During the war, the armed forces had used an audio-lingual approach to instruction of foreign languages that had proved highly successful. Curriculum projects in the foreign languages have accepted the audio-lingual approach, and listening and speaking skills based on an understanding of the structure of the language are primary goals. To develop these skills it has been necessary to start instruction earlier, often in elementary school, and continue it longer. Again the emphasis is on integrated, sequential programs. There has been a great increase in the audio-visual and other supplementary teaching materials. Language laboratories are a common facility in many secondary schools where only a few years ago none existed. At the same time, the number of languages taught in the precollegiate curriculum has been increased and has corrected to some extent the imbalance of previous offerings.

The arts have continued to be the step-children of the curriculum. The renewed interest in the disciplines that so greatly benefited mathematics and the natural sciences had an adverse effect on the arts, at least initially. In some cases budgets in art and music were actually cut back to provide extra funds for the "solid" subjects of mathematics and science. However, in the established pattern the federal government is now giving the arts a belated boost by supplying federal monies in substantial amounts.

Two newly created organizations, the National Foundation in the Arts and Humanities and the Arts and Humanities Program of the United States Office of Education, are now sponsoring projects designed to improve instruction in the arts and to enhance their status in the organization of the general education component of the K-12 curriculum. The summer of 1966 saw what by now is a sign of the times, the first summer institute for music teachers, and hopefully other institutes for teachers in other artistic endeavors may be expected to follow.¹

A Pattern for Change

The preceding description of the status and organization of curriculum reform in the various academic areas reveals a number of common trends and a more or less standard pattern for change. The great bulk of effort has been directed toward three major aims: to update the content of the school subjects; to emphasize the structural elements of principles and methods; and to contribute to the effective foundational preparation of specialists destined to enter as workers in a complex industrial technology.

¹Ibid., pp. 82-84.

The reform movement that has developed from these aims has been characteristically discipline-centered. In this view of curriculum development, organized knowledge as represented by the various academic disciplines is both the ends and means of schooling, and scholars from the disciplines under revision have taken a leading, even dominant, role in updating and reorganizing the content and methods of instruction. These physicists, biologists, or mathematicians, as the case may be, have sought to revise their subjects around the primary structural elements of the disciplines, i.e., major concepts, key ideas, underlying principles, and methods of inquiry.¹ Another feature common to the current pattern of reform is that revision is generally planned from the top down. The planners determine what they believe a graduating senior needs to know to be adequately prepared in a particular subject. Adequate preparation, at least initially, has often been defined as the preparation needed to enter college. Content has then been selected and organized around structural elements of descending levels of complexity. This has meant that the high schools and junior high schools have usually been first to receive the attention of planners. Elementary schools have felt the effects of reform to a lesser degree and more often in

¹Ibid., pp. 14-15.

the last few years. It is also true that science, mathematics, and foreign languages, as a result of national needs and consequent allocation of financial support, have received first attention, while the social sciences and humanities are only now beginning to receive substantial help.

Most projects make use of developments in learning theory that emphasize a new concept of readiness. This view of readiness assumes that heredity will endow most students with at least average intelligence and a rather normal pattern of physiological maturation. In this view of readiness, the key factor in the ability to assimilate and interpret new data at any point of development becomes the quality and variety of previous interactions with the environment, just as the continued development of intelligence is to a large extent dependent on the kinds of experiences yet to be encountered. Cognitive maturation is not just a natural process of unfolding, but a process whose rate and extent can be directly influenced by planned encounters with the environment. A learner will not necessarily be better prepared to understand a new concept simply because he is older. As a result, there has been an almost universal trend among curriculum planners to introduce the structural elements in each of the content areas at earlier ages and grade levels.¹

¹Robert S. Gilchrist and Donald Snygg, "The Case for Change," New Curriculum Developments, ed. Glenys G. Unruh

As indicated previously, scholars from the specific academic disciplines have assumed the leadership in the curriculum projects of this period. They have worked in partnership with teachers from the schools who have themselves been specialists in the subjects they taught. As planned, the scholars have provided the depth and insight into the structural elements of a discipline, and the teachers have furnished the knowledge of children and the practical experience in instructional problems. The two groups have usually met in summer committee sessions, focusing their energies on the production of instructional materials packages, assuming, apparently with some justification, that they could in this manner make the greatest immediate impact on curriculum. As a result, curriculum projects of this period have typically produced sample texts, supplementary books, workbooks, teachers' manuals, films, film strips, programmed materials, and laboratory experiments.

The materials developed have usually been tested during the following academic year, often in the classrooms of teachers cooperating in the summer planning. The materials have then been revised on the basis of this experience during a second summer session,

again tested in the schools, usually on some extended basis, and revised a second time before they have finally been offered for distribution. Some projects have planned materials meant to supplement or replace parts of the traditional programs. Other projects have developed completely new materials and have required adoption of the total package. Most projects have made available to the in-service teacher some kind of introduction to the new content and methods being recommended. University-sponsored and government-financed summer and academic year institutes in which the in-service teacher has been paid to learn the proper use of the new materials have become standard practice.

The problems of evaluation have been particularly troublesome to project planners. Existing testing procedures and instruments were judged to be generally inadequate to the job of evaluating the newer programs. Whenever the project materials represented a thorough revision of the conventional programs, they inevitably emphasized different skills, organizing concepts and principles, methods of learning, and attitudes. Therefore, the planners had rather limited choice as to initial methods of evaluation. They could ask experts to observe the effectiveness of the new materials; they could question participating teachers and students about their reactions to the new programs; they could design new testing

procedures and instruments; or they could compare the performance of students from traditional and new curricula on traditional and specially designed tests. Most projects used all four options.¹

Finally, both the finances for the present reform movement and the leadership and direction of the various projects have come primarily from outside the local school district, this in spite of a traditional commitment to local control of the schools. National policies have undoubtedly influenced both the kind and rate of curriculum revision now occurring in the schools. The money to finance the revision has come largely from national foundations and the federal government. Local school districts generally have had the choice of adopting rather than any substantial part in creating or even adapting the various curriculum packages that have resulted. In most cases, the range of choice has not been great nor have the local schools shown much inclination toward a thorough assessment of local needs and objectives as a basis for adopting a particular materials package.

Yet the fears of federal control of a completely nationalized curriculum have not materialized, at least not in the sense that such fears are usually expressed. The federal government has allowed

¹Goodlad, pp. 99-102.

complete freedom of development within the projects financed. For the most part, materials and methods developed by the federally supported projects have been made available to the private publishing industry with no strings attached. Alternative designs in every field have been encouraged. In fact, as the federal government has broadened its support to include the social sciences and humanities, even the charge that the federal government is guiding change in a particular direction has lost some of its force.

Theoretical and Operational Relationships

The chief purpose for reviewing the descriptions of the various curriculum projects has been to determine if the procedures used and the materials produced represent reasonably well what the theorists had suggested in their defining statements. Using the dictums of the theorists as evaluative criteria, it will be helpful to consider the ways in which the projects might be judged successful.

Telescoping the theory of structure in order to devise some manageable yardstick of success, structure for a discipline may be said to include a framework of explanatory principles, the methods of inquiry, and a developmental history. Structure may best be determined by the scholar in the discipline and, since structure is a cognitive map invented by the scholarly mind, it is possible--in

fact, likely--that there will be a number of possible structures for each discipline. Students must be taught to understand the revisionary character of modern inquiry and to realize that structures and the knowledge they interpret will inevitably change. Instructional methods and materials developed must in some way allow for the cognitive maturity and experiential background of the individual and should emphasize student participation in discovery and inductive reasoning.

The first question to consider might be whether the projects have made diligent efforts to base their revisions on the structural elements of the disciplines. The answer seems to be an emphatic "yes." For example, the Biological Sciences Curriculum Study decided to produce three basic versions of biology around nine unifying themes. About two-thirds of the content was to be the same in each version, with the main differences being in approach and emphasis. In a similar manner, project after project pledges itself to develop underlying principles or central themes.¹

The second defining characteristic of structure, the methods of inquiry of the scholar, figure just as prominently in the discussions of the projects. For example, a social science curriculum

¹Ibid., pp. 41-42.

development program at Harvard University is based on the analysis of public controversy with the objective of training students to examine and analyze the kinds of disputes that cause social conflicts. Their instructional materials consist primarily of case studies which are designed to present the student with the raw data of human experience.¹ The objective to develop the “attitudes, skills and modes of inquiry that are characteristic of disciplined study and are most useful in lifelong learning” is common to revisions of the social sciences and to all the projects in general.²

The third feature of structure, the history of the development of the disciplines, is not so often separately verbalized in the descriptions of the projects, but the developmental history is implicit in the integrated and hierarchical nature of the curriculum units being developed by so many of the projects. The Biological Sciences Curriculum Study project does, however, list the “intellectual history of biological concepts” as one of its nine unifying themes and is an example of a project that specifies developmental history as a goal.³

¹Ibid., pp. 58-59.

²Michaelis, p. 71.

³Goodlad, p. 42.

Since the theorists charge the scholars of the disciplines with the responsibility of determining the structure for each subject area, how faithfully have the projects made use of academicians? The projects rate close to perfect on this criterion. Almost every project is headed by an outstanding scholar representing the discipline under revision, and established academicians are equally well represented in the working committees and subgroups of each project. Professor Zacharias, who has directed the Physical Science Study Committee, and Professor Begle, a mathematician at Yale University who has directed the School Mathematics Study Group, are examples of the success with which recognized scholars have been attracted to curriculum planning within the disciplines.

