

Variables for Arriving at a Theory of Instruction

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Introduction

It is important that teachers think about the aims of education, how they should treat children and the wider social purposes of education. However if they are to have a genuine impact upon children's life chances and enhance their academic progress, then they must address pedagogy or the science of teaching and the problems of how to teach subject matter so as to promote learning.

Put simply, the essential purpose of teaching is passing on of knowledge, and teachers must learn how to do this as effectively as possible.

“How to do it” however is a slippery concept. For instance, can theoretical knowledge of theories of learning result in good teaching practices? Theory of course is of value to practice. These theories tell us how children generally learn. But the relationship between theories and good instruction whether they be learning theories or any other, is not simple and direct.

There are many variables other than just how children learn, that affect a teaching-learning situation directly or indirectly. The more important of these mediating variables could be listed as follows:

- nature of the discipline and its structure
- nature of the content dealt with
- learner differences
- teacher behaviours and teaching styles
- social climate in the classroom

In this session we would discuss the structure of a discipline and learner difference. Other variables would be dealt with in subsequent sessions.

We will first find out what is meant by the structure of a discipline and discuss its practical implications for the selection of content and sequence, on integration and on teaching method. Among individual or learner differences, the more important variables are age, ability, learning style, socio-economic background and motivation to learn.

Most of the concepts related to individual differences would be already familiar to you. It may not be so regarding the nature of subject structure and its relevance to a theory of instruction. It would therefore be discussed in greater detail and you are

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expected to go through the Readings provided very carefully to get a clear grasp of what is meant by the structure of a subject and its implications for a theory of instruction. You should make a genuine effort at each stage of the discussion to relate the ideas that surface to your particular subject expertise and come up with relevant examples so that by the end of the lesson you would achieve the objectives listed below.

Lesson Objectives

By studying this lesson , the teacher educators will be able to:

- Outline the major variables that must be considered in arriving at a theory of instruction
- identify the elements that must be looked into in the structure of a discipline
- Determine the structure of the discipline/disciplines familiar to them and integrate it for developing a theory of instruction
- Guide student teachers to identify the key elements of subject structure and use it in organizing content, in integration and in planning methodology
- Outline individual variables that must be taken into consideration in planning teaching –learning situation and identify their implications in a teaching-learning situation
- Explain the significance of intelligence and social competence in school achievement
- Outline ways in which classroom instruction should be organized so as to induce students from deprived socio-economic background to reach higher levels of achievement
- Guide student teachers to draw concept maps, show relationships between major concepts and identify rules, principles and models of inquiry of a particular discipline.

Nature of Disciplines

You are familiar with subject streams made available to students preparing for the GCE Advance Level examination. Subjects are included in a 'stream' on the basis that subjects or disciplines in one stream has more or less a common structure when compared with subjects in another stream. For a long time scholars have known that differences between disciplines existed and good teachers had paid attention to these differences in teaching their subjects. One of the weakest links in modern teaching is that this fact has been ignored and teachers have learnt to rely on the same approach or same mode of instruction in all subject areas.

New developments in educational theory around the beginning of the 20th century were partly responsible for the present position. They led to a gradual shift, away from the earlier emphasis on the training of 'faculties' such as analysis, judgement, memory and the production of general understanding through specific disciplines, to an emphasis on acquisition of specific skills and identification of identical elements that were thought to have transfer value. While the **original** theory of formal disciplines, and training of facilities of the mind is unacceptable as it was practiced then, it is now accepted that general transfer takes place through the identification of principles and the generalization of these principles achieved by appropriate learning. Under optimum conditions it leads one to 'learn how to learn'. This change in outlook has stimulated interest in designing learning to produce general understanding of the structure of the subject matter that is used in instruction.

The following statement reflects their change and the renewed interest in the structure of disciplines.

"The traditional science courses concentrated on the knowledge of scientific facts, laws, theories and technological application while the new courses put emphasis on nature, structure and unity of science and on the process of scientific inquiry".

Your task is to understand what is meant by nature, structure and the unity of science (or 'History' as the case may be) and the process of scientific (or historical) inquiry. Knowing these will help you to grasp what is meant by the structure of a discipline and identify content and techniques of instruction best suited for transmitting it to students.

Read through the section on structure of a discipline given within the box and attempt to answer the questions at the end of it.

Structure of a Discipline

Supplementary Reading 1

It is important for the student teacher to understand the structure of the subject one teaches because subject structure has a direct and practical effect on

1. Content sequence
2. Integration
3. Teaching method and
4. Learning style

Bruner has argued that every subject has a structure that provides the underlying simplicity of things organized around the fundamental concepts and relationships. It is by learning the nature of this structure that the intrinsic meaning of the subject can be appreciated. Such structure-based understanding:-

1. Aids comprehension by stressing fundamentals,
2. Makes knowledge gained usable beyond the learning situation.
3. Improves memory by organizing facts in terms of principles and ideas from which they may be inferred, and
4. Narrows the gap between elementary and advanced knowledge.

Knowledge is organized and individuals differ in the way in which knowledge of particular topics is organized.

Knowledge is not an accumulated list of facts or skills. Knowledge is organized into **sets of related ideas**. In this sense there is a difference between the novices and experts in knowledge structures. This can be illustrated by means of differences between novices and experts in the way they approach problem solving. The knowledge of novices is organized around the **literal details** given in a problem statement. Expert's knowledge, on the other hand, is organized around **principles and abstractions**, not apparent in the problem statement but are derived from the knowledge of the subject matter. They draw inferences from given data and reasoning about underlying principles.

