ED 071 332   EM 010 477

TITLE   Introduction to Psychology and Leadership. Leadership
                 Course; Phase I, Sequencing Rationale.
INSTITUTION   Naval Academy, Annapolis, Md.; Westinghouse Learning
                 Corp., Annapolis, Md.
SPONS AGENCY   National Center for Educational Research and
                 Development (DHEW/OE), Washington, D.C.
REPORT NO   TP-6-2
BUREAU NO   BR-8-0448
PUB DATE   19 Mar 69
CONTRACT   N00600-68-C-1525
NOTE   28p.; See also EM 010 418 and EM 010 419

EDRS PRICE   MF-$0.65 HC-$3.29
DESCRIPTORS   Autoinstructional Aids; *Communication (Thought
                 Transfer); *Course Content; Curriculum Design;
                 *Curriculum Development; Individualized Curriculum;
                 *Individualized Instruction; Individual Psychology;
                 Instructional Design; Leadership; *Leadership
                 Training; Management Education; *Military Training;
                 Multimedia Instruction; Psychology; Social
                 Psychology; Technical Reports

ABSTRACT
         The rationale for determining the content sequence of
the leadership course developed for the United States Naval Academy
by Westinghouse Learning Corporation (the final report appears under
EM 010 418, EM 010 419, and EM 010 484) is discussed. Each of several
theoretical bases for sequencing is discussed and sample applications
of the rationale are presented. EM 010 418 through EM 010 447 and EM
010 451 and EM 010 512 are related documents. (Author/RH)

Westinghouse Learning Corporation

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LEADERSHIP COURSE — PHASE I

SEQUENCING RATIONALE

CONTRACT NO. N00600 68 C 1525

TP-6.2   March 19, 1969

SEQUENCING RATIONALE

Contract No. N00600-68-C-1525

ABSTRACT

This paper presents the rationale for determining the content sequence for the leadership course being developed for the United States Naval Academy. Each of several theoretical bases for sequencing is discussed and sample applications of the rationale are presented.

Approved By:

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Project Manager
Leadership Course

TP-6.2

TABLE OF CONTENTS

SEQUENCING RATIONALE

1.0 Introduction

Two general kinds of "sequences" must be constructed in the
development of any course of instruction. The first is the Con-
tent Sequence, which concerns the organization of the subject
matter; the second is the Procedural Sequence, which concerns the
organization of the instructional presentation. To be sure,
there are interactions at every stage of course development be-
tween content and procedure; the content arrangement often deter-
mines elements of the instructional methods, and an analysis of
teaching methods may suggest a revised ordering of the subject
matter. However, because the two sequences are constructed more
or less independently - with the content specified and organized
before the instructional procedures are designated - it is
both possible and desirable to discuss them separately, and to
indicate at the appropriate places where their developments inter-
sect.

This report is an analysis of the rationale for sequencing
the content of the Naval Leadership Course.[1] WLC considers the
content organization to be a critical factor in the course develop-
ment. The "sequencing rationale," derived from contemporary
educational and psychological theory, and supported by consider-

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[1]
Procedural (or instructional) sequencing will be discussed in
the Course Strategy Document (TP. 6.4).

1

able experimental evidence, has served as the logical basis for the content analysis which WLC researchers and writers have undertaken.

1.1 Definitions of Content and Sequence

The content of a course may be defined as (1) the set of behaviors and capabilities which the learner is expected to achieve as a result of the instructional experience, and (2) the specific form and type of examples, rules, generalizations and applications through which the student achieves these behaviors and capabilities. As Evans (1968) has pointed out, it is not sufficient to specify content solely in terms of behavioral objectives, because different students may achieve the same objective by different means (i.e., by learning different rules and examples; by exposure to different training stimuli in different patterns, etc.). The content must be defined in terms of both student-performance measures and elements of the task, i.e., what the student will accomplish and by what path he will accomplish it.

The specification of content is thus a very elaborate, detailed process. However, since the learning "steps" are derived from the objectives of the course, WLC may describe the content sequence solely in terms of the objectives; that is, the content sequence may be defined as the planned arrangement of behavioral objectives in the order of their expected accomplishment.