Have the projects demonstrated an awareness of the tentativeness of knowledge and the possibility of several structures coexisting at the same time in a discipline? The evidence is abundantly clear on this point. No project has claimed that its efforts were definitive or final. Even the School Mathematics Study Group project, for example, established a goal of sample textbooks designed to provide examples of the kinds of mathematics that many of the mathematicians of the country thought suitable for the various grade levels. The texts were supposed to stimulate further exploration and modifications in curriculum as time and experience

indicated profitable directions. The SMSG has itself written two separate versions of its tenth-grade geometry course.¹ As a result of its broadened scope and financial support from Congress, the National Science Foundation has in the last two years been able to encourage about as many curriculum study groups in each subject area as there were well-devised requests for funds. As a result the broad fields of mathematics, science, social science, and the humanities are all represented by a number of projects, all differing in some respect in their purposes, level of application, conceptual orientation, or emphasis.

Another indication of the awareness within most projects of the revisionary nature of modern inquiry is that on completion of their initial goal, whether the product represents an integrated program for grades kindergarten through twelve or a program for a single year of study at a particular grade level, most projects acknowledge the rudimentary nature of the revisions accomplished and then cite a need for expanded experimentation and development. SMSG, which has probably been in operation as long as most projects and which has already produced sample materials for grades

¹William Wooton, "The History and Status of the School Mathematics Study Group," New Curricula, ed. Robert W. Heath (New York: Harper and Row, Inc., 1964), pp. 40-43.

kindergarten through grade twelve, is now working on revisions of many of the materials first developed and is concentrating on three additional concerns for the future: providing closer connections between mathematics and other subjects where mathematics is used; continued research on how students learn mathematics; and curriculum materials for below-average students.¹ Many projects are developing organizational structure of a more or less permanent nature. Educational Services, Inc., formed to study revisions in the physical sciences, has combined with the Institute for Educational Innovation to become one of the twenty regional centers provided for in Title IV of the 1965 Elementary and Secondary Act.²

How effectively the projects have been able to adapt logical structure to the cognitive maturity and processes of the individual is far from certain. Certain positive provisions for such adaptations can be identified, however. Psychologists have been included on the advisory committees of many of the projects. In-service teachers have played an integral part in planning and testing instructional materials and have provided the feedback on which the

¹ Ibid., p. 26.

² James D. Koerner, "EDC: General Motors of Curriculum Reform," Saturday Review, August 19, 1967, pp. 56-57.

materials have been revised one or more times. To the extent that psychologists have contributed any substantial direction to curriculum revision and to the extent that teachers possess in-depth knowledge of the cognitive maturity and processes of the students they teach, the problems of the psychological structuring of knowledge have been considered. Certainly the use of the practical instructional experience of the in-service teacher is far superior to prescription by the outside expert alone.

Bruner has warned that instructional materials must be adjusted for the stage of cognitive development of the individual. At the earliest stages the child is concerned with the relationship of action to things. At the level of concrete operations, much behavior is internalized and reversible but the child is still confined largely to immediate and present reality. Therefore, it is futile to attempt to teach basic concepts by presenting formal explanations that are based on a logic that is different from the child's mode of representation.¹ Thus, early representations of a concept may take the form of physical manipulation of objects while later representations may be made in the form of manipulation of symbols or words.

¹ Bruner, The Process of Education, pp. 36-37.

There is evidence that some projects have given serious consideration to the problem of how soon and in what manner concepts should be verbalized. For example, in explaining the use of the discovery method in the program developed by the Illinois Committee of School Mathematics, Beberman says:

It is important to point out here that it is unnecessary to require a student to verbalize his discovery to determine whether he is aware of a rule. The teacher can use a sequence of questions to determine whether awareness is present. In fact, immediate verbalization has the obvious disadvantages of giving the game away to other students as well as the more serious disadvantage of compelling the student to make a statement when he may not have the linguistic capacity to do so.¹

He goes on to say that the technique of delay in the verbalization of important discoveries is characteristic of the program. While it is difficult to determine short of a project-by-project analysis how completely developmental stages are considered in designing instructional materials, it is clear that most projects are cognizant of the need to adapt method and content to the cognitive maturity of the child.

Most of the theorists have recommended involving students in discovery, letting them formulate generalizations from observing data,

¹Max Beberman, "An Emerging Program of Secondary School Mathematics," New Curricula, ed. Robert W. Heath (New York: Harper and Row, 1964), pp. 24-25.

and providing them with practice in self-direction. Goals such as these imply a new style of teaching and a shift from what Bruner has called the "expository mode" to the "hypothetical mode."¹ The projects have tried conscientiously to produce materials that would require change in teaching style more analogous to the hypothetical mode. Moreover, the projects have indicated the importance they give to changed teaching styles by the amount of effort they have allotted to in-service training. The teacher institutes have been adopted as a standard method by which in-service teachers could be trained in the proper use of the new methods and materials. Every project has provided a wealth of supplementary materials and aids designed to contribute to more effective and challenging teaching based on student participation and discovery.

The discussion above has detailed the ways in which the various curriculum projects of this period have followed the concept of structure as it has been developed by theorists who support the concept as a viable curriculum tool. The evidence leaves little doubt as to the intent of the projects. The revisions were planned to implement the concept of structure as it was interpreted by the working committees of each project. Given the peripheral involvement

¹ Bruner, On Knowing: Essays for the Left Hand, pp. 81-96.

of the theorists and the speed and manner in which revision has proceeded, it would be surprising indeed if all the concerns of the theorists could be properly considered and implemented. The next question to be considered, then, is at what point practice ignores or violates the dictums of the theorists.

While the curriculum projects have in general successfully implemented many of the mandates of the theorists, there are some cautions or advisements that have been totally or in some part disregarded. Again the evaluative criteria are what the theorists have said can and should be done. In the area of the definition of structure for the disciplines, one of the main oversights of the projects --understanding that they were functioning under pressures for immediate and substantial change--seems to be in the manner in which the logical structure of the disciplines has been adjusted for the psychological structuring occurring in the minds of children. While psychologists were often included on the advisory committees of the various projects, there is no indication that they participated to any extent in the actual construction of instructional materials. Instead, this phase of the revision was handled in most cases by the academician and the in-service teacher. Nor has time allowed for any controlled experimentation to compare alternate materials, particularly materials designed in differing representational modes and at

several levels of complexity or abstraction. In general, the criterion or test of the efficacy of presenting a particular concept in a particular way and at a particular level has been the judgment of the teacher as to how well students were learning the concept and to whether students believed they were learning more effectively. This represents useful and important evidence, but it does not represent very thorough exploration of the relationship between the structural principles of a discipline and individual cognitive styles of ordering such principles.

It seems apparent that most projects, at least initially, have focused their attention on cognitively mature individuals at each succeeding level of development and have yet to develop a number of alternate packages for different levels and styles of cognition. It is only fair to note in passing, however, that the projects are now in the process of broadening the scope of their efforts to include studies of how different types of children learn subject matter in different instructional and environmental settings.

The projects have a good record in respect to encouraging the development of parallel structures in the disciplines where they seem to exist. Seldom is a voice raised in defense of a single, all-encompassing structure for any of the disciplines. Yet it is equally true that there is not a wide choice of instructional

packages or alternate programs in most disciplines and the dialogue over existing packages has not tested to any extent the logic presented in any of them. Again, the projects seem to be moving toward a more thorough investigation of the logical structure for their disciplines and hopefully the number and variety of offerings will increase at the same time that present packages are being refined and improved.

The most salient failure of the projects to consider the cautions of the theorists lies in their complete neglect of the problem of relatedness. Several theorists have warned that discipline-centered curriculum development would not provide for a method of developing the relatedness of knowledge within a particular broad field of disciplines such as the social sciences. For example, the discipline of economics does not present a complete picture of man in the social setting. The projects have made only cursory attempts to explore the possibility of a metastructure for allied disciplines, and such beginnings as have been made have been largely limited to the elementary school where tradition supports a more unified approach to learning.

If the projects have failed to explore the relationships among allied disciplines, it is almost inevitable that they would not have undertaken any study of the relatedness of knowledge among the

broad fields of the natural sciences, mathematics, social sciences, and the humanities. Nor have they, with a few notable exceptions occurring within a specific project and discipline, considered the relatedness of the knowledge represented in the disciplines to the problems of life. Other than the general faith that a thorough and rigorous exposure to the explanatory principles and methods of inquiry of the individual disciplines will be easily transferable to life situations, the projects simply have not addressed themselves to this problem.

The general failure to heed the warnings of the theorists about relatedness--and again the speed and pressure for observable revision is no small exonerating factor--opens the curricular reform movement to the serious charge of failing to build a balanced curriculum. Although the theorists did not present structure as a remedy for all curriculum ills, it has been applied in the projects as though it were one. In this case, the men most dedicated to balance in the curriculum, the professional educators, have been used largely in advisory roles at the top levels of specific projects. Even here they have been generally mistrusted as a group dedicated to a "watered-down," life-adjustment curriculum, the very thing that many planners believed the projects had been organized to correct. It is unfortunate, indeed, that more of the talent, time, and energy of the very fine scholars and teachers involved in the projects has

not been spent in interdisciplinary dialogue concerned with achieving a more balanced curriculum.