It is important for beginning teachers to think of knowledge as more complex than a straight forward accumulation of facts which is characteristic of the receptive view of learning. This narrow view of knowledge has to change. For the experts, concepts are embedded in a richer interrelated network and the chances are that any one concept will evoke many other concepts.

The schema theory is widely held in the study of knowledge structures. A schema is an organizational structure that summarizes knowledge about a variety of cases linked to one another on the basis of their similarities and differences. For example when you enter a restaurant, you call into play a 'restaurant schema' which involves waiter, menu, prices, time, tips etc. Interpretation of a text or a situation can be influenced by the existing schema.

'Knowledge structures' or 'schemata' change as a result of information received through instruction and experiences that lead the learner to construct new knowledge.

Two important questions to ask in trying to determine the structure of a subject are -

1. What methods are used to obtain warranted knowledge in that discipline?
2. What are the key concepts, rules and principles that guide inquiry?

The first is called the **syntactic structure** of a subject or in other words, the pattern of its procedures, its methods and how it goes about using its conceptions to attain its goals. The second is called **substantive structure** or the body of concepts functioning as guide to inquiry.

Example:-

Analysis of the structure of Social Studies.

Substantive Concepts or structure.

Sovereignty, power, habitat, conflict, morality and choice, culture, industrialization, urbanization, institutions, input-output, scarcity, social, social change, compromise and adjustment, saving, market economy, etc.

Value Concepts.

Dignity of man, loyalty, equality, government by consent, empathy.

Syntactic Concepts or structure

Historical method, geographical approach, analysis, synthesis, evaluation, interpretation, question and answer, evidence, objectivity, causation, observation, classification, measurement.

The above framework for the analysis of structure of a subject is useful because it brings into focus the three domains - cognitive, affective and psychomotor as well.

Self- Assessment Task

Check your understanding of the following:

1. Why is it important for the teacher to understand the structure of the subject one teaches?
2. In what ways does structure based understanding of a subject help the learner?
3. Give five examples each of facts, key concepts rules and principles selected from your major teaching subject.
4. What methods are used to obtain warranted knowledge in the discipline you selected in question 3
5. Check your understanding of the following terms:

Substantive structure

Syntactic structure

Schemata

Domains of knowledge

6. Each discipline has value concepts attached to it. Name as many value concepts as you can, that are attached to your special subject.

Write in your own words a definition of each of these.

As the first five questions given above are directly based on the Reading, go back to it if you have any doubts about the answers.

You are now ready to read further on disciplines as sources of structure and its importance in classroom instruction. Go through Supplementary Reading 2 given below and make notes on the following as you go along.

- * Different ways in which individuals acquire knowledge
 - * Recent changes in schooling
 - * The goals of these recent changes
 - * The ways in which these goals can be achieved.
 - * The new shift in organizing instruction.
 - * Different suggestions as to how structure of disciplines can be identified.
 - * Various definitions of 'structure of disciplines' given in the Reading.
- The arguments advanced in support of building the curriculum and structural components derived from disciplines.

Supplementary Reading 2

New Designs for the Elementary School Curriculum

By

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McGraw Hill Book Co. New York

ACQUISITION OF KNOWLEDGE

Individuals acquire knowledge in several ways. One means is through contacts with other in which traditions, customs, and symbols are learned as a part of daily living. Another ways is through instruction that is given in the home, the school, and other institutions. Another is through response to ideas that flow through mass media of communication. Still another is through individual travel, study, reflection, and contemplation. All these ways take humans into the world of knowledge, but some penetrate far more deeply than do others.

Some individuals do not go far beyond the knowledge that is gained through elementary schooling and personal experience. Some advance beyond this through additional schooling and more varied experiences. Still others push to the edge of knowledge in a given field and dedicate themselves to a lifetime of study and reflection.

Modern societies have made systematic arrangements that are designed to assure minimum levels of understanding of the realms and knowledge. The home, church, schools and other institutions provide learning experiences that virtually take one from the cradle to the grave. Systematic programs of instruction are provided and standards have been set to guide the licensing of individuals who desire to work in various occupations and professions. Care is taken to establish minimum levels of competence that are deemed essential to the general welfare

Schooling has assumed increasing importance as a means of providing systematic entry into the realms of knowledge. All levels of education have been given fundamental responsibilities; when linked together, the various levels provide an introduction in depth to organized branches of knowledge. Yet it is recognized that schooling is only an introduction, for the pursuit of knowledge is a lifelong task.

The realization that the pursuit of knowledge is a lifelong task has spurred recent changes in schooling. **One of the most significant changes is the emphasis on competence in using conceptual schemes and methods of inquiry so that the individual can “get it on his own” and thus continue to learn throughout his lifetime.** The goal is to develop the understanding and learning strategies that will enable the individual to reap greater benefits from personal experiences, mass media, schooling, and other means of penetrating the domains of knowledge more deeply. Indeed, a further goal is to begin the development of the ability to extend man’s knowledge far beyond the present horizon.

This new emphasis on developing the ability to inquire has forced a reconsideration of schooling as a systematic means of introducing individuals to domains of knowledge. **The nature of knowledge has been restudied in order to get clues that might facilitate curriculum planing. The systematic ways in which human’s acquire, organize, and use knowledge have been examined to identify conceptual structures and methods of inquiry that should be used as foundations of instruction.** High value has been placed on developing programs of instruction that are consistent in approach, methods, and styles of thought with those employed by scholars in the basic disciplines.

THE DISCIPLINES AS SOURCES OF STRUCTURE

Out of the discussion, study, and planning of ways to improve instruction has come a mode of curriculum development that relies heavily on basic disciplines. In current approaches, direct attention is given to a critical review of the disciplines on which the school subjects are based. The nature of knowledge and the structure of the disciplines are viewed in new ways. Fundamental elements of knowledge and modes of inquiry are discussed in terms that are directly related to curriculum planing. (ELAM 1964). Ways of extending and structuring knowledge are being analysed in order to derive implications for organizing instruction.