1.2 The Importance of Content Sequencing

Briggs (1968, p. 5) has clearly stated the "educational importance of the sequencing problem:"

> ...if all the elements of skill and knowledge
> a student is to acquire during a given course
> of instruction are <u>independent</u> one from an-
> other (that is, if the learning of one element
> does not facilitate the learning of another),
> then the different elements could just as well
> be taught in any arbitrary or random sequence;
> but if the elements are <u>dependent</u> one upon an-
> other (that is, if the learning of one element
> <u>transfers</u>, thus facilitating the learning of
> another), then a careful sequencing of elements
> in terms of the direction of such transfer
> should be more effective than a random sequence.

Because the content sequence determines to a large extent how a course is organized, it is reasonable to believe that the sequence may contribute substantially to the efforts of the instructional experience in producing the desired behavior changes. Such a suggestion has been supported by a number of recent studies (e.g., Gagne and Paradise, 1961; Gagne, Mayor, Garstens and Paradise; 1962; Newton and Hickey, 1965).

To paraphrase Briggs (1968, p. 107), the value of planned content sequencing is supported by the experimental finding that learning progresses better under some sequences than under others. There is presently an intense research effort to examine those sequencing variables which significantly affect the efficiency of instructional procedures; it is WLC's intent to utilize what information is now available, so that the content sequence will facilitate the instruction of Naval Leadership at Annapolis.

2.0 The Basis for Content Sequencing - The Hierarchical Structure of Learning

A fundamental concept underlying the development of a valid and useful sequencing rationale is that the acquisition of learned behaviors may require prerequisite capabilities of other, "subordinate" behaviors. This idea, that new learning is built upon prior learning, is a basic element of many recent educational theories. Although the theories often differ in their description of the learning process, in their specific terminology, and in their emphasis on particular aspects of the instructional situation, they each describe human learning as a hierarchical accumulation of acquired behaviors. The word "hierarchy" is used, in the broadest sense, to identify the structural arrangement of a learning experience by specifying the relationships between the prerequisite and terminal behaviors. A brief discussion of three theoretical positions may help to clarify the concept of learning hierarchy as related to content sequence.

Bloom (1954), in describing the organization of his taxonomy of behavioral objectives, wrote:

> Although it is possible to conceive of these major classes (of behavioral objectives) in several different arrangements, the present one appears to us to represent something of the hierarchical order of the different classes of objectives. As we have defined them, the objectives in one class are likely to make use of and be built on the behaviors found in the preceding classes in this list.

Gagne has developed a logic of planned content sequencing based on both task and performance variables. In his book, <u>The Conditions of Learning</u> (1965), Gagne described eight types of learning, "defined in terms of the conditions required to bring

4

them about. These learning types are arranged in order from the most "simple" (stimulus-response learning) to the most complex (application of principles); they are related to each other in that for a given unit of content the acquisition of the simpler types of behaviors is a prerequisite for learning the more complex tasks:

> The most important class of condition that distinguishes one form of learning from another is its initial state; in other words, its prerequisites. The conditions for chaining, for example, require that the individuals have previously learned stimulus-response connections available to him, so that they can be chained. If this condition is not met, one finds one-self dealing with conditions for establishing these prerequisite Ss $\longrightarrow$ R's and thus likely to draw incorrect conclusions about chaining, itself. This generalization, applied to the (eight) varieties of learning...may be briefly stated as follows:
>
> > Problem solving (type 8)
> > which requires as prerequisites:
> >
> > Principles (type 7),
> > which require as prerequisites:
> >
> > Concepts (type 6),
> > which require as prerequisites:
> >
> > Multiple discriminations (type 5),
> > which require as prerequisites:
> >
> > Verbal associations (type 4) or
> > other chains (type 3); etc.

Gagne has related the hierarchy of learning type to the process of learning by attempting to show that "each variety of learning...begins with a different state of the (student) and ends with a different capability for performance."

5

In other words, "each of the eight varieties of learning conditions...establishes a different kind of capability in the learner," so that learning may be described as the hierarchical achievement of learned capabilities. The acquisition of knowledge would therefore be defined as the achievement of "an inferred capability which makes possible the successful performance of a class of tasks that could not be performed before the learning was undertaken." (Gagne, 1962, p. 355)

Briggs (1968) has echoed Gagne's conceptualization of the learning process as a hierarchical acquisition of learned capabilities. He used the term "subordinate competencies" to describe those capabilities which must be achieved before a particular task can be mastered.

In a consulting report submitted to the USNA, Briggs and Talmadge (1967) described the necessity of studying and analyzing the content and objectives "for the purpose of determining the sequence of instruction. Included in this analysis would be a detailed specification of the 'prerequisite competencies', referring to the subordinate skills and knowledges which must be acquired in particular sequences in order to attain the mastery of a particular behavioral objective." These suggestions were echoed in the Request for Proposal.