The theorists have warned of the problems of changing modes of teaching and the projects have responded with valiant efforts that have resulted in excellent instructional materials, including numerous and varied supplementary teaching aids, and the ubiquitous teacher institutes. The evidence indicates, however, that project personnel and almost everyone connected with current curriculum reform have underestimated the job of retooling the schools of a nation made up of local autonomous districts that are widely different in resources and needs. Certainly project planners of the future will need to divert more time and effort into careful consideration of the change process, or their best efforts will be jeopardized by lack of adequate provision for the diffusion and adoption of their programs.

Finally, the theorists have pointed out that the rate of change in the disciplines resulting from the revisionary nature of modern inquiry will require some built-in process for continued renewal. The refinement of existing structures, the discovery of new ones, and the elimination of the obsolescent will require constant attention. Curriculum planning can no longer proceed in a wavelike, crisis-reaction pattern. There is much indication that some projects

and reformers are taking heed of this warning but, like the problem of diffusion, it is easy to underestimate the size of the task. Certainly the general public is not likely to be aware of the need for this kind of continuing action, but is more likely to ignore the problem until the next crisis builds up and the press of events again focuses it to its attention. It is definitely a responsibility of the curriculum planner to forestall such a situation.

CHAPTER IV

EVALUATIONS OF THE THEORY AND USE OF STRUCTURE

The analysis of the place of structure in the curriculum projects of the last years presented in Chapter III indicates rather conclusively that the concept of structure for the disciplines served as a rationale for revision in most of the projects. As the projects began to have an impact on the K-12 curriculum, many educators interested in curriculum attempted to evaluate what was happening. One of the main points under investigation in this study is whether such global evaluations of structure have resulted in confusion about the concept and in some misleading conclusions about its efficacy as a curriculum tool. For example, have the evaluations clearly distinguished between criticisms leveled at the concept and criticisms leveled at its use in the particular curriculum projects of the last few years? Furthermore, are such critics imputing to the concept greater power than the theorists have been willing to claim for it and in turn criticizing the concept for lacking this same omnipotency?

A review of the evaluations should provide evidence on these and related issues.

At this juncture, it should be stated again that it is not within the scope of this study to consider the debate over a particular structure as it has been defined and implemented by a specific curriculum project for a specific discipline. The statements of the theorists in Chapter II have indicated repeatedly that the scholars in a discipline must assume primary responsibility for determining the elements of structure for that discipline. Moreover, the concept of structure states just as plainly the probability that each discipline has several structural maps, each useful as a partial explanation of the meaning of data in the discipline. The evaluations considered in this chapter are, therefore, the global evaluations of the concept of structure and its place as a tool in the total pattern of curriculum revision.

Under the circumstances it will be rather important to subject the evaluative statements to an orderly examination based on the purposes of this part of the study. First of all, it will be necessary to list what the evaluators label as the successes of the concept as it was implemented in the various curriculum projects of this period. Following this, the concerns or doubts that the evaluators have about this approach to curriculum revision will be

summarized. These concerns will then be analyzed on the basis of whether they attack the theory of the concept or the manner in which the concept is being used. Finally, the criticisms will be examined for their validity. Are the evaluators attacking the theory of the concept as it was advanced by its proponents or are they attacking theory that has been extrapolated from the manner in which the concept was implemented? In other words, are the theorists and evaluators speaking to the same points?

Support for a Concept

A host of educators and academicians have reviewed the progress of current efforts to revise the precollegiate curriculum. In general, they have judged a structure-oriented, discipline-centered approach to change to be one of mixed blessings at best. They usually start by admitting that change was long overdue and more or less inevitable. An emphasis by educators and psychologists on the physiological, emotional, and social development of children and the general lack of interest on the part of most academicians in the precollegiate curriculum had both contributed to some extent to a serious gap in knowledge between the subject matter being taught in the schools and the newest developments in the parent academic disciplines. Therefore, the current reform movement is usually credited,

even by its critics, with two major successes. It has been responsible for attracting the academician with his considerable expertise and insight back into program planning for the K-12 curriculum, and it has resulted or will result in thorough re-evaluation of much of the subject-matter component of the curriculum.¹

The most gratifying result in the first instance is that educators, particularly the in-service teacher, and academicians have provided visible evidence that the two groups can work cooperatively to solve the problems of updating and revising the content and methods of the various disciplines. The projects have demonstrated effectively the natural relationship between the theoretical and operational in curriculum planning.

There are a number of achievements commonly attributed to the re-evaluation of the subject-matter component. There has been a dedicated attempt, the evaluators admit, to cut through the volume of detail and arrive at basic themes and principles. There has been serious deliberation over what is important enough to learn and be included in the curriculum from kindergarten through grade twelve. In addition, the approach has emphasized the tentative and developing

¹Doll, pp. 18-19.

nature of knowledge and the accompanying need to continue to learn throughout a lifetime.¹

Moreover, the re-evaluation has placed the methods of discovery of the discipline as central to instruction in that discipline. Inductive reasoning has been raised at least to a par with the analytic as a tool for learning. The study of cognitive growth and development has promoted the interest in discovery learning and in turn has been stimulated by the need for greater understanding of the processes involved.²

The hypothesis that most students are capable of reasonable academic attainment in a learning environment that is properly adjusted or structured has opened up great possibilities for instructional practice and research. Such a stance offers hope for success to any instructional program that properly translates the elements of the structure of a given subject into the correct cognitive mode for the individual student. When such a properly structured environment also encourages discovery and self-direction, it

¹William M. Alexander, Changing Curriculum Content (Washington: Association for Curriculum Development, 1964), pp. 4-7.

²John I. Goodlad, "The Curriculum," Rational Planning in Curriculum and Instruction (Washington: National Education Association, 1967), pp. 18-19.

emphasizes the intrinsic motivation of competency rather than such extrinsic rewards as grades. Teachers, in turn, are encouraged to use new methods of teaching that depend less on the telling-listening relationship of the traditional classroom.

The end product of most revisions has been the materials package, and in general it has been far superior to the single product of former revisions of content--the ubiquitous textbook. The current projects have emphasized the revision of textbooks but have reduced their central importance by including a wealth of supplementary resources such as films, recordings, books, and programmed materials. In most cases the materials provide for a decidedly different way of utilizing the skill of the teacher.

One of the most important successes credited to the projects has been the development of in-service education for the teacher. The summer and year-around institutes have emphasized changed teacher behavior as a basic ingredient in curriculum revision and it is an emphasis that most evaluators can support enthusiastically. It is a lesson they feel should not be ignored by future curriculum planners.¹

¹Alexander, p. 10.

In the final analysis, however, the most important long-range effect the current curriculum projects may have on the future development of curriculum may be as an illustration of pattern or method. The cooperation of teachers and scholars in developing and testing instructional materials has approached the ideal.¹ Moreover, the infusion of large amounts of money and dedicated interest have indicated what can be done when the two ingredients are supplied in proper amounts. Certainly the size and complexity of the problems of revision in the centralized, technological society in which we now live have been clearly demonstrated.²

A Concept in Question

While the evaluations of the concept of structure and the curriculum projects using it as a rationale have for the most part been fair in assigning credit where it is due, they have been even more conscientious in exposing the alleged weaknesses of the concept. Sometimes the evaluations express concern over what might happen or what is likely to happen. At other times the concern is over

¹ Ibid.

² Goodlad, in Rational Planning in Curriculum and Instruction, p. 18.

what is presently taking place. In any case, the importance of such critical analysis to this study is in its level of application--theoretical or operational--and in the clarity with which the evaluator distinguishes between the two.

One group of problems that commonly get their share of attention has to do with the definition of the concept of structure. Such evaluations usually begin by pointing out that there is no single, precise, and commonly accepted definition of what a discipline is. What is more, there is plenty of evidence from history that new disciplines are emerging while various combinations of established disciplines have reached a status closely akin to that of a separate discipline. Therefore, they say, the disciplines do not represent a very stable foundation upon which to build curriculum reform.

Just as important, it is not difficult to uncover evidence that scholars within a discipline cannot unite on a single structural map for that discipline. Since the theory of structure itself allows for the possibility of several viable structures existing at any one time in a discipline, how can revision take place on the basis of any one structure?¹

¹ Alice Miel, "Knowledge and the Curriculum," New Insights and the Curriculum, ed. Alexander Frazier (Washington: Association for Supervision and Curriculum Development, 1963), pp. 80-81.

Evaluators see another set of problems developing from the necessity of coordinating the logical structure of a discipline with the psychological ordering characteristic of the cognitive processes of the individual. Such evaluators insist that the expertise of the scholar alone is not sufficient to the job of revision. First of all, the structure of underlying principles of a discipline is an order imposed on the data by the minds of mature scholars and is not necessarily coincident with the conceptual development of a child. In similar analogy, the methods of discovery of a discipline are procedural modes distilled after the fact by mature scholars. The evaluators suggest that it is a moot question as to whether such structures and methods are suitable guides to discovery for the immature mind.¹

Some evaluators have been concerned that the pattern of development for structure has been characterized by a direct jump from theory to instructional prescription. One such evaluator says:

The point made here is that our developmental metaphors are interesting and reasonably valid within the context in which they were developed. When these metaphors are extrapolated and projected into instructional settings, they lose a considerable

¹J. B. MacDonald, "Myths about Instruction; The Myth of the Structure of the Disciplines," Educational Leadership, XXII (May, 1965), 575-610.

portion of their validity and become less probable as valid basis for prescribing instructional practices.¹

Goodlad has expressed a similar doubt when he notes that the current projects have seldom devised a test of their assumptions but only tests of whether their assumptions are being carried out.²

Two other trends disturb the evaluators. There has been a general tendency to plan revision within a subject from the top down. This practice seems especially inconsistent when compared with the developmental nature of the cognitive processes in children which follow a general pattern of simple to complex and concrete to abstract. It seems obvious that the logical structure of a discipline will not automatically translate into the psychological structure as it develops in most children. Moreover, there seems to be a tendency to regard the ability of children to learn a particular concept as proof enough that they should learn it. The evaluators would have the decision to teach a concept made on the bases of available alternate ways of using the time of the learner rather than on the single criterion of the learner's ability to understand.³

¹Ibid., p. 574.