The search for knowledge of greatest worth has also taken a new turn. No longer is it merely a quest for new information. Rather, efforts are being made to specify structural components of disciplines that can be used to design areas of the curriculum. The specified structure is used to select content and to plan units of instruction. The intent is to develop curricula that are logically organized around those concepts, key ideas and methods of inquiry which scholars believe to be the most fundamental and powerful in their field of specialization. In additions, attention is given to those disciplines which shed light on social and psychological foundations of the curriculum. Thus the disciplines are viewed as primary sources of data for curriculum planning.

Persuasive arguments have been advanced in support of building the curriculum on structural

components derived from the disciplines (Bruner, 1960; Health, 1964; Phenix, 1964; Rosenbloom, 1964). Economy of learning is enhanced by the focus on fundamental ideas and the use of content to develop key ideas. Relationships among ideas are highlighted as a sense of structure emerges through the use of concepts and generalizations in active inquiry. Fundamental ideas are brought to bear upon the solution of problems, and current problems are used to extend understanding of key ideas. Transfer of learning is facilitated as concepts and generalizations of broad applicability are stressed. Curricula may be kept-up-to-date because of the close liaison with scholars in the basic disciplines. Teaching strategies and basic study skills may be closely linked with methods of inquiry drawn from the disciplines. Motivation may be heightened as the lure of discovery characteristic of the work of inquiries is made a part of instruction. By using techniques that are tested and yet are being continually improved, students can get a grasp of fundamental approaches to knowing and to the means by which knowledge is extended. Better articulation can be achieved between instruction in the schools and institutions of higher learning. The role of the school can be kept in sharper focus as emphasis is given to the cognitive and affective outcomes to be attained through the pursuit of knowledge via modes of inquiry.

Identifying the Structures of Disciplines

A key problem for curriculum builders is to specify the structures of the basic disciplines that are used to develop curricula in different school subjects. What is needed is an outline that can be used to identify the fundamental aspects of those disciplines which are used as a basis for structuring the curriculum.

Broudy (1954) has outlined the elements of a discipline that students should understand if they are to master it: (1) basic entities or units, such as events in history, atoms in physics; (2) relationships among the entities or units, such as chronology in history; (3) established facts or data; (4) tentative hypotheses generally accepted by scholars in the field. Broudy argues that the mastery of these elements should be pursued in a manner that clarifies the total structure of the discipline.

Bruner's report (1960) on the conference of scholars of Woods Hole stresses the importance of relationships in defining structure. Concepts and principles are viewed as focal points which students can use to get a grasp of the structure of a subject, to guide inquiry, and to organize and retrieve information. Bruner stresses the importance of guiding students to discover how ideas are related. He insists that methods of inquiry used by the students should be the same as those used by scholars. "It is easier for him to learn physics behaving like a physicist than doing something else" (Bruner, 1960, p. 120).

Foshay (1961) has proposed that direct attention be given to the disciplines in curriculum planning. He suggests that structure be defined in terms of the domain of study of each discipline, the methods, rules, and concepts used to handle data, and the history or traditions of the discipline. Foshay also urges that attention be given to basic social problems of current importance, pointing out that we must "have it both ways" - learning based on the disciplines and on problems.

Schwab (Elam), 1964) has discussed the syntactical and conceptual structures of disciplines.

Syntactical structure includes the kind of evidence, the techniques used to obtain data, the interpretation of data, and other processes of inquiry important in a discipline. Conceptual structure includes the concepts, principles, themes, generalizations, and other constructs that guide inquiry. Both structures are intimately intertwined in actual inquiry.

Bellack (1963) has also emphasized the importance of examining both the conceptual and the methodological dimensions of the disciplines. Key concepts are used to pose questions, frame hypotheses, and draw conclusions. There is a hierarchy of ideas in a discipline; some ideas are more explanatory than the others. A variety of methods are used to investigate problems within the domain of a discipline; these should be examined to determine the styles of thought, logical processes, and other procedures that are employed. Also stressed by Bellack is the fact that there is a plurality of structures in most disciplines. This plurality is clearly evident in the diverse definitions of structure that have appeared in current curriculum materials.

A review of conceptions of the structure of disciplines has been prepared by King and Brownll (1966). In summary, they point out that a discipline may be viewed as a domain, a tradition, an expression of human imagination, and a community of persons. The major structural components are substantive, or conceptual, and methodological, or syntactical. A discipline is marked by specialized language, it has a heritage of literature and a network of communication, and scholars within a discipline take a value and affective stance.

Now we can summarize the following with regard to structure of a discipline as a variable to be considered in arriving at a theory of instruction.

❖ Basically there are two major structural components or aspects of a discipline namely.

1. Substantive structure, or the body of concepts, themes, principles and generalizations functioning as a guide in studying the subject and
2. The syntactic structure or the kinds of evidence, the methods and procedures used in obtaining knowledge in that subject in the interpretation of data and other processes of inquiry.

❖ Different writers have outlined elements of a discipline that students should understand if they are to master it. Some of them are

- basic entities or units eg. events in history
- relationship among units eg. chronology in history
- established facts
- tentative hypothesis
- concepts and principles as focal points
- relationships between ideas

- the hierarchy of ideas in a discipline
- styles of thought, logical processes and other procedures employed
- a specialized language
- a heritage of literature
- a value component

Practical Effect of Structure of a Discipline on Selection of Content, Sequence, Integration and Teaching Method

We listed at the end of the previous sections some elements of a discipline students should understand if they are to master it. If you number them, there are twelve elements listed there.