3.0 Behavioral Hierarchies and Course Structures

The description of learning as a hierarchical attainment of
acquired capabilities has direct application to the planned se-
quencing of content, since this sequence has already been de-
fined as the ordered arrangement of behavior objectives, and
since these objectives are defined as the expected behaviors
acquired by the learner as a result of the instructional ex-
perience. The task of content sequencing thus involves analy-
zing the behavioral objectives to determine their dependent
and independent relationships, so that the achievement of pre-
requisite competencies enables the student to attain succeed-
ing behaviors. The rationale for such an analysis has been
stated by Gagne (1965):

> The existence of capabilities within
> the learner that build on each other...
> provides the possibility of the plan-
> ning of sequences of instruction. If
> problem solving is to be done... then
> the... principles to be applied to the
> problem must be previously learned; if
> these principles in turn are to be learn-
> ed, one must be sure there has been pre-
> vious acquisition of relevant concepts;
> and so on. Thus it becomes possible to
> "work back" f· m any given objective of
> learning to determine what the prerequi-
> site learning must be; if necessary,
> all the way back to simple verbal associ-
> ations and chains...When such an analysis
> is made, the result is a kind of map of
> what must be learned.

It is this "map of what must be learned" which represents
the basic structure of the course. As defined by Briggs (1968),
course "structure" is "the description of dependent and indepen-
dent relationships among component competencies, arranged so as
to imply when sequencing can be random or optional and when

7

sequencing must be carefully planned, on the basis that transfer will be optional in order to build up from simple skills to more complex ones."

Briggs (1968) has developed a classification scheme for a number of possible types of structure:

1. A flat structure. This phrase is employed to describe the organization or structure of the course when it does not appear to matter in what sequence the instruction for the various major objectives or subobjectives is arranged. For a course with a flat structure one could either conduct the instruction in a random sequence or in any arbitrarily chosen order which one prefers. The significance of such a structure would be that the competencies gained in reaching each objective are independent from the competencies gained in reaching all other objectives. It is conjectured that if a course is well analyzed for the purpose of deciding upon the sequencing of the instruction, a truly flat structure will seldom be encountered. When one does encounter an apparently flat structure of a course, one can question the value of the course, or perhaps the objectives should be restudied to make sure that they are in fact behavioral objectives rather than content objectives (see Briggs et al., 1967). An example might be a foreign language course involving written vocabulary, but no sentence translation or speaking. Another might be a history course limited to learning dates on which events occurred.

2. A vertical structure. This term is applied when there is one fixed best sequence, in which Objective A should first be taught, then Objective B, and then C, and so on. A course having such a vertical structure thus contains no "lateral transfer" among competencies which would otherwise appear at the same level in a hierarchical structure. It is believed that this type of structure would also be encountered infrequently for a course as a whole, although it may be encountered sometimes in planning the instruction within a single course objective. This type of structure then has only one competence per level.

8

3. <u>The hierarchical structure.</u> This kind of structur-
    ing is represented by a pyramid-shaped arrangement
    of the objective of the course in which the objec-
    tive at the top of the pyramid is a global, total
    course objective, and the subordinate objectives
    are arranged in layers. A hierarchical structure
    implies that all of the competencies within a layer
    should be taught before instruction for the next
    layer is begun (because vertical transfer is ex-
    pected), although there may be options in the se-
    quencing of the instruction within a layer (if
    lateral transfer is not expected). A hierarchi-
    cal structure is a frequently-reported structure
    for carefully analyzed learning objectives or
    tasks.

4. <u>Mixed structure.</u> This would be illustrated by a
    course in which two or more major parts can be
    taught in random orde·, but where hierarchies
    may exist within the parts. This is called
    "parallel learning" by Ausubel and Youssef (1963).
    A special case might exist as for foreign lan-
    guage, where vocabulary and sentence structure
    are both involved. Just how vocabulary and sen-
    tence structure are time phased would permit at
    least these options, desirable or not: (a)teach
    <u>all</u> the vocabulary, then sentence structure; (b)
    teach some vocabulary and some sentence structure,
    using familiar words only in the latter; (c) same
    as b, but introduce new words in the course of
    instruction on sentence structure. There may be
    instances of the reverse situation, where sequence
    is important among major objectives but not in the
    learning of the individual objective.