²Goodlad, in Rational Planning in Curriculum and Instruction, p. 25.

³National Education Association, Deciding What to Teach (Washington: The Association, 1963), pp. 45-46.

Perhaps the single most disturbing psychological issue for the evaluators of structure is that they believe the concept tempts curriculum planners to use a theory of learning that concentrates almost exclusively on the intellectual development of the child. They charge the projects with ignoring the research that indicates the great influence of emotional and social factors on learning. In a similar fashion, they charge the projects have in the main begged the question of individual differences and the instructional problems that result.

The great bulk of the criticism leveled at the concept of structure results, however, from what the evaluators say is a lack of overall direction in curriculum planning. The typical project establishes as its goal the understanding of the data collected within the confines of the discipline. This understanding is best accomplished by teaching the underlying explanatory principles of the discipline and the methods of inquiry used by the scholars in the discipline. In this manner, each discipline is effectively revised, but to what end? Even assuming that most students could learn the underlying principles and methods of the rather large number of existing disciplines--and most evaluators do not admit to this--is there any guarantee that a student would then be a good citizen, would see the relatedness of things, would develop vocational goals, or would be

equipped to function effectively in the society in which he finds himself? This lack of overall direction in terms of specified goals makes the job of evaluating the results of a discipline-centered revision almost impossible.¹

The charge of a lack of clearly stated objectives leads into a series of doubts about the concept of structure as it has been used in the curriculum projects of recent years. The curriculum projects have represented a piecemeal, uncoordinated attempt at curriculum revision. The subjects already in the curriculum have become more firmly entrenched than ever before. Newer disciplines of particular significance to the life-style developing in the United States will, as a result, have a tougher time than ever in gaining consideration in the precollegiate curriculum. Moreover, the early priorities established in answer to national needs have resulted in an emphasis on science and mathematics when, in the minds of some, our technological and scientific know-how already outstrips our social skill in utilizing this knowledge.

Furthermore, the imbalance created by revising curriculum a single discipline at a time is not likely to get at a very basic

¹Goodlad, in Rational Planning in Curriculum and Instruction, pp. 23-24.

problem, the limited amount of time available in the school day and year. Apparently some selectivity of content will always be necessary. The seven separate disciplines within the general field of social science are a case in point. It seems highly unlikely that all seven can be added as separate entities to an already crowded school schedule. One temptation may be to favor the disciplines with the most apparent structures. The discipline-by-discipline approach has already created a collection of rather powerful lobbies that have engaged in a kind of power struggle, competing for available funds and the limited time in the school schedule. What is more, any selection of representative disciplines does not solve a second pressing problem, that of the relatedness of the disciplines and the knowledge they encompass.¹

Other types of imbalance are also created, say the evaluators. The emphasis on the structure of the disciplines and an accompanying concern for excellence in student achievement has generally favored the capable student over the average or poor student, yet one of our most crucial problems is represented by the students not presently being reached by the traditional curriculum--the dropout

¹Herbert M. Kliebard, "Structure of the Disciplines as an Education Slogan," Teachers College Record, LXVI (April, 1965), 601-2.

or force-out so prominently featured in current educational literature. College-bound youth are best served by the new materials. General education and education for job-bound youth continue to be problems the projects have largely ignored. Standards of excellence are most easily met by the capable and the highly motivated.¹

The emphasis on discovery learning has some recognizable limits, too, say the critics. Certainly analytical reasoning is as much a part of inquiry as inductive, and it is patently clear that learning through inductive processes is extremely slow and will have to be used selectively in any case. Moreover, the implementation of discovery teaching requires a wealth of supplementary resources and a depth of knowledge on the part of the teacher that are not, at present, uniformly available.²

Within the limitations listed above, the evaluators see the separate-subject approach as working best for the secondary school where departmentalization and specialization is common. The elementary school presents larger problems. First of all, the teachers are not ordinarily trained as specialists in a particular discipline

¹Cecil J. Parker and Louis J. Rubin, Process as Content: Curriculum Design and the Application of Knowledge (Chicago: Rand McNally and Co., 1966), p. 29.

²National Education Association, p. 39.

and in most cases are responsible for teaching a variety of subjects. Secondly, the elementary school is not departmentalized around a group of specific subjects. It seems unlikely that the elementary school could ever accommodate as many as fifteen or sixteen separate subjects. Some sort of grouping in broad combinations is imperative.¹

Finally, problems of balance encompass a very basic consideration, the relatedness of school and life processes. The evaluators are concerned that the emphasis on the theoretical and abstract will contribute to an existing gap between what a youngster experiences in the school environment and what he considers important to know to live successfully in his life out of school. Problems resulting from the interaction of individuals in the social setting draw upon the knowledge of many disciplines for their solution. Such problems are interdisciplinary in scope. Unless the knowledge gained from the study of the structure of separate disciplines is demonstrably applicable to solving the problems of real life, young people are likely to dismiss their school experience as pointless ritual.²

¹Goodlad, The Changing School Curriculum, p. 16.

²Ibid.

Another source of dissatisfaction for the critics of structure springs from their belief that the process of change has been either ignored completely or inadequately served. For one thing, say the critics, the very completeness of the materials packages being developed emphasizes program more than effective, imaginative teaching. Teaching may be changed but only toward a new routine that could be labeled the "structural" approach. Furthermore, the new materials packages, if interpreted correctly, require the use of supplementary resources that simply are not available in most school systems, particularly in the elementary schools. Provision for adequate resource centers on a local and regional basis are a requirement concomitant with the proposed changes in teaching methods.

In spite of the considerable resources devoted to educating in-service teachers in the methods of the revised curricula, there is also a serious gap between the stated objectives of the curricula and what happens in the classroom that is using the new materials. In the final analysis, say the critics, the only way you can change instruction in the classroom is to change teacher behavior, and far too often teachers are teaching a new formula labeled "discovery" or "structure."¹ The situation is complicated still more by the gap

¹Goodlad, in Rational Planning in Curriculum and Instruction, p. 25.

existing between the changed and unchanged programs existing within a particular school system or individual schools and among local school districts across the country. Since teachers and students are by past standards extremely mobile, the continuity of program for a single school or for a specific student is very difficult to maintain.¹

Analogous problems of continuity have developed at several other levels according to the evaluators. The high school senior graduating from a curriculum emphasizing the new reforms often enters a very traditional college curriculum. Such students, thoroughly indoctrinated in the newer methods, are already experiencing some frustration. A similar problem results from the slow introduction of the newer methods and materials into the preservice teacher-education programs. First-year teachers coming through a traditional program may take jobs in a system using the new programs while their counterparts graduating from revised programs may find jobs in a school system with a traditional curriculum. There is an equally urgent need to introduce the new materials and methods at the graduate level where most in-service teachers can be reached.²

¹Alexander, p. 13.

²Ibid.

The new curricula have created some acute problems for the local schools. The cost of the curriculum projects--as much as eight million dollars has been spent by the School Mathematics Study Group project alone--is such that no local district could seriously contemplate participation except as a unit in some larger effort. The local districts are of necessity, then, adopters of pre-packaged programs, and their choice at the moment is rather limited. It is incongruous to insist that they adopt programs on the basis of needs and objectives when only one or two alternatives are available in any specific area. Neither is there very much clear-cut evidence on which the local district may evaluate the programs. Any evaluating the projects have done to date usually results in the rather meaningless statistic that students in the new programs do as well as students in traditional programs on traditional tests. They do better than the students in traditional programs on tests designed to evaluate the new methods and materials. Other evidence usually runs to testimonials by teachers and students on how much they prefer the newer programs to the traditional.¹

Finally, the curriculum planners have never made adequate provisions for supporting planned innovation at the local level. It

¹Goodlad, in Rational Planning in Curriculum and Instruction, p. 23.

should be expected, say the critics, that thorough curriculum revision would result in corresponding changes in scheduling, building design, resource centers, class loads, and a myriad of other related areas. Such changes inevitably require additional expenditures for materials and professional staff time. In-service programs and demonstration projects at the local level are two examples of the extra effort necessary. A number of attempts to innovate have failed not because of an inherent weakness in program but because enthusiastic administrators and school board members have been tempted, often as a result of a "band wagon" attitude, into adopting too much, too quickly. Teachers, students, and parents are all integral factors in the change process and must be considered.¹

Perspective in Evaluation

Assuming from the evidence in Chapter III that the concept of structure has been influential in shaping the direction and organization of the current curriculum-reform movement, and that evaluations of the curriculum projects are all, therefore, more or less direct evaluations of the concept of structure or its implementation, it seems accurate to say that the evaluators are satisfied

¹Alexander, p. 15.

with many of the results of structure-oriented revisions. Academicians have rightfully assumed a responsibility for curriculum planning and have demonstrated they can work effectively with teachers. Content for many subjects has been thoroughly revised on the basis of current accuracy, underlying principles, and methods of inquiry. An attempt has been made to design instructional materials that are representative of the cognitive level of the students they serve. The instructional packages prescribed have been superior to anything developed in the past, and teachers have been encouraged to adopt a new discovery mode of teaching that emphasized inductive reasoning and self-direction. The pattern of revision has demonstrated what can be accomplished when enough talent is provided the time and means for working on curriculum problems. These are significant credits by any standard of evaluation.