Please go back to that list and identify those that have a bearing on

Content.....

Sequence.....

Integration.....

Teaching methods.....

Selection of Content

Instruction that takes the structure of the discipline into account will pay attention to the following in selecting content.

- Units that go to form curriculum content will be selected so as to bring out **key ideas** or **events** characteristic of the discipline. If the subject taught is history, it would be key events. It would be different if the subject is Mathematics, it would be methods of solving a problem. It leads to economy in learning as opposed to focusing on facts and details which burden the memory. Facts should not be the focal point in a lesson. Focal points should be the events, concepts and principles supported by established facts.

The key ideas, events, concepts and principles will have to be elucidated using the wealth of literature available and a good grasp of the specialized language used by

exponents of the discipline. Mastery of fundamental ideas seen especially in their historical perspective will enable students to frame tentative hypothesis which can be brought to bear on the solution of present problems. Selections of fundamental ideas as the focal points will enable the students to arrive at relationships between/among these ideas, these providing a scaffolding into which further information could be added with ease and understanding. Application of these ideas and principles to current problems will demonstrate their generalizability and facilitate transfer of training. The value components attached to a discipline also will get focused in the process.

Sequencing

Once the material is selected, sequencing is a simpler task. If the subject is history, chronology would be a key factor in sequencing. Any discipline will have a hierarchy of ideas. This could be from simple to complex or from less inclusive to more inclusive. If the content involves mastery of tasks, such as solving a mathematical problem, a task analysis would be required. Depending on the discipline and the content selected, the principles to be followed in sequencing will thus differ. Logical sequencing of concepts and principles is most important. So are the facts that go with them. Proper sequencing, on the other hand will guarantee logical presentation and enable the learner to identify relationships.

Integration

Integration is facilitated by the way the selected units are arranged so as to bring out relationships that exist between the units, by paying attention to the hierarchy of ideas, and the relationships among these ideas themselves and by paying attention to the commonalties that exist for example in the style of thought, method of inquiry and other procedural elements. Thus within a given discipline integration can be between units, ideas and principles or processes in the curriculum selected for a particular grade.

Integration can be vertical from grade to grade within a given discipline. This too is achieved by the hierarchical organization of units, key concepts and principles so as to take the student deeper and deeper into discipline.

Integration can be cross-curricular as well. This is generally known as horizontal integration which stresses the generalizability of concepts, principles, methods, facts, and skills.

Methodology

Before you proceed read through Reading 3 given below.

Supplementary Reading 3

An Operational Approach Structure

The approach to structure may be characterized as operational in the sense that examples are given of the actual ways in which structure is outlined in new curriculum materials. A search has been made of ways in which the substantive and inquiry dimensions of structure have been embedded in programs of instruction. In short, an attempt has been made to identify the varying interpretations of the concept "structure" and to give concrete examples of ways in which the concept has been implemented in curriculum development.

By way of introduction it may be pointed out that sets of concepts and generalizations are widely used to outline the substantive base of areas of the curriculum. Throughout the text the expression "concept clusters" is used to refer to illustrative sets of concepts in different subjects.

The methodological or inquiry dimensions of structure include a variety of methods and processes, ranging from observation and experimentation in the natural sciences to criticism and evaluation of human expression in the arts. From the wide array of methods and techniques extant in the disciplines have been selected those adjudged by curriculum developers in mathematics, the sciences, and other fields to most useful in instruction.

How May Knowledge Be structured for Optimum Comprehension?

Bruner suggests that the ultimate aim of teaching any subject or group of related subjects is "general understanding of the structure of a subject matter". "Grasping the structure of a subject is understanding it in a way that permits many other things to be related to it meaningfully". Furthermore, knowledge has a *hierarchical* structure, which may be expressed in each of the three modes of representation through the coding or structuring system that one develops.

The task of teachers is to give students a grasp of the structure of knowledge in such a way that they can discern knowledge that is significant from information that is less so. Since "everything cannot be taught about anything", if teaching is to be accomplished at all, students must, in some way, achieve a generalized set of basic ideas or principles. They constitute a structure of knowledge that is optimal for comprehension.

The value of a knowledge structure depends upon its power for simplifying information, generating new propositions, and increasing the / manipulability??? of a body of knowledge. The inventive task of teachers and curriculum makers, then, is to translate propositions to levels that are appropriate to the mentalities of the persons who are being asked to master them. Hence knowledgeable experience should be *coded* in such a way that it is usable by students in both present and future learning and living situations.

Bruner defines a *coding* system as "s set of contingently related, non-specific categories "that make up one's pattern of enactive, iconic, and symbolic representations. Therefore, one's coding system constitutes the structure of one's knowledge. It is a person's manner of grouping and relating information concerning his world. One's coding system is a hypothetical construct that is not directly observed. It is inferred from the nature of observable antecedent and consequent events and is subject to constant change and recognition.

It is one's coding system that enables one to go beyond the information given, that is, to develop inventive behaviour or to be creative. Bruner proposes that when a person goes beyond the information given, he (she) does so by virtue of his ability to place available empirical facts into a more generic coding system, based upon either learned contingent probabilities or learned principles of relating materials.

For Bruner, much of what has been called transfer of learning can be fruitfully considered a case of a person applying learned coding systems to new events. Positive transfer represents a case where an appropriate coding system is applied to a new array of events. Negative transfer characterizes a case of either a person misapplying a coding system to new events or of the absence of a coding system that may be applied.