5. <u>The special case of a flat structure requiring</u>
    <u>spiral sequencing of instruction.</u> This type of
    structure is sometimes encountered when the major
    objective of a course is that the student learn
    to solve complex problems by analyzing each of
    several major components in a problem. An example
    of this has been encountered in discussions with
    subject-matter experts on learning to analyze for-
    eign policy problems. Subject-matter experts in
    this area indicate that in making each foreign
    policy decision encountered in practice, it is
    necessary to analyze each of a dozen important
    factors going into each foreign policy decision
    in such a way as to appraise each factor individ-
    ually and also to arrive at the best trade-off
    decision as relating to each of the 12 factors.
    In arranging instruction in this case one might
    proceed first by teaching some individual concepts
    and principles needed later in analyzing each of

9

the 12 factors to be considered in making a foreign
policy decision; this constitutes the first "spiral."
These 12 introductory sequences can be taught in any
order. Next, a problem would be presented to the
student in which the analysis is given to him for
11 factors, and he solves the problem by analyzing
the 12th factor and arriving at a decision based on
use of the analyses provided for the other 11 (second
spiral). In the next problem given, two factors would
essentially be left blank, requiring the student to
consider the supplied information on 10 factors in
terms of his own analysis for the other two factors.
By spiraling the instruction the programmer or ex-
perimenter continues to supply an increasingly small
part of the total solution, while the learner develops
the competency to solve an increasingly large part of
the problem. After a dozen such cycles or spirals he
has acquired the capability to analyze a new problem
by analyzing all 12 of its components, and making the
decision for action. While there might conceivably
be a better way to approach such instruction, the
spiral sequencing at least represents one logical ap-
proach for this type of problem. This type of learning
structure has been discussed by Glaser (1962) and by
Bruner (1963), who refers to this sequencing proce-
dure as "revisiting," or learning which "turns back on
itself." In the "RULEG" system of programing discussed
by Glaser, a wider variety of examples or finer dis-
criminations may be accomplished by the latter spirals.

Although Briggs has outlined a number of possible structural
arrangements of behavioral objectives, both he and Gagne have hypo-
thesized that the analysis of most courses of instruction would
reveal a hierarchical structure, "represented by a pyramid-shaped
arrangement of the objectives... in which the objective at the
top of the course is a global, total objective, and the subordin-
ate objectives are arranged in layers." (Briggs, 1968, p. 12).
Gagne (1965) has suggested that "the subjects of school instruc-
tion possess hierarchical organizations with respect to re-
quired types of learning. Each can be analyzed to reveal pre-
requisite learnings that grow progressively simpler as one works
downward from principles to Ss⟶ R connections.

10

And Briggs (1968) has cited a number of studies which have:

> ...supported the view that many courses or por-
> tions of them, when analyzed carefully, dis-
> play an inferred hierarchical structure
> whose validity can be supported by compar-
> ing sequences of instruction designed to
> follow the hierarchy with some other
> strategy of sequencing. Several experi-
> ments provided various kinds of evidence
> of the validity of the hierarchy, because
> when learning was sequenced accordingly,
> learning progressed better than under other
> sequencing procedures.

3.1   The Levels of Behavioral Objectives

"In a general sense," Briggs (1968, p. 4) wrote, "an analysis of the behavioral objectives for any course of instruction should be the starting point. A study of the extent of apparent inter-dependence or independence among such objectives should suggest the latitude one might have in blocking out the molar units of instruction as to their place in the course, and an effort to determine the internal structure for each objective in terms of structures which appear to be vertical, flat, or hierarchical in nature should provide a starting point for considering the more molecular structure of the course."

Briggs' suggestion, that the more general and comprehensive objectives should first be identified and sequenced, has been extended by Stolurow and Brennan (1968). According to these authors, statements of behavioral objectives can be made at two basic levels. The first level is the macro-level of objective, which roughly corresponds to behaviors brought about in students as the result of studying relatively large areas of the content.

11

The second level is the micro-level of objective, which corresponds to behaviors brought about in students as a result of studying relatively specific elements of the content.

Stolurow and Brennan (1968) define macro-objective as the overall, large-scale instructional intention of the objective or test item. Macro-content refers to the general section of the course to which the objective or test item is aimed. In this case, macro-content refers to the clustering of content into meaningful course Chapters (or Parts). For example, a Part concerned with communication should have as the basic objective the development of skills in communication as evidenced by the ability to appropriately apply principles of communication in new problem-solving situations. Macro-objectives will be stated as expected changes in student behavior which occur as the result of interaction with Parts or macro-content. They will not necessarily include the specific activity the student must perform to demonstrate his mastery of the objective.

