Psychology of Learning: improving pupil performance

3

BEHAVIOURAL OBJECTIVES AND SYSTEMATIC INSTRUCTION

Perhaps Skinner was a flamboyant cheer-leader, as Leith suggested. His work, however, did have profound effects on educational thought in a number of ways related to the general concept of programmed learning. Attention was focussed first on the objectives of instruction in a general sense (Bloom et al., 1956), and then on the specific objectives of the behavioural objectives movement (Mager, 1962). The idea of mastery learning, popular in the 1930's but failing because of lack of a technology to sustain it (Block, 1971, p.4), was also resurrected as a corollary of programmed instruction, and with it evolved an interest in learning hierarchies and the structure of knowledge (Gagné and Paradise, 1961). These, in turn, have been influential in the development of systems of learning and instruction (Keller, 1968; Bloom, 1968) which have achieved the improvements in standards of learning which Skinner had hoped to bring about by his technological revolution. Here the emphasis has turned from technology in education, with its emphasis on hardware, to the technology of education.

BLOOM'S TAXONOMY OF OBJECTIVES

The 'Taxonomy of Educational Objectives: Handbook 1: The Cognitive Domain' (1956) arrived at a time when the demand for improvements in the efficiency of education was being made by Skinner and his colleagues. The idea for such a taxonomy came during a meeting of examiners attending the 1948 American Psychological Association Convention. Bloom and thirty-three colleagues met over a five year period to discuss their taxonomy, which was then organised and written by a select committee of five members. The taxonomy was to provide a 'theoretical framework which could be used to facilitate communication among examiners.'

> It is intended to provide for classification of the goals of our educational system. It is expected to be of general help to all teachers, administrators, professional specialists, and research workers who deal with curricular and evaluation problems. It is especially intended to help them discuss these problems with greater precision. (Bloom et al., 1956, p.1)

It was hoped that such ambiguous terms as 'really understand', 'internalize knowledge' and 'grasp the core or essence', would be redefined as a set of standard classifications, making exchange of information about curricular development and evaluation more precise. Equally important, the psychological relationships within the taxonomy were seen as forming a basis for psychological investigations to shed light on changes in the learner's behaviour. This aspect of the taxonomy has been pursued in various forms throughout Bloom's extensive involvement in the study of education.

The educational objectives described in the taxonomy were in a behavioural form and were seen as being consistent with relevant and accepted psychological principles and theories (p.6). They were concerned with the changes produced in individuals as a result of educational experiences. In other words, the taxonomy was a classification of behaviours which represented the intended outcomes of the educational process (p. 12). However, it was not intended to evaluate the actual behaviours acquired by the students. The emphasis was on obtaining evidence on the extent to which desired and intended behaviours were learned by students. Determining the appropriate value to be placed on the different degrees of achievement of the objectives of instruction was considered to be a matter of grading or evaluating the performance and as such it was considered to be outside the scope of the taxonomy.

One major principle of the taxonomy, that it should be consistent with the then current understanding of psychological phenomena, was reflected in the behaviourist overtones that it should be applied only to those educational programmes which could be specified in terms of changes in 'intended student behaviours.' It was assumed that these changes in behaviour were changes from the simple to the complex.

Figure 3-1. Major Classes of Taxonomies of Educational Objectives. (Based on Bloom et al., 1956; Krathwohl et al., 1964; Harrow, 1972)

Bloom et al.: Cognitive Domain

1.00 KNOWLEDGE
2.00 COMPREHENSION
3.00 APPLICATION
4.00 ANALYSIS
5.00 SYNTHESIS
6.00 EVALUATION

Krathwohl et al.: Affective Domain

1.00 RECEIVING (attending)
2.00 RESPONDING
3.00 VALUING
4.00 ORGANISATION
5.00 CHARACTERIZATION BY A VALUE OR VALUE COMPLEX

Harrow: Psychomotor Domain

1.00 REFLEX MOVEMENTS
2.00 BASIC-FUNDAMENTAL MOVEMENTS
3.00 PERCEPTUAL ABILITIES
4.00 PHYSICAL ABILITIES
5.00 SKILLED MOVEMENTS
6.00 NON-DISCURSIVE COMMUNICATION

> If we view statements of educational objectives as intended behaviours which the student shall display at the end of some period of education, we can then view the process as one of change. As teachers we intend the learning experiences to change the student's behaviour from a simpler type to another more complex one which in some ways at least will include the first type.
> (Bloom et al., 1956, p.16)

This view led to the taxonomy being organised into six major classes (Figure 3-1), with a hierarchical order, the objectives in one class making use of and being built on the behaviours in the preceding classes (p.18). According to Bloom, research showed that there was 'an unmistakable trend pointing toward a hierarchy of classes of behaviour' which was in accordance with the 'Taxonomy Of Educational Objectives: Cognitive Domain.' Similar arrangements were to be found in the second part of the taxonomy dealing with the affective domain (Krathwohl et al., 1964) and the tradition was maintained in the taxonomies of the psychomotor domain developed separately by Simpson (1966) and Harrow (1972).

The cognitive domain was further divided into subclasses and subcategories, giving a more comprehensive picture of each level of the hierarchy. For example, the class 'Knowledge' was divided into two subclasses, each with several subcategories (Figure 3-2).

Davies (1976) maintains that there is also a fundamental division in the cognitive domain, which has been largely overlooked in subsequent literature. It was divided into two broad areas, with the lower area of knowledge dealing with products, where little more than recall and recognition is required. The higher areas deal essentially with intellectual processes and require more complex intellectual abilities, such as determining relationships between and within the knowledge associations acquired in the lower levels of the domain.

Validity of Bloom's Taxonomy

Kropp and Stoker (1966) tested the validity of the hierarchical arrangement for the cognitive domain. The theoretically expected relative order for the categories Knowledge, Comprehension, Application and Analysis was obtained, but not for Synthesis and Evaluation, which both fell between Knowledge and Comprehen-

Figure 3-2. Taxonomic Structure of 'Knowledge'. (Bloom at al., 1956)

1.00 KNOWLEDGE

1.10 Knowledge of specifics

1.11 Knowledge of terminology
1.12 Knowledge of specific facts

1.20 Knowledge of ways and means of dealing with specifics

1.21 Knowledge of conventions
1.22 Knowledge of trends, sequences
1.23 Knowledge of classifications and categories
1.24 Knowledge of criteria

1.30 Knowledge of the universals and abstractions in a field

1.31 Knowledge of principles, generalizations
1.32 Knowledge of theories and structures

sion. Madaus, Woods and Nuttall (1973) suggested that the taxonomy had a Y-shaped structure, with the stem formed from Knowledge, Comprehension and Application and subsequently divided into one branch of Analysis and another branch from Synthesis to Evaluation.

Ormell (1974) has also found contradictions in the taxonomy. He believes that certain demands for the Knowledge category are more complex than the demands for Analysis or Evaluation. He has suggested that the hierarchical organisation based on increasing complexity of operations should be abandoned and the taxonomy should be split into six parallel categories, but maintaining the different levels within each category.

The linear assumption has been heavily criticized by a number of philosophers of education. For example, Pring (1971) argues that even 'knowledge of specifics' has a variety