The problem of improving instruction "concern the best coding system in terms of which to present various subject matters so as to guarantee maximum ability to generalize". Bruner provides an example of a technique that teachers may use to discover whether children are learning proper codes in school. It is as follows:

We provide training in addition, then we move onto numbers that the child has not yet added, then we move to abstract symbols like $a+a+a$ and see whether 3 emerges as the answer. Then we test further to see whether the child has grasped the ideas of repeated addition, which we fool him/her by calling multiplication. We devise techniques of instruction along the way to aid the child in building a generic code to use for all sorts of quantities. If we fail to do this, we say that the child has learned in rote fashion or that, in Wertheimer's moralistic way of putting it, we have given the child "mechanical" rather than "insightful" ways of solving the problem. The distinction is not between mechanical and insightful, really, but whether or not the child has grasped and can use the generic code we have set out to teach him.

It appears, then, that Bruner views the process of coding as one within which concepts are combined into generalizations or knowledge structures. Furthermore, generalizations permit both "backward and forward" predictions of which particularized statements are most likely to be either true or false. Accordingly, he states "a good theory – a good formal or probabilistic coding system should permit us to go beyond the present data both retrospectively and prospectively". A formal code either takes the form of, or is subsumed under, some principle of logic. Aprobabilistic or informal code is a generalization that is acquired inductively, perhaps even intuitively.

Bruner sites a significant coding experiment conducted by Miller, Postman, and himself. They arranged some fifth grade children into two groups – those who fell in the lowest quartile on a standard spelling achievement test and those who fell in the highest quartile. In short, they identified a group of poor spellers and a group of good spellers. They first confronted these students with a set of pseudo words (i.e. letter combinations that were not real words) that only slightly resembled English words. Both groups identified the words as English to about the same degree. But when both groups were presented with a group of pseudo words that resembled English very closely in letter patterning (and which, as Bruner says, "but for the grace of God, might have been in the dictionary") the good spellers were much more likely than the poor to identify the words as English.

Bruner suggests that the good spellers had learned to code the English language with respect to typical letter patterning. He concludes, "The difference between the two groups is in what they had been learning while learning to spell English words. One group had been learning words more by rote, the others had been learning a general coding system based on the transitional probabilities that characterize letter sequences in English.

Successful coding produces a situation within which new instances can be recognized with no further

learning and the memory of instances already encountered no longer depends upon sheer retention. Knowing a code, a student can reconstruct the fact that all positive instances that are encountered are characterized by certain critical attributes. It is obvious, therefore, that the more extensively a subject can be encompassed by systematic coding, the easier the subject is to be understood and utilized.

As code is built upon code, or generalization is built upon generalization, a learner achieves increasingly “large” grasps of a subject. That is, he sees an ever increasing number of concepts and generalizations as related. The more generalized a coding system is, the more useful it is to a learner in that it relieves him of any need to learn and try to remember a great mass of isolated facts.

Source: cite the source again..and in full...

If you read carefully you would have noted an emphasis on the following:-

- Concept clusters
- Inquiry dimensions of structure which include methods such as:-
 - Observation and
 - Experimentation in natural science
 - and
 - Criticism and
 - Evaluation of human expressions in the arts
- Generalized set of basic ideas and principles
- Translating propositions to levels that are appropriate for mentalities of the students
- Coding experiences in such a way that is usable by students

Selection of concept clusters and developing concept maps that bring out relationships between concepts and ideas is useful in any theory of instruction that takes the structure of the disciplines into consideration. (If you are not already familiar with the idea of a concept map, refer to the example given at the end of the lesson in Annex I)

The methodologies such as observation and experimentation in science and criticism and evaluation in the arts, all help students to study the subject in the same way that scholars in the relevant disciplines proceed in generating facts and developing a generalized set of ideas and principles. Bruner had said that it is easier to study physics if you proceed in the same way as a physicist would. In addition the higher levels of Bloom’s taxonomy can never be achieved unless the student is introduced to the techniques of analysis, synthesis and evaluation. Depending on the subject, there

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are categories to be followed in analysis, for example cause and effect and chronology in History. Certain basic principles, particular to the discipline has to be followed in evaluation. To take History as an example again, validity of historical data is evaluated against the sources of such data.

You also would have noted that according to Bruner, the inventive task of the teacher is to translate what is stated to levels that are appropriate to the cognitive capacities of those who are expected to master them. This is achieved by helping the student to 'code' the experience in such a way that is usable in both present and future learning and in actual situations. What Bruner means by a coding system is the individual's way of grouping and relating information concerning his experiences.

Improving instruction is concerned with providing the best coding system for various subject matters so as to guarantee maximum ability to generalize.

A coding system is achieved when concepts are combined into generalizations. It is the presence of a good coding system that enable the individual to go beyond the present data in both directions backward and forward.

Transfer takes place by a person applying coding systems to new events. Negative transfer will take place when one misapplies a coding system to new events on when there is no coding system that may be applied.

The points highlighted above bring out the need to arrange instruction so as to enable the mastery of the concepts and the relationships between them thus helping the learner to these concepts to form principles and generalizations.

The model is a cognitive model of teaching and learning which would enable learners to go beyond the present data, predict, recognize new instances, utilize the subject knowledge, achieve a broad grasp of the subject, see an ever increasing number of concepts and generalizations as related and yet relieve the learner of the need to remember a great deal of facts.

Individual Differences

Child as a Developing Organism

Lessons in developmental psychology would have exposed you to fundamental principles of child growth and development, the nature of developmental change and the similarities and differences a teacher would encounter in a group of children the same age range, in a given aspect of development.