Micro-objectives, on the other hand, will be stated as terminal behaviors the student will engage in, and will immediately imply his degree of mastery of the objective. These objectives will contain a verb ("virile verb") which specifies the exact performance expected of the student in relation to the specific content measured.

Stolurow and Brennan (1968) define micro-objective as a statement of something the learner will "do". The rationale for stating the objective in this way is that the learner's behavior can be observed and measured, i.e., tested (Mager, 1962; Loree, 1965; Gagne, 1965). Micro-content is defined as the very specific area

12

of knowledge with which the test item or objective is concerned. It is the specific object of the "do" statement. Stolurow and Brennan note a major distinction between micro- and macro-content in that micro-content is always found in a typical statement of an educational objective whereas macro-content is often merely implied. The value of stating the behavioral objectives at both levels is that the macro-objective may be used to describe the general course structure, and the micro-objectives may be sequenced independently within macro-content units.

Considering the theoretical statements which have been discussed, WLC is now ready to examine their applications to the sequencing of the Naval Leadership Course.

4.0 The Development of the Leadership Course Content Sequence

4.1 The Specification and Sequencing of Macro-Objectives

As already stated, the specification of behavioral objectives is a preliminary task in the development of the content sequence (primarily because the sequence may be defined as an ordered arrangement of the objectives).

The USNA subject matter expert, who is also the Project Manager, had provided, as the "core content," 81 "critical factors" abstracted from the film script of General Order 21 and from the 41 Critical Behavior Categories contained in NAVPERS 92224A.

W L C's next undertaking, therefore, was to categorize this material into individual topic units, each defined (in behavioral terms) as a macro-objective. It should be mentioned that there were a number of advantages in identifying these macro-objectives, besides those discussed earlier in this paper:

a. It was possible to identify the intent of the course in a few, rather than many, general statements.

b. The macro-objectives lend direction to the sequencing of major aspects of course content and to the sequencing of instructional procedures.

c. The macro-objectives can themselves be defined by a set of micro-objectives. This facilitates the efficient classification of content material within topic units, and also aids in planning the sequence of the units.

d. The macro-objectives can be tested to determine the effectiveness of the instructional system.

14

e. Tests, based on macro-objectives, will also give some indication of long-term retention of the principles of leadership.

After analyzing the content and the critical factors provided by the SME, WLC, in conjunction with the Naval Academy, categorized the content into twelve topic units (or domains) called Parts (or Chapters). Each of these eleven parts was represented by a macro-objective; the last part was designated as a Summary and Review.