Apparently there is evidence here to support the concept of structure, although the support is largely implicit. If structure encourages revision around the basic elements of principles and methods of inquiry and develops instructional materials in terms of the cognitive maturity and processes of students, and this is improvement over past revisions of content, the implication is that disciplines do have basic structural elements around which instructional materials and methods may and should be designed. Without belaboring

the point, the recognition of positive results, especially when those results spring from the most basic precepts of structure, represents a kind of admission, albeit grudging, that the concept has worked, whatever the problems of definition and use.

Many of the evaluators do doubt the validity of the basic theory of structure, however. The criticisms pointing out the uncertainty about the defining characteristics of a discipline and of the disturbing fact of parallel structures for a single discipline are expressions of doubt over the possibility of defining any structure accurately enough for it to become the organizing basis for instruction. The doubts remain and at the moment are just as amenable to proof as statements supporting structure.

The theorists have spoken to this point, however, and they have said that such ambiguity may be expected at our present stage of development. Both the defining characteristics of a discipline and of the structure for a single discipline are frameworks developed in the minds of men for ordering and explaining data about the real world. Such frameworks may be expected to change as man increases his knowledge, but they remain useful as a basis for current inquiry and as explanations of the real world around us. Until experimentation yields additional evidence, both sides to the debate

may practice the art of polemics with little fear that empirical evidence can be produced to destroy their respective cases.

The evaluators also attack the theory of structure when they raise the questions concerning the amount of coincidence between the logical and psychological ordering of knowledge. Many proponents of structure such as Bruner say there is a natural relationship between the two, but some psychologists and philosophers have enough doubts that they recommend considerable research to indicate the exact nature of any such relationship. This is another case where the doubts of the evaluators are probably as susceptible to proof as the claims of the theorists. A logical case may be made for both.

Surprisingly enough, these two criticisms seem to be the only ones directed primarily at the theoretical basis of the concept of structure. By far the bulk of the contention is over the way the concept has been implemented and the negative results of such poor implementation. For example, one of the first criticisms indicated that there has been a prescription of instructional materials and methods before there has been a satisfactorily thorough examination of the proposed structure for any of the disciplines. There seems to be some merit to this charge although the use of the scholars from a discipline as working members of revision committees reduces the danger of misrepresenting what the structural elements

for a discipline are at the time of revision. Such men should have encountered and evaluated any debate over the structural elements for their disciplines and should represent an established viewpoint. Given adequate time and means, there is no doubt that additional dialogue would be helpful in defining the structural elements of any of the disciplines. It is clear, however, that at this point the evaluators are attacking the implementation of the concept of structure and not its basic theory.

There is an equal possibility that scholars and others could disagree over the instructional materials and methods that are to represent the structure of a discipline, even when the same scholars agree on the structural elements to be represented. Again the question seems to concern adequate time for experimentation and evaluation and is not a question of the validity of the concept.

Another concern of the evaluators is the general pattern of developing program from the top down--i.e., starting with the requirements for college entrance and working down through the grade levels of the precollegiate curriculum, planning a program for a grade at a time, each program at the next lower level being foundational to and integrated with the one above it. Such a procedure emphasizes intellectual development, interprets ability to learn as justification enough for instruction, and ignores the developmental

order of the cognitive processes. It is easy enough to see a general top-to-bottom pattern of planning in the projects but it is reasonable to speculate that this probably resulted as much from the pressure of national priorities--i.e., the need to provide more adequate foundational preparation for specialization, particularly at the college level--as it did from any theoretical convictions about curriculum development. Leaving the job of defining the structural elements of a discipline to the academician, top-down or however, it would seem that program planning could then proceed at several levels simultaneously as long as all planning fitted into some pre-conceived and integrated pattern. It is not where the planning starts but how such planning is relevant to the total curricular scheme that makes the difference. Nor does emphasis on the intellectual and the able student necessarily mean that structure cannot enhance understanding at any ability level. If cutting through detail to basic elements is desirable for the keen mind, it is at least of equal importance for the average or below. The question of whether materials can be developed for students at all levels of ability and background has yet to be settled.

The evaluators express their greatest concerns when they speak of what they allege to be happening to balance in the K-12 curriculum. The discipline-centered approach has been piecemeal,

has strengthened existing inequities, has favored selected subject-matter areas, and has neglected relatedness among allied disciplines, broad fields, and to the problems of life. These are certainly problems but they cannot necessarily be imputed to an inadequate theory of structure. The warnings of the theorists about such unresolved issues are the best evidence of their gravity. It is difficult to see why the concept of structure or any other curriculum theory must be discarded because problems of its effective use have yet to be resolved. It seems somewhat analogous to prohibiting the use of the energy of the atom for any purpose because such energy incontinently released has threatening destructive power.

The evaluators have raised another series of objections to current curriculum projects that is even more clearly an indictment of implementation. These allegations charge the projects with neglecting the change process. The completeness of the instructional package encourages routinized teaching, albeit a new routine; inadequate measures of in-service and preservice education for teachers threaten continuity of the revised programs; and innovation at local levels has been inadequately planned and financed. A case supporting or denying these charges can be developed. In certain instances the warnings of the theorists could be used as supporting evidence. The point for this study, however, is that the allegations all directly

concern the operational use of the concept of structure and do not represent an indictment of the concept itself.

The bulk of the evidence in the preceding analysis of the evaluations of structure as a curriculum concept seem to support the following general statements. While the evaluators have some doubts about the efficacy of the concept as theory, particularly about its defining characteristics and supporting psychological rationale, they are generally pleased with the thorough way in which the substantive component of the K-12 curriculum has been revised. They believe the emphasis on the structural elements has produced some desirable changes in instructional methodology. They have serious doubts about the way the concept has been implemented and the process by which the instructional packages have been introduced into the schools of the nation. Most evaluators do not make a distinction between criticisms directed at rationale and criticisms pointed at operational problems of implementation, but when their statements are analyzed on this basis there are surprisingly few arguments leveled against the rationale of the concept and a great many leveled at its implementation.

CHAPTER V

STRUCTURE IN FUTURE CURRICULUM PLANNING

The Concept of Structure as Curriculum Theory

The controlling purpose of this study and hence the purpose of the analysis of information collected in the first four chapters has been to examine the implications of the concept "structure of a discipline" for curriculum planning in the schools of the nation. To this end, Chapter I has been devoted to a description of the forces responsible for the particular direction of current curriculum reform and for the consequent interest in the concept of structure. Chapter II has presented a composite view of structure as its proponents have defined it and includes their reasons for supporting the concept as well as their concerns about the way in which it might be defined and used. Chapter III surveys the current curriculum projects to determine how theory has actually been applied and implemented. Chapter IV reviews the evaluations of structure-oriented revision to discover what the evaluators believe the weaknesses and strengths of this approach to curriculum planning

to be and to determine if the criticisms presented are indictments of the concept of structure or of its implementation. The evidence collected in this manner may now be used to answer some pertinent questions about the concept of structure.

How has the concept of structure
for the disciplines measured up
to the claims made for it
by the theorists?

Structure as an organizing rationale for the curriculum projects of the last seventeen years can be credited with some substantial successes. The scholars in the disciplines have shown a new interest in planning for the precollegiate curriculum. Content in a number of the key subject areas has been thoroughly revised and updated to bring it more in line with the newest knowledge in the parent disciplines. Such revisions have emphasized basic concepts and principles rather than factual detail. Instruction in the subjects has been organized around the methods of discovery employed by the scholars in the academic disciplines, and methods and materials have been substantially changed to emphasize inductive reasoning.

Moreover, the projects through which these successes have been accomplished have provided mute testimony on the basic ingredients necessary to effective curriculum planning in a highly industrialized, centralized economic system: large outlays of money,

national concern and recognition for results, and the best available talent. Within the projects, educators, academicians, psychologists, and teachers have demonstrated a real capacity for cooperative and effective teamwork. These are some of the visible signs of the positive effects the concept of structure has had on the curriculum.

Although the concept has, in the main, accomplished for the subjects in the precollegiate curriculum what its supporters claimed it could, the picture is not one of uniform success. Many of the benefits claimed for a structural approach to curriculum reform must still be accepted either on faith alone or on the basis of the enthusiasm shown by teachers and students involved in the newer programs. Structure is represented as a powerful tool for learning. It allegedly enhances memory and transfer, provides intrinsic motivation, and promotes intellectual potency. Furthermore, the logical structure of the disciplines and the psychological structuring of data within the individual have coincident and supportive relationships. These claims, it may be fairly stated, still lack for empirical proof. Moreover, the newer programs have not demonstrated clearly that they serve all levels and types of children equally well. Perhaps the best the projects can say as a result of their evaluative efforts is that students in the newer programs do at least as well as those in the more traditional programs.