For a teacher interested in a theory of instruction, one of the most important principles of growth and development is associated with the view that development takes place in stages, with pronounced qualitative changes from stage to stage. These qualitative changes are associated with how the child perceives the world, learns, thinks about himself/herself and others and the way the child's brain or body functions. Psychologists such as Piaget or Erikson who follow the stage theory, have defined them in terms of the typical or average age levels at which the stages can be expected to begin and end. As the child moves from one stage to another, whether in terms of cognitive, language or social development, the child will show a change in skills along with a change in neurological functioning and thinking.

When a teacher is faced with children who are unable to master important academic or social tasks, a teacher taking into account the developmental perspective will have to raise questions such as the following:-

- Are the materials and techniques used to teach the child appropriate for the child's developmental level?
- Does the child have the necessary schemata to successfully learn the given task?
- Is the teacher assuming that the learner has attained certain knowledge, concepts and rules that the child may not have?
- Has the child had sufficient opportunity to explore the material and actively manipulate it both cognitively and physically? Could the child be in need of more time to acquire the necessary schemata?
- Are the expectations unrealistic given the child's age and developmental history?
- Are the materials and experiences too unfamiliar or irrelevant to the child's existing schemata and prior experiences to create the disequilibrium necessary for new learning to occur?

- Has the child received instruction that has taught the necessary pre-requisite skills?
- Do your lessons include important facts, discriminations, concepts, rules or strategies the learner will need to master subsequent tasks?
- Is the child bored because he has already mastered these skills or frustrated because they are beyond what they can be expected to learn?
- Has the teacher been expecting the learner to acquire knowledge that is incompatible with his culture or does he use instructional methods that are culturally unfamiliar or contradictory?
- Has the teacher met the child's social learning needs?

Learner Related Factors

Ability level

The stage of cognitive development, pre-requisite knowledge, concepts, experiences, skills, learning strategies and social and cultural relevance are important in determining a theory of instruction.

Further, Ability in specific areas is considered more predictive of future accomplishment than is general intelligence. Nevertheless especially in the elementary grades, when it is believed that learners are still developing their special abilities, general intelligence is believed to matter more in the child's response to learning experiences.

Even at the junior and secondary levels, scores of general intelligence, especially when obtained through verbal tests, are closely related to success in learning experiences because verbal tests reflect special verbal and mathematical abilities.

However it is a constant teachers' dilemma that they have to cater to learners who pick things fast and others who do not.

In terms of a theory of instruction there are three questions to ask, namely:-

- (a) What can be done to aid those who are slow in picking up learning tasks?
- (b) How much does knowledge of a child's or children's level of intelligence provide information that is of use for making important instructional decisions in the classroom?

- (c) This brings up a third question namely how much does classroom learning depend on skills that are measured by ability tests?

Let us consider what Scarr (1981) has to say about the contribution of general intelligence to classroom learning. Scarr indicates that many factors besides IQ will contribute to a learner's success, for example motivation, health, social skills, emotional well-being, family support, prior knowledge and quality of teaching.

This is illustrated in the following diagram.



Scarr calls this group of factors social competence. Even quality of teaching is listed under it because it is a variable other than the learner's intelligence that affects learning. Thus it can be said that the child's level of intelligence will matter only in the case of slow learners, when deciding a theory of instruction because special steps will have to be taken to enable them achieve mastery in a given learning task.

Social competence however is common to all learners. We would discuss a few more variables associated with learner differences before taking up factors contributing to social competence.

Brain Laterality, Learning Modalities and Learning style

Among themselves students differ in the methods of learning they employ. Brain laterality, learning modalities and learning styles are factors that can lead to such differences in the way children learn.

* Brain Laterality

The brain is divided into right and left hemisphere and the dominance of one or the other hemisphere in a person orients him or her to learn better by using cognitive processes characteristic of that hemisphere. The left hemisphere is said to dominate verbal learning, logical and convergent thinking and the academic, cognitive processes. The right hemisphere is said to dominate affective, intuitive, spatial, emotional and visual elements.

What does this mean in terms of learning? Some students learn better through the verbal medium while others, those with right hemisphere domination learn better through visual, kinesthetic and tactile experiences.

Its implication for a theory of instruction is that the teacher will have to provide a variety of instructional options so that more students will learn more, most of the time. Connecting what is being learnt with real life situations and utilizing audio-visual aids will enable the teacher to cater to both groups successfully.

* Learning Modalities

Learning modalities also refer to the manner in which individuals receive information. Basic learning modalities are four in number:- visual modality, auditory modality, kinesthetic modality or by being physically involved and tactile modality. Individuals are said to have what is called modality preferences and modality adeptness or strength. It may not always be that the modality preference in some, as the individuals modality adeptness. Some students do well with a mix of modalities and other achieve modality adeptness with experience.

Students with auditory modality strengths do better with the spoken word but may not do well in written tests. Written tests tend to favour those with mixed or visual modality strength.

In the middle level and higher grades auditory modality strength becomes more important than kinesthetic modality strength. It is possible that teachers would use more often the modality in which they are adept. It can however affect the achievements of some students. Instruction that uses a single approach for example, verbal delivery would be most unfair by students who learn best in another way.

There is a good theory of instruction, there should be provision for integrating the modalities learning units based and themes provide opportunity for modality

integration. In teaching a mixed group of students with differences in learning abilities, language proficiency and cultural background, instruction should be designed so as to integrate all learning modalities.

* Learning style

Learning style is not an indicator of intelligence but an indicator of how a person learns. Strictly speaking there can be as many learning styles as there are individuals. But starting with Karl Jung (date) a number of writers have identified differences in how individuals perceive situation and how they process information.