These macro-objectives were then sequenced in the manner suggested by the theories which have already been reviewed. The basic inferred course structure, as generated by the sequencing of macro-objectives, was found to be a hierarchical arrangement of the Parts. Figure 1 illustrates this hierarchical structure.
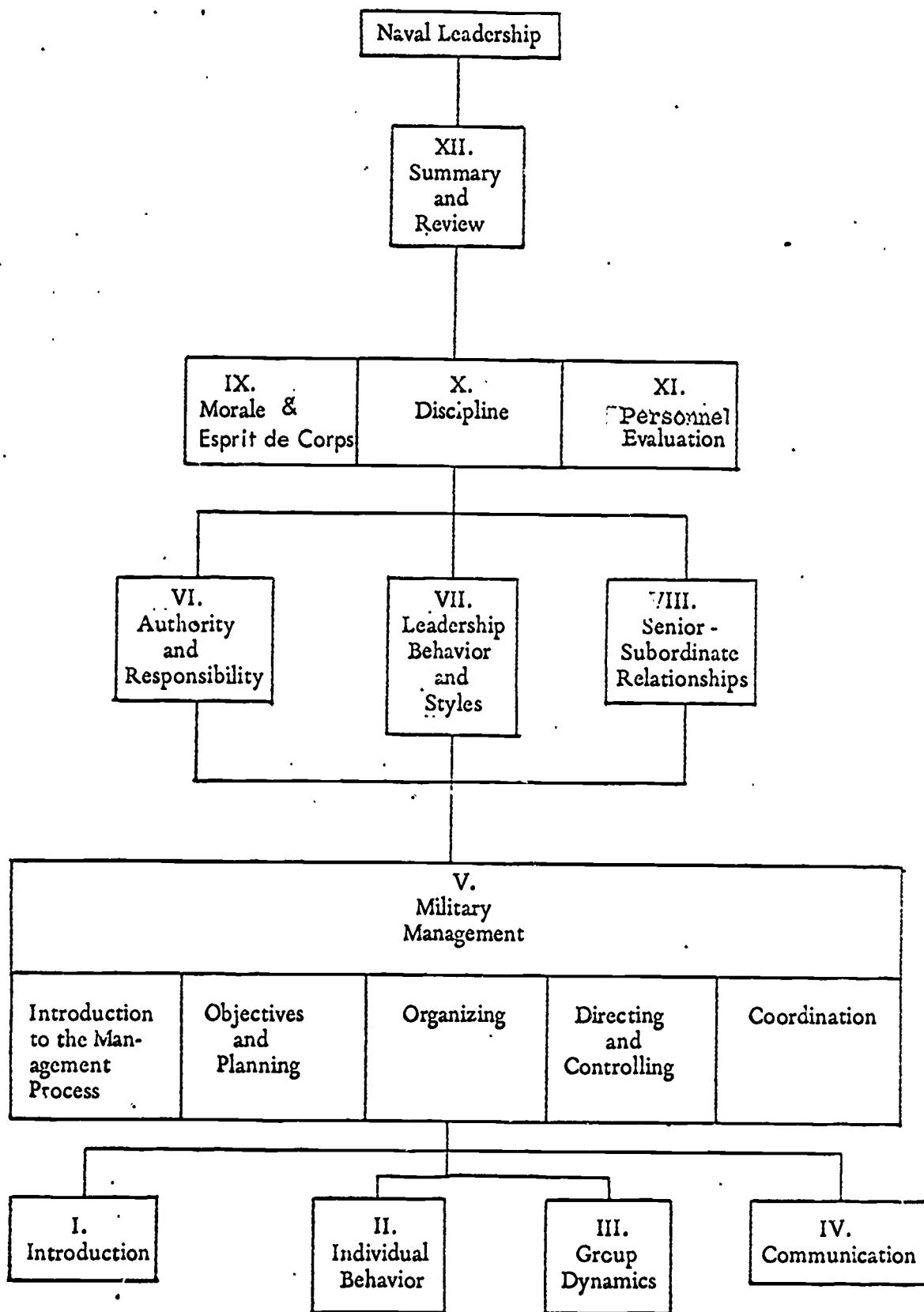
Fig. 1 Hierarchical structure of the topic units (Parts) of the Naval Leadership Course

It can be seen that the course is organized into four (horizontal) levels, each level containing one or more topic units. The achievement of the macro-objectives at each of the levels is prerequisite to the acquisition of knowledge in the next higher level. Mastery of the principles of military management, for example, is facilitated by the knowledge of the principles of individual behavior, group dynamics, and communication.

4.2 The Specification and Sequencing of Micro-Objectives

The micro-objectives (or "terminal objectives") identify the specific learned behaviors which the student is expected to accomplish as a result of the instruction. The micro-objective closely fits Mager's (1962) definition of a behavioral objective as an "intent communicated by a statement describing a proposed change in a learner -- a statement of what the learner is to be like when he has successfully completed a learning experience."

It is important to recognize the critical relationships between macro- and micro-objectives. A macro-objective, although by itself a rather general description of achievement, is exactly defined by the set of micro-objectives comprising the topic unit. The macro-objective may then be considered as a "summary statement" of a number of content-related micro-objectives. An example of each type of objective, in its relation to each other and to content, might be:

MACRO-CONTENT (PART): Communication

MACRO-OBJECTIVE: the student will be able to demonstrate the ability to communicate effectively.

17

MICRO-CONTENT (SEGMENT): Second principle of communication.

MICRO-OBJECTIVE (TERMINAL OBJECTIVE): Given a list of hypo-
thetical situations, the student will demonstrate his
understanding of the second rule of communication by
selecting the appropriate situation in which it would
apply.

The micro-content and terminal objectives are being derived
from the content provided by the SME. Since this content is
largely a description of the principles (rules) of leadership, the
terminal objectives are statements of the students' expected in-
depth acquisition of these principles; the objectives are empha-
sizing three major types of capabilities:

a. The student will demonstrate his knowledge of the rule
by being able to discriminate a statement of the rule
from a number of alternatives.

b. The student will demonstrate his understanding of the
rule by being able to generalize the rule in a given
situation.

c. The student will demonstrate his ability to apply the
rule by using it in problem solving situations.