On balance, then, there is evidence that many of the claims made for structure are well founded. These successes center around the logical components of structure and the operational procedures for implementation. Claims growing out of the psychological domain of learning theory and stressing cognitive development are less amenable to empirical proof. At the present time, however, it would be equally difficult to disprove the claims. The lack of negative evidence at the very least justifies continued exploration of the utility of the concept as curriculum theory.

Has the concept of structure been
seriously challenged by the
evaluations of the current
curriculum reform
movement?

This study has maintained a position that evaluation of the concept of structure has been complicated by the unusual way in which the concept has been developed. A group of theorists have proposed the concept, a second group of curriculum planners have applied and implemented it, and a third group of scholars have evaluated the results. Evaluating the concept as a curriculum tool, difficult enough under any circumstances, has been complicated still further by a failure of the evaluators to specify whether their criticisms were directed at theory or at the current methods of application

and implementation. Even when the problem of theory is isolated for consideration, the way in which the concept has been developed leaves three possible referents for the term: the theory of the scholars who have proposed the concept of structure; the theory of the curriculum planners in the various projects as they have interpreted the statements of the theorists; and the theory that evaluators may attribute to the concept as a result of their interpretations of the statements of the theorists or of the actions of the curriculum planners. This study has taken the position that evaluation should be directed toward the theory of the men who have proposed the concept, such men as Bruner, Phenix, or Schwab. These men may be classed as theorists for the concept, and if the concept is to be evaluated it is their theory that should be considered. If their admonishments about the defining characteristics of structure and the problems of application and implementation have been carefully considered in the curriculum projects of this era, evaluations of project results are legitimately evaluations of the theory of the concept. Where the projects have failed to consider the dictates of the theorists, it may be assumed that the concept is not being tested and, as a result and within this framework, is not the subject of evaluation.

An assessment of the evidence collected in Chapter IV leaves large areas of the rationale of the concept of structure for the disciplines relatively unchallenged. There seems to be overwhelming support from all segments of academic endeavor that the fields of inquiry recognized as disciplines do have underlying explanatory principles that can be fitted together in a hierarchical framework useful for establishing the meaning of data collected in the discipline. While there may be disagreement over the specifics of the kind, number, and order of such principles, few scholars in or out of the academic disciplines care to dispute their existence.

In the same fashion, it is generally accepted that each discipline has certain methods of inquiry used in discovering and validating data and in generating new investigation within the discipline. Scholars in a discipline can and do agree on general methodology even when they must admit to the existence of recognized alternative methods of discovery within a single discipline. Nor would there be many who would seriously dispute the contention that the disciplines each have a history that explains the development of the basic concepts and methodology.

The only major theoretical premise that has come into any degree of contention is that there is an easily established, even natural, relationship between the logical and psychological ordering

of knowledge. Bruner proposes three stages in cognitive development, each level having its own peculiar mode of representation purportedly requiring adaptations in instructional methods and materials.¹ Ausubel compares the logical and psychological structuring of data in four areas--meaning, process of organization, arrangement of component elements, and cognitive maturity of content--and finds important differences in each area.² There seems to be ample evidence that prescription of instructional methods and materials should be preceded by or at the very least accompanied by extensive experimentation and study of the relationship between the psychological classification and representation of data in the minds of individual students and the logical classification and representation of data within a discipline. Yet, there is little indication that such experimentation has been undertaken in the curriculum projects. Implementation of theory at this point may be largely at the common-sense rather than the scientific level and can neither be supported nor disproved by any substantial amount of empirical evidence.

The only other controversial issue concerning the concept of structure is the admittedly temporary, almost ephemeral, nature of

¹ Bruner, The Process of Education, pp. 33-38.

² Ausubel, pp. 222-26.

structure and the related problem that several structures may exist for any one discipline. The issue is whether instructional practice can be built on such an uncertain base. For those willing to assume that the explanatory principles and methods of inquiry of a discipline are the inventions of the human mind and that the present state of knowledge gives every indication of being at a comparatively primitive level of development, there seems little left to do but to build instructional practice on the basis of the best that is now known. Since one of the main goals of a structural approach is to develop in the student an attitude of suspended judgment about the interpretations of data within a discipline, this particular concern does not represent a serious challenge to the rationale of structure at this time.

It seems accurate to summarize the present status of the rationale of structure by acknowledging that its logical components of explanatory principles, methodology, and developmental history are relatively unchallenged as acceptable precepts. Its psychological component, the representation of subject matter in the cognitive mode of the students at each level of development, remains relatively untested. On balance, therefore, there seems to be little reason to discard structure as curriculum theory.

Have the actions of the projects or the statements of the evaluators resulted in some confusion about the theory and use of structure?

The manner in which the global concept of structure has been applied to the practical problems of instructional prescription and the processes by which the instructional materials and methods that were produced have in turn been disseminated throughout the K-12 curriculum has provoked some serious criticism and should be considered in some detail. Unless curriculum workers are ready to discard an admittedly viable concept, it is in the areas of application and implementation that the most productive modifications might be made.

The evaluations surveyed in Chapter IV are for the most part assessments of how current curriculum projects have proceeded and what they have accomplished and have not challenged structural pronouncements in specific disciplines. Such evaluations become assessments of the concept of structure because the evidence indicates that structure has been the organizing rationale for most projects. It is most important to remember, however, that the methods and products of the projects do not all spring from recommendations included in the rationale of structure, nor do they by any means represent the only methods or the only products that

could have resulted from the use of structure as an organizing concept. What has happened is not necessarily what had to happen or should have happened.

First of all, the review of the project descriptions in Chapter III indicates rather conclusively that whatever the projects may have claimed as objectives of revision, most had two closely related goals that took precedence over all others: updating the subject matter taught in the K-12 curriculum, and building an effective foundational program for advanced specialized training. The priorities assigned by the federal government were in no small measure responsible for the particular pattern that developed in curriculum reform during this period. If the curriculum projects have caused imbalance, as charged, one reply might be that the fault lies primarily in the priorities assigned and is not necessarily inherent in the organizing concept of structure. Evaluation at this point speaks to what occurred, often failing to mention why it may have occurred. The impression left is that structure as a concept may be expected to produce similar results in spite of how it is utilized.

The whole problem of balance is an especially interesting one. The evaluators of the concept of structure often leave the impression that discipline-centered, structure-oriented revision is largely to blame for any imbalance that has resulted in the K-12 curriculum.

In the first place, there is no indication that any of the theorists who proposed the concept of structure believed that it was a concept capable of producing a balanced curriculum. The objectives of these theorists, while broader than those of the federal government, were confined largely to updating the content of the subjects taught in the K-12 curriculum and in revitalizing the way in which these subjects were taught. Their enthusiasm for structure as a vehicle for such revisionary goals could easily be mistaken as belief in structure as a monolithic concept for curriculum reform. Actually their warnings were quite clear: the concept of structure alone was not likely to produce a balanced curriculum.

The conclusion is obvious. The concept of structure should not be held accountable for balance in the K-12 curriculum. The theorists who proposed structure recognized and warned of inadequate provisions for balance. For similar reasons, it is almost as pointless to criticize the national curriculum projects for creating imbalance. With their original limited objectives, they also performed in a very predictable manner.

Bruner and other theorists had a vision of the general organizational pattern that would most effectively pool the available talent for developing structure-oriented revision of subject matter. Educators, psychologists, academicians, and teachers were to work

together as a team to cooperatively plan and carry out such revisions. This recommendation has been dutifully implemented in most of the current curriculum projects. Educators and psychologists have served alongside academicians and teachers from the K-12 curriculum on the advisory committees and councils for most of the projects. However, the specific provisions for the use of the special talents of the team members are open to some speculation.

Assuming that the professional educator may have been included because of his general knowledge of the curriculum, the nature of the learner and learning, and pedagogical methods, it is difficult to see how his talents could receive maximal use when he is serving on an advisory committee whose assignment is narrowly confined to revising and updating instruction in a single discipline, particularly when such revision is to be structure-oriented with primary emphasis on intellectual development. The psychologist, in turn, was to provide the insight into the cognitive processes and, it is assumed, leadership in the development of teaching materials. Yet in the majority of projects, even to the present time, there is little sign of controlled experimentation on learning problems peculiar to specific subject areas.

Instead, the real work of the projects was done by the academician and the classroom teacher, and most evaluators believe it was

done well. There is no doubt of the academician's qualifications to define the structural elements of principles, methods, and developmental history. It must be assumed that if some provisions were built into the organizational pattern to avoid closure, the academician could continue to carry out his assigned role with distinction. The teacher from the precollegiate curriculum was included to provide both the insight into student behavior and the practical experience with pedagogical method that the academician lacked. The teachers seemed to have performed this latter role with distinction. The evaluators rate the materials packages produced as some of the best ever.

Attention, therefore, needs to be focused on the manner in which the talents involved were utilized. The educator, who might have contributed perspective on general curriculum issues, was circumscribed by limited goals. The psychologist, who could have provided the insight into the cognitive processes, was not usually included in the working committees. The teacher, although performing capably, seems to have been expected to provide the in-depth knowledge about the intellectual growth and development of children that may have more appropriately been the domain of the psychologist. The academician seems to be the only one cast in the role for which he was best suited. It is reasonable to conclude that the

logical components of structure for the disciplines--i.e., explanatory principles, methodology, and developmental history--have received at least adequate consideration by the consulting expert, the academician, but that the psychological components of structure, represented by new insights into the cognitive processes, have by contrast received only peripheral attention. Balance in curriculum offerings has been largely ignored as the various subject areas proceeded to revise content independently of one another.