McCarthy (date) describes four major learning styles as follows:-

1. *The imaginative learner.* Imaginative learners perceive information concretely and process it reflectively. They learn well by listening and sharing with others, integrating the ideas of others with their own experiences. Imaginative learners often have difficulty adjusting to traditional teaching.
2. *The analytic learner.* Analytic learners perceive information abstractly and process it reflectively. They prefer sequential thinking, need details, and value what experts have to offer. Analytic learners do well in traditional classrooms.
3. *The common sense learner.* Commonsense learners perceive information abstractly and process it actively. This type of learner is pragmatic and enjoys hands-on learning. Common sense learners sometimes find school frustrating unless they can see immediate use to what is being learned.
4. *The dynamic learner.* Dynamic learners perceive information concretely and process it actively. They prefer hands-on learning, and are excited by anything new. Dynamic learners are risk takers and are frustrated by learning if they see it as being tedious and sequential. (Kim & Kellough, 1995)

Look at Essential Reading 2 to find more about learning styles.

Similarly Gardner based on her theory of Multiple Intelligence, lists seven styles of learning namely

- Verbal – linguistic
- Logical – mathematical
- Intra-personal
- Visual – spatial

- Musical – rhythmic
- Body – Kinesthetic and
- Interpersonal

(Kim & Kellough,1995)

Most traditional teaching uses the first three methods which would fail to motivate students whose type of intelligence is different.

From the above discussion based on brain laterality, learning modalities and learning styles what comes out clear is that **all students do not learn and respond to learning situations in the same way.**

It's implication for a theory of instruction is clear. A teacher who users only one type or only a few types of teaching for all students, in all situations is obstructing learning in those students who learn better another way.

Read the following from McCarthy and “using the 4 MAT System to bring Learning Styles to Schools (1990).

“With the 4 MAT system teachers employ a learning cycle of instructional strategies that reach each student’s learning style. Within the cycle, learners sense and feel, they experience, then they watch, they reflect, then they think, they develop theories, then they try out theories, they experiment. Finally they evaluate and synthesize what they have learnt in order to apply it to their similar experiences. They get smarter. They apply experience to experience.

Socio-Economic Factors and Theories of Instruction

Read Recommended Reading on Education and Social factors by Gunawardena (1995)

Go through carefully the research evidence on early school learning and low educational achievement/failure, and list the variables that have been found to be correlated with each of them.

Your list would show that the socio-economic factor is a powerful determinant of values in relation to schooling and educational achievement. Parents from low socio-economic background do not provide adequate stimulation relevant to schooling and school achievement. The environment is not supportive and parents are disinterested. Parents have other goals for their children such as early employment. They fail to perceive education as useful, show little interest in school achievement and fail to

motivate the child to achieve higher levels. Correspondingly children's aspirations are low, their language ability is poor and not lucid enough to indulge in conceptual thinking. The language in textbooks is unfamiliar to them and they face learning difficulties especially in Mathematic. There are school-based factors as well contributing to low achievement, for example use of archaic methods of teaching and lack of equipment and poor teacher expectations etc.

If a person struggles for the attainment of some goal, we can say that the goal possesses a high degree of value for him/her. Therefore a child, raised in a home where self sacrifice and long range educational planning are an accepted part of the environment, is likely to be motivated by these values.

In contrast children growing up in a poor environment may find themselves deprived not only of material things related to schooling or opportunities for schooling but of values that relate to goal seeking.

This is so because each social class has a social milieu made up of the group of individuals with whom the person is most likely to associate on an intimate basis, share common ideals, values, attitudes and ways of behaving. This social milieu creates a learning environment for the child which provides him with available goals for which he may work. Within this context the home is an important influence on the pattern of needs acquired by the child.

Of course there are instances where homes and individual children rise above these barriers. However the failure to bring down dropout rates significantly by providing incentives to schooling such as free text books and uniforms is evidence that these alone cannot overcome the influence of values, attitudes and conditions that are negatively correlated with high school achievement.

Another important factor associated with low socio-economic status and schooling is the extent to which the self-esteem of a child can plunge in relation to school achievement. Self-esteem involves a comparison between what the child perceives himself/herself to be achieving and what he/she would like to be when the child sees himself/herself as not living up to the standard it will produce a low self-esteem. It exerts a direct influence on school achievement and whether it is high or low, it will have a cumulative effect.

Teachers can play a major role in enhancing self-esteem by designing instructional arrangements that allow for co-operative learning, heterogeneous grouping and performance assessment. The self concept is something the child constructs himself over time by living and learning in an emotionally and intellectually supportive environment.

Read the following case study published in the American Educational Research Journal (1889. Vol.26) by D. Dillon.

“Appleby’s effectiveness as a classroom teacher was due to her ability to assume the role of translator and inter-cultural broker. Appleby was thoroughly knowledgeable about the background of his learners and with this cultural knowledge he created a classroom with three significant attributes.

- He created a social organization where teacher and learners knew one another, trusted one another, and left free to express their opinions and feelings
- He taught lessons that were built around the prior knowledge and experience of the learners. Because of his knowledge of his learners’ background, he was familiar with their knowledge, skills and attitudes towards the content. This knowledge allowed him to represent the subject matter in ways that encouraged his students to link it with what they already knew and felt.
- He used instructional methods that allowed learners to participate in lessons and to use language and social interaction patterns with which both he and his learners were familiar.

Dillon concludes that in order to be successful with culturally different learners, a teacher must understand the importance of three relationships. Namely (1) learner-subject matter relationships (2) teacher-subject matter relationships and (3) teacher-learner relationships. The first refers to the learner’s prior knowledge, attitudes and experiences with the subject matter that may facilitate or frustrate learning. The second means that the teacher’s way of thinking and portraying the knowledge taught may or may not match the way the learners think about it. The third reflects on the teacher-pupil and pupil-pupil relationships as expressed in the social organization of the classroom.