Some advantages of specifying the terminal objectives in this
way, in addition to those already mentioned, are:

a. The micro-objectives will require the student to "do"
something which can be observed and measured.

b. The micro-objectives will lend direction to the sequenc-
ing of the segment content and sequencing of presenta-
tion variations within segment instruction.

18

c. The micro-objectives can be tested by a number of test items which involve discrimination and generalization as well as problem-solving abilities.

d. Tests of the micro-objectives will provide valid and reliable estimates of the effectiveness of segment presentation.

e. Tests of the micro-objectives make it possible to pinpoint the student's specific areas of difficulty in learning materials.

Within the Parts, the terminal objectives are usually achieved independently; i.e., they are not hierarchically arranged.

4.3 The Specification and Sequencing of Enabling Objectives

An individual terminal objective (T.O.) only partially defines a macro-objective, and therefore, is by comparison a relatively small unit of behavior. However, by itself a T.O. represents a sizable achievement, requiring a number of prerequisite competencies for its accomplishment. Since these prerequisite competencies "enable" the student to achieve the final terminal behavior, they are called, appropriately, enabling objectives (E.O.).

The analysis of each terminal objective - which entails the specification and sequencing of its enabling objectives - is one of the most difficult, most elaborate, and most important tasks in the organization of the Leadership Course. It is in this task that the theory which we have been discussing finds its most effective application, because the sequence of the instructional

19

procedures is derived in large measure from the sequence of
enabling objectives.

Suggestions from six different theories have contributed to
the rationale for the specification and sequencing of enabling
objectives:

1. <u>Gagne</u> (1965) has stated that complex, learned behaviors
   are built up from more simple behaviors. Since most of
   the terminal objectives are at the Type 7 (Principles)
   and Type 8 (Problem Solving) levels, one facet of the task
   is to specify the enabling behaviors in terms of Gagne's
   learning types. The analyses completed thus far have
   indicated that the enabling objectives are arranged in
   a hierarchy within each terminal objective.

2. <u>Bloom's</u> (1965) taxonomy has also been used in the anal-
   ysis of the terminal objectives. Bloom's major categories
   of educational objectives (knowledge, intellectual abil-
   ities, and skills) have served as the basis upon which
   the T.O's are measured; the student will demonstrate his
   mastery of each T.O. by being able to discriminate the
   rule, generalize from the rule, and solve problems by
   applying the rule. Each of these requirements indicate
   the content and form of many of the enabling objectives.

3. <u>Briggs'</u> (1968) discussions of course structure based on
   hierarchies of competence have also contributed to the
   construction of the E.O. sequences.

4. The <u>RULEG</u> system, proposed by Evans, Homme, and Glaser (1962), has contributed procedures for analyzing the T.O's and E.O's in terms of their rules and examples. This method also considers the hierarchical nature of learning based on the type of discrimination and generalization required.

5. <u>Gilbert</u>'s (1962) competition-facilitation analysis has been used extensively in the designation of the enabling objectives. This procedure deals with other elements of transfer besides hierarchical facilitation. It is essentially an analysis of behavior domains in which discrete components of subject matter are identified and grouped. Gilbert's methods suggest which behaviors should be taught together, which should be taught separately, and the general ordering of the instruction.

6. <u>Tosti and Ball</u>'s (1969) media selection model has considered the importance of planning the sequence of instruction. These authors have included, sequence within the "distribution" dimension of presentation. This dimension refers to "the ordering, grouping, and sequencing of behavioral items and the temporal spacing between such items. Distribution includes such items as the distribution of practice, the frequency of review, and the hierarchy of content presentation." Describing the concept of behavioral hierarchies, Tosti and Ball (1969) write:

It is known that behavior which can be
built onto already existing behaviors is
generally facilitated in its acquisition,
retention, and generalization. This is
one of the primary differences between
the application of modern behavioral
theory and the application of behavioral
theory in the twenties. T.us, if a new
stimulus-response (S-R) pair is going to
be installed, it would be most advan-
tageous to have certain other S-R pairs
previously established. Of course, such
antecedent behaviors may have been estab-
lished before the instructional setting,
or the distribution decision to create
and establish such behaviors within this
instructional setting might be made before
the establishment of the new behavior.
There are several classes of such behaviors
which must be considered. These include
stimulus discrimination, response differen-
tiation, existence of mediators such as
understanding, analogy, or mnemonic, and
those response sets concerned with ob-
serving and covert responding sequence.

The specification and sequencing of the terminal and enabling
objectives is presently being completed by WLC, based on the the-
oretical positions we have just described.