The paradoxical nature of attempts to evaluate the concept of structure are particularly evident at this point. The theorists warned of the need to explore in some depth the relationship between the psychological and logical factors in structure. The projects, however, did not make extensive provisions for investigating this relationship although they heeded the dictums of the theorists at least superficially by using the psychologist on advisory committees and the teacher on working committees. In their turn, the evaluators point to the uncertainty of the relationship as one of their key doubts about the rationale of structure. The end result is that the relationship between psychological and logical ordering of data in the disciplines is no clearer now than in the early years of reform, and the concept of structure, by implication, is branded as theoretically

weak because of this lack of positive evidence that the relationship exists.

Balance in the curriculum is a second case in point. The theorists worried about relatedness among the allied disciplines, the broad fields, and to the problems of life. The projects generally ignored the problems of relatedness. The evaluators again point to imbalance in the curriculum as one of the chief defects in the current reform movement. Again the implication comes through clearly that the concept of structure has failed to do its proper job. The real danger in such confusion is that it becomes even more difficult to direct future curriculum study to the source of the problem.

By contrast, the theorists who outlined the defining characteristics of structure were firm in their support of the structural elements of principles, methods of inquiry, and developmental history. They expressed little in the way of doubt over the possibility that these elements could be defined with accuracy. In turn, the projects have experienced little difficulty in working with these particular defining characteristics and in developing instructional methods and materials around them. The evaluators then point to the materials and methods developed from these features of structure as some of the most solid successes of the projects.

The curriculum reform movement of the 1950's and 1960's seems to have functioned in the best tradition of scientific inquiry in many respects. A particular component force from the complex of forces acting on the precollegiate curriculum, subject matter, was isolated and broken into observable variables, the structural elements for each of the disciplines. Instructional methods and materials were prescribed on the basis of the experience of knowledgeable men with these variables, tested in regular classrooms, and revised on the basis of the empirical evidence so collected.

However, a survey of the other forces acting on the curriculum may point up some of the dangers of this apparently sound scientific approach. The component of needs, societal needs, is a prime example. The major societal need recognized by the projects, at least initially, was the need for highly educated citizens to man the developing industrial technology. Updating the precollegiate curriculum was instrumental to satisfying this need. The projects are on the way to accomplishing a major part of their goal to update the curriculum, particularly in the natural sciences and mathematics, which alleviates somewhat the pressure for improved foundational preparation in these critical areas. National interest, as represented by the action of Congress in broadening the scope of the National Defense Education Act, is now being interpreted as more

comprehensive than scientific supremacy alone and includes the social and aesthetic components of living and hence of subject matter. Certainly the problems of the so-called "culturally deprived" and the racial unrest of the last few years have done much to correct an initial imbalance in emphasis on needs. Yet, until recently the subject of needs has been very narrowly conceived.

The component of knowledge about learning has been treated just as summarily. The rationale of structure states that a discipline may have several structural maps. Perhaps the classic illustration of this generalization is to be found in the discipline of psychology and the learning theory developed from psychological investigation, where a number of explanatory maps of human behavior have been developed. Yet, the reform movement of this period singled out one such structural map, that of cognitive learning, and emphasized it almost exclusively. The theorists who developed the concept of structure showed less concern in this case, although Phenix, for example, warns that emotional and social adjustment are important factors in learning.¹ It seems fair to conclude that until the last few years projects have assumed that the students for whom they were planning were an emotionally stable, reasonably intelligent

¹ Phenix, Realms of Meaning, pp. 293-98.

product of a satisfactorily rich social environment. The rationale of structure, too, seems preoccupied with this type of youngster. Without defending or condemning this emphasis, it is possible to affirm a certain imbalance.

A similar situation prevails in the case of the component force of knowledge about the growth and development of children. The projects, rightly or not, have been largely devoted to intellectual attainment and the intellectual processes. The practical effects of the pressures for success in the academic areas and for entrance to college have undoubtedly had repercussions for emotional health and for scheduled time available for desirable physical activity, to cite two examples. There is some indication that the growth of the whole child has been subordinated, both in practice and by implication, to intellectual excellence.

Again the actions of the curriculum projects are understandable, even predictable. They were charged with specific responsibilities, given the needed money and talent, and asked to proceed with dispatch. The positive accomplishments have been cited previously. What is often overlooked is the direct relationship between the limited and, from some viewpoints, unsatisfactory results of the reform movement and the fact that the movement reacted to narrowly conceived national needs, applied a restricted interpretation of the

concept of structure to a few chosen subjects, emphasized a single psychological theory to the exclusion of several others available, and concentrated on a specific kind of growth, the intellectual. Since structure has been the central organizing rationale of most projects, it has the dubious honor of receiving the credit for the collective results of such a restricted approach to curriculum planning.

Evaluators are prone to spend a considerable amount of time listing the ways in which the projects have failed to provide adequately for the dissemination of the new programs throughout the schools of the nation. They point out that the new materials and methodology are only now beginning to make their way into undergraduate and graduate teacher-education programs. The in-service institutes have been an effective device for disseminating the materials and methodology of the new programs, but even if they were expanded in scope, so the argument goes, they would be unable to get the job done alone. Furthermore, the rationale of structure puts emphasis on new teaching methods but the complete instructional packages encourage a routinized teaching posture. Teaching itself may, as a result, be little changed even when the new programs are adopted. Thousands of schools have still failed, through design, neglect, or lack of available funds, to investigate and adopt new

programs, creating additional problems of continuity for an increasingly mobile student population. The impulse is to answer these charges with a simple "yes." There is no doubt that more is known about the process of planned change than was ever used in disseminating the current reform packages. Yet it is difficult to see how this kind of criticism can be interpreted as an indication of the inadequate theory of the concept of structure. Any program developed under any rationale faces somewhat similar problems of dissemination and adoption.

Conclusions about the Theory and Use of Structure

All evidence seems to indicate that the concept of structure, if properly defined and used, can make a real contribution to the selection and organization of educational experiences based on the content of the academic disciplines. However, it is the conclusion of this study that all features of the concept have not, to date, experienced equally well-devised, thorough testing, and as a result the concept is receiving criticism for weaknesses that might more accurately be assigned to other causes.

First of all, the most controversial features of the theory of structure have received almost no orderly exploration. One of the problems has been the rapid jump from theory to instructional

prescription. Since the academicians have for years been engaged in dialogue aimed at refining their views of the explanatory principles, methodology, and developmental history of each of the disciplines, the process of applying these defining characteristics of structure to the individual school subjects and of developing relevant instructional materials could proceed almost simultaneously, assuming the availability of adequate professional expertise. Teachers from the K-12 curriculum could supply practical knowledge of effective pedagogical techniques. But the newest and most controversial feature of structure, the representation of subject content in the cognitive mode of the student, was in need of thorough exploration through controlled experimentation before the prescription of instructional materials could proceed with any exactitude. While gross adjustments of subject matter to the cognitive mode and maturity level of the student could be made rather easily on a more or less common-sense basis, the psychological structuring described by the theorists implies a more sophisticated process of translation. Therefore, a crucial portion of the rationale of structure must still be thoroughly tested before anyone can say with certainty that the concept is valid in its entirety.

However, the concept gives every indication, to date, of being the most helpful existing tool for considering the content component of the precollegiate curriculum. Therefore, it would be somewhat of

a disaster if it were hastily discarded as curriculum theory on the basis that it had not been thoroughly tested. But the evidence collected in this study indicates that the rationale of structure will never be adequately tested until the men who are establishing the hypotheses of the concept are brought into closer working relationships with project members assigned the task of applying the theory to a discipline and of developing instructional materials from this base. The academician and the classroom teacher will always emphasize and expand upon those features of structure that are most familiar to them, while avoiding extensive and difficult experimentation with unfamiliar elements. The philosophers, psychologists, and other scholars who support structure, or their assigned representatives, would be more inclined to view the concept with perspective and insist on a more comprehensive application and development of all defining elements.

Furthermore, the theorists or their representatives should be responsible for helping in the evaluation of the developing concept. The concept should be held accountable for its stated objectives and aims and not for objectives attributed to it by outside observers. In this way, rationale would have to be stated clearly and succinctly and methods of evaluation would test rationale. At present, questions

of rationale, application, and implementation are often treated as if they were all questions of rationale alone.

Another most important conclusion of this study is that structure was not proposed as a monolithic concept for curriculum construction and can never be made into a single, all-encompassing theory for curriculum planning. Structure is best adapted to deliver in an orderly and effective manner the content component of instruction as it is drawn from the disciplines. The curriculum projects, in their rather single-minded pursuit of revising subject content, have given tacit support to the impression that curriculum revision would be adequate and comprehensive once the structure of each of the disciplines was properly translated into instructional materials. Unfortunately the concept of structure is not equipped to bring balance to the curriculum. It must be viewed as a tool useful in completing one planning step in a well-conceived hierarchy of such steps.

Finally, the evidence collected in this study indicates that the many criticisms directed at the application and implementation of the concept of structure are not indictments of the concept itself. Many of the criticisms could be corrected by modifying procedures for applying the concept and by additional provisions for its adequate implementation.