The case study actually brings out the importance of an instructional ‘atmosphere’ that will provide an opportunity for living and learning in an emotionally and intellectually supportive environment, which is what is necessary to counteract the

negative conditions and values characteristic of children from low socio-economic background.

Refer back to the diagram given by Scarr and note that the contribution of 'social competence' to classroom learning is as high as 75%. A successful theory of instruction will have to take into account not only learning styles, learning modalities and other cognitive-process related variables but the values, interests drawbacks, self concepts and concerns of their learners as well.

Motivation

Most of what we discussed above can be related to differences in motivation for academic achievement that can be attributed to differences in socio-economic background of the learners. As a result, the best laid plans of a teacher may never work sometimes, with some children. Many children may feel that they are not good enough at a particular task to achieve what is expected of them.

Bandura advanced a theory of motivation which he called the self efficacy theory of motivation (1986). It refers to a person's judgment of his/her capabilities to organize and execute courses of action required to attain given types of performance. It refers to an individual's personal expectations, internal standards and self-concept.

Bandura believes that learners initiately work hard and persist longer at tasks they judge themselves to be good at. Such judgments are based on a number of factors. The learner considers and weighs factors such as task difficulty, pattern of success and failure, current and past feelings of anxiety, amount of help one gets, perceived similarity and differences from peers and values related to goals, identified by their teachers.

In the case of children from poor socio-economic backgrounds, sense of self-efficacy rated in these terms is very likely to be low. In terms of instruction, its implications mean that teachers will have to take these into account in goal setting, information processing and modeling if they are to help improve judgments of self-efficacy.

Bandura advocates the following steps:-

- * Identify goals that are short range, concrete and challenging. These would promote intrinsic motivation.

- * Identify goals in terms of specific performance indicators, for example giving specific instructions to 'work five sums within the period' rather than saying 'increase your speed'.
- * Give immediate performance feed-back.
- * Let students set their goals where possible.
- * Teach information processing techniques.

A student may feel:-

I am not good at comprehension or

I am not good at figuring out main ideas or

I am not good at remembering details etc.

Such feelings lead to doubts about the ability to succeed. The answer would be to teach learning strategies. If a learner uses a strategy consciously, that itself gives him the idea that he/she can succeed. Let-children peers talk about strategies they use. The teacher has abundant opportunities in class to model - think aloud such strategies. Project based learning where the student can attempt small steps at a time and get guidance step by step, helps to improve self-efficacy.

In a good theory of instruction a teacher will incorporate means of raising the intrinsic motivational level of his/her students in order to get students to persist longer at tasks, exercise initiative and achieve expected performance levels so as to enable them to develop a sense of self-efficacy.

Summary

This reading attempted to introduce you to two groups of variables that must be taken into consideration in developing a theory of instruction namely those related to the discipline taught and to individual differences among the learners.

We must not forget that theories of learning, such as Behaviorism, Cognitivism, Constructivism, and Constructionism also explain how learning takes place in an individual. . Especially teacher educators must be concerned about the adult learning theories as they are more relevant to explaining learning of student teachers. Learning styles discussed in Essential Reading 2 are also relevant in this context.

Renewed interest in the structure of disciplines has arisen as a result of the increasing importance given to schooling as a means of providing systematic entry into areas of knowledge and as a preparation for self learning which will continue throughout ones lifetime.

The structure of the discipline taught has implications for developing curricula for selecting content, for sequencing content, for bringing about integration and in selecting methods of teaching. The structure of a subject can be understood in relation to its two major components; the substantive structure on the body of concepts including value concepts, functioning as a guide to inquiry and the syntactic structure, on the pattern of its procedures.

You were guided through three readings and related discussion and the implications of subject structure on developing a theory of instruction. Special emphasis was placed on using concept clusters, introducing the inquiry dimensions of structure, developing a generalized set of basic ideas and principles, translating knowledge to levels that are appropriate for the mental level of the students and helping children to code their experiences in such a way that is usable by them in future learning.

Among the individual variables that need to be considered in arriving at a theory of instruction, the discussion dealt with the importance of the stage of development of the learners, the ability level of the learners, differences arising out of brain laterality, learning modalities and learning styles, socio-economic background, social competence and motivation. Steps that could be adopted by the teacher to overcome differences in learning outcomes and enable more children to learn more, most of the time were suggested at each end of the discussion. Among the methods suggested were those that would enhance learners' social competence, self concept and feelings of self efficacy.

References

- Kim, E.C. & Kellough, R.D. (1995). *Resource Guide for Secondary School Teaching*: Englewood Cliffs, New Jersey, Ohio
- Scarr, S. (1981). Testing for children: Assessment and the many determinants of intellectual competence. *American Psychologists*, 36 (10), 1159 – 1166

Annexure 1

Concept Mapping. A technique based on Ausubel's theory of meaningful learning concept mapping has been found useful for helping students in changing their misconceptions. As defined by Novak, "Concepts are regularities in events or objects designated by some arbitrary label". A concept map typically refers to a visual or graphic representation of concepts with bridges (connections) that show relationships. Figure 2.2 shows a concept map in social studies. Junior high school students have made connections of concept relationship related to fruit farming and marketing.

The general procedure for concept mapping is to have the students: (1) identify important concepts in materials being studied, often by circling those concepts, (2) rank ordering the concepts from the most general to the most specific, and (3) arranging the concepts on a sheet of paper, connecting related ideas with lines, and defining the connections between the related ideas. Concept mapping has been found to help students in their ability to organize and to represent their thoughts, as well as to help them connect new knowledge to their past experiences and precepts".

Part I Orientation to Secondary Schools Teaching and Learning...is this an appropriate title for this map??