5.0 Summary and Conclusions

WLC has been using the suggestions from a number of psychological and educational theories in the development of the content into a well-organized and properly-sequenced course of instruction.

One stage in this development has been the specification, on three levels of behavioral complexity (macro-, micro-, and enabling objectives), of those behaviors which were considered to be functionally related to each other. Intensive content analysis, which began with the restatement of the subject matter in terms of behavioral objectives, has resulted in the conclusions (1) that the general course structure was best represented as a hierarchical arrangement of macro-objective; (2) that the macro-objectives were defined by a set of relatively independent terminal objectives; and (3) that the enabling objectives could be arranged in a hierarchical sequence within each terminal objective.

The content sequence is now being completed by WLC. It is expected that this planned sequence will substantially facilitate the instruction of the Naval Leadership Course.

REFERENCES

Ausubel, D. P., and Youssef, M. Role of discriminability in
    meaningful parallel learning. Journal of Educational
    Psychology, 1962, 53, 243-249.

Briggs, L. J., Sequencing of Instruction in Relation to Hierar-
    chies of Competence. Final report submitted to the U.S.
    Department of Health, Education and Welfare. Pittsburgh:
    American Institutes for Research, 1968.

Briggs, L. J., and Tallmadge, G. K., Plan of Action To Be
    Followed by Contractors in Developing Each of Four Proposed
    Multi-Media Courses of Instruction for the U.S. Naval
    Academy. Final report (Contract No. N00161-67-C-0058)
    submitted to the U.S. Naval Academy. Pittsburgh: American
    Institutes for Research, March 6, 1967.

Briggs, L. J., Campeau, P. L., Gagne, R. M., and May, M. A.
    Instructional Media: A procedure for the design of multi-
    media instruction, a critical review of research, and
    suggestions for future research. Pittsburgh: American
    Institutes for Research, 1967. (Monograph No. 2)

Bloom, B. S., Taxonomy of Educational Objectives. Handbook I:
    Cognitive Domain. New York: McKay, 1956.

Bruner, J. S., Needed: A theory of instruction. Educational
    Leadership, 1963, 20, 523-532.

Evans, J., Behavioral objectives are no damn good. Technology
    and Innovations in Education. New York: Frederick A.
    Praeger, 1968.

Evans, J. L., Homme, L. E., and Glaser, R. The RULEG system for
    the construction of programed verbal learning sequences.
    Journal of Educational Research, 1962, 55, 513-518.

Gagne, R. M. The Conditions of Learning. New York: Holt,
    Rinehart and Winston, 1965.

Gagne, R. M. The acquisition of knowledge. Psychological Review,
    1962, 69, 355-365.

Gagne, R. M., and Paradise, N. E. Abilities and learning sets
    in knowledge acquisition. Psychological Monographs:
    General and Applied, 1961, 75. (Whole No. 518).

Gagne, R. M., Mager, J. R., Garstens, H. L., and Paradise, N. E.
    Factors in acquiring knowledge of a mathematical task.
    Psychological Monographs: General and Applied, 1962, 76.
    (Whole No. 526).

Glaser, R. Some research problems in automated instruction, instructional programming and subject matter structure. In J. E. Coulson (Ed.), Programmed Learning and Computer-Based Instruction. New York: Wiley, 1962, 67-85.

Gilbert, T. F. Mathetics: The technology of education. Journal of Mathetics, 1962, 1 (1), 7-75.

Loree, M. R. Psychology of Education. New York: The Ronald Press Co., 1965.

Mager, R. F. The need to state our educational intents. Technology and Innovation in Education. New York: Frederick A. Praeger, 1968.

Mager, R. F. Preparing Instructional Objectives. Palo Alto, California: Fearon, 1962.

Newton, J. M., and Hicky, A. E. Sequence effects in programmed learning of a verbal concept. Journal of Educational Psychology, 1965, 56, 140-147.

Stolurow, L. M., and Brennan, R. L. Technical recommendation No. 4. USNA Contract No. N00161-7339-4781, May 31, 1968.

Stolurow, L. M. Instructional systems validation planning. technical recommendation No. 2. USNA Contract No. N00161-7339-4781, March 29, 1968.

Tosti, D. T., and Ball, J. R. A Behavioral Approach to Instructional Design and Media Selection. BSD Paper Number 1: Observations in Behavioral Technology. Albuquerque: Behavior Systems Division, Westinghouse Learning Corporation, 1969.