Recommendations for Future Development

In Chapter III, Woodring was quoted as saying that educational reform comes in waves with long periods in between in which the reforms are re-evaluated and modified.¹ At least wavelike motion carries with it a promise of overall movement in a single direction. Unfortunately, the course of educational reform sometimes seems more pendulum-like in that it swings from excess to excess. The progressives of the 1930's and 1940's may have supported too vigorously the emotional, social, and physical elements of growth as a protest against the highly formalized, subject-centered curriculum of the early 1900's. At present, many observers would claim that the pendulum of reform has swung in the opposite direction to over-emphasis on the intellectual with a corresponding neglect of emotional, social, and physical development. There are some rumblings of another reaction in the direction of "humanizing" the curriculum, marking a return to the interest in the total development of the individual.

Each swing of the pendulum seems to be prompted by a temptation to oversimplify. In their enthusiasm for a point of view,

¹Woodring, p. 2.

educators push each other into polarized positions or opposing camps. As a result, both sides find it difficult to recognize the strengths of the opposing position. In accounting for the several different theories of learning, Hilgard makes the point that "all theorists accept all the facts."¹ Most educators admit that all facets of growth--intellectual, physical, social, and emotional--affect learning. In other words, they all accept all of the facts. Yet, they often find themselves supporting one type of growth as if the others failed to exist. It would be extremely unfortunate if dissatisfaction with current discipline-centered, intellectually oriented curriculum revision resulted in another swing of the pendulum and a corresponding neglect of the intellectual component of growth.

After reviewing the evidence, this study concludes that structure is a viable curriculum concept that has already been instrumental in producing thorough revision of curricula in several subject areas. Academicians have shown that they understand and can work with the concept. Teachers are pleased with the instructional materials and methods developed from its application. Instruction in the schools has shifted its emphasis from teacher-telling to student

¹Ernest R. Hilgard and Gordon H. Bower, Theories of Learning (New York: Appleton-Century-Crofts, Inc., 1966), p. 9.

involvement. Therefore, it is recommended that the development of the concept of structure not only be continued but expanded. It is the contention of this study that expanded experimentation with the concept will result in structure being assigned its proper place in curriculum construction as a specialized tool that performs effectively within certain specified limits.

Expanded study of the concept of structure should proceed on three levels. First of all, structure should continue to be explored at the level of the individual discipline. It is evident that the rapid rate at which new knowledge is being discovered creates a perennial need to update the subject content of the precollegiate curriculum. Furthermore, investigation in Chapter IV indicates that the curriculum projects have had little time for developing parallel or contrasting instructional packages from which the schools may choose. Nor have all of the defining characteristics of the concept been explored thoroughly to this point. Much work remains to be done before structure may claim to be a proven curriculum tool.

It is recommended that numerous curriculum centers be established in universities around the nation for the study of the problems of precollegiate curriculum development in each of the subject areas. Psychologists, academicians, educators, and teachers should be assigned to curriculum teams but not necessarily in the same

working relationships as in the current curriculum projects. It is also at this point that the theorists or their representatives should be involved as guarantors of a comprehensive application and exploration of theory. A number of centers for each discipline would be a preferred arrangement, thereby insuring a more thorough dialogue about the structure of each of the disciplines and a wider range of choice of instructional methods and materials. Such centers should be supported on a continuing basis to insure continuity of program, but personnel should be rotated in some manner to guarantee a substantial amount of cross-fertilization and a variety of viewpoints. Centers should be responsible for both short- and long-term research into all of the defining characteristics of structure with the goal of developing more definitive statements about its application in specific subject areas.

A second level of dialogue should be encouraged among the allied disciplines in a single broad field of knowledge such as science. National or regional projects should be established to provide finances and facilities for such study, and leading scholars from the related academic disciplines involved should be urged to participate. Representative academicians serving in the university centers for the study of individual disciplines should serve as liaison people to the regional projects on the allied disciplines.

Educators, psychologists, and teachers should be included to provide additional balance and insight. Such projects should be assigned the K-12 curriculum and the school schedule within which to plan and should be charged with the responsibility of considering curricular balance among the allied disciplines under consideration. Their search should be for likenesses and differences in principle and method. Exploratory dialogue might consider such potentially unifying organizational constructs as Bloom's Taxonomy of Educational Objectives, Cognitive Domain, Bellack's modes of thought, or Phenix's realms of knowledge. Whatever the results, the projects would certainly produce data in an area where very little now exists.

The third level of exploration should be directed at the relatedness of knowledge among the broad fields of social science, humanities, science, and mathematics. One kind of mathematics, for example, is basic to research in sociology, while another is used in physics. Knowledge provided by the social sciences provides a basis for decisions about the use of the knowledge of science. The real unity of knowledge is apparent at this level, and the provisions for general education or basic studies programs in the colleges and universities of the nation are one indication of prior interest in the problem. The scholars at this level would also be concerned with relating the knowledge of the disciplines to the problems of students

in the K-12 curriculum and to the problems these students would meet in later life. Again, the search would be for unifying principles and methods and the expertise should be provided by representative scholars from the disciplines. Liaison with exploration in single and allied disciplines would be especially important at this level. Feedback among the various levels of investigation should prove mutually supportive.

The heart of the recommendations above is the assumption that we need to know just as much about the content component of curriculum as scholarly investigation can tell us. To promote maximum activity, discipline-centered curriculum study needs to be expanded from single disciplines to groups of allied disciplines and broad fields of study. In such a way, academicians will be tempted into dialogue with one another over the structural theory of basic principles, methodology, developmental history, and cognitive or intellectual patterns of development at three successive levels of application.

Two notes of caution seem appropriate at this point. The levels of study recommended above are largely concerned with the subject-matter component of the curriculum and with intellectual development. There is nothing inherently wrong with this approach, just as there has been nothing inherently wrong with the structure-

oriented revision of the current curriculum projects, as long as everyone involved is aware of the limited scope of such study. It is also apparent that such comprehensive study at three successive levels is likely to be expensive. However, the combination of money, opportunity, and recognition could mark curriculum planning as a significant scholarly activity with the result that some of the best minds of the nation might be attracted into planning for the pre-collegiate curriculum. The importance and size of the problem may warrant just such a monumental effort.

The emphasis of the previous recommendations has been focused on the content component of the curriculum, the academic disciplines. Academicians have been assigned the task of deciding what from the academic disciplines is important enough to include in the K-12 curriculum and the methods by which such knowledge may best be taught. These recommendations have been primarily concerned with the intellectual development. But knowledge of the individual suggests that he grows emotionally, physically, and socially at the same time he is growing intellectually, and that emotional, social, and physical growth set the limits of learning and the conditions under which it will occur. At the same time, content learned must equip the student to function in a particular cultural milieu in which he finds himself. Thus, a balanced curriculum will

result only from an organized effort to balance the curricular forces of the knowledge of learning, of human growth and development, of society, and of the disciplines.

The problem, then, becomes one of channeling these basic forces through an organizational screen that results in careful consideration of all of the component parts of the curriculum. In this manner, subject matter will be put in proper perspective as one of four available kinds of information. Taba has proposed one such organizational plan for orderly curriculum construction, and it serves as an example of what must be done. Her steps are as follows:

1. Establish needs
2. Establish objectives
3. Select content
4. Organize content
5. Select experiences
6. Organize experiences
7. Evaluate¹

Under this plan, certain needs would be established as a result of knowledge of how children grow and develop, others from what is known about how children learn, and still others from what is known about our developing social and economic environment. Such needs would have to be considered at least on three levels: national, regional, and local. In turn, objectives for the precollegiate

¹Taba, p. 12.

curriculum could be based on the national, regional, and local needs so identified.

The third step in Taba's hierarchy, selection of content, would then be based on the decisions made in steps one and two. Once the forces acting on the curriculum had been analyzed for national, regional, and local needs and objectives, the content component of the K-12 curriculum would be selected, organized and presented on the basis of stated objectives and would come packaged in the structural form determined by the three levels of dialogue in the subject-matter areas, i.e., single disciplines, allied disciplines, and broad fields. Balance in the curriculum would result from two different kinds of processes. Scholars from the disciplines would be viewing subject matter from greater perspective, and curriculum planners would be considering the information turned over to them by such scholars as one of four possible influences on what would finally be taught to students.

It is also recommended that the team approach to revision be altered in some respects. Psychologists should be asked to plan the experimentation necessary to verify or disprove the assumptions that the rationale of structure makes about the psychological processes in cognition. They should also be charged with the responsibility for perspective on learning theory so that curricular revision is not

dependent on a single explanatory psychological map. Educators, in their turn, must supply the leadership in experimentation with the organizational procedures necessary to preserve an orderly and comprehensive consideration of all curricular forces effecting decisions about the K-12 curriculum. One of their main functions should be providing the perspective necessary to avoid the pendulum-like swing of curriculum reform from one enthusiasm to another before careful investigation can support each new direction of movement. The academician and the teacher might reasonably be expected to continue their present roles, while one new team member, the theorist or his representative, should be added. This member would be charged with the responsibility for orderly development of rationale and effective evaluation of results in terms of that rationale.

Finally, it is recommended that regional laboratories for planned change be established and supported so that the organization and expertise vital to effective implementation of curriculum reforms would be available on a service basis. Such centers would need access to university undergraduate and graduate teacher-education programs as well as to demonstration schools in the local setting. Curriculum projects could then specialize in the areas of their expertise and could rely upon the services of the regional centers for the insight into the change process. In this manner,

once a curriculum reform had received approval, it could be assured of adequate dissemination.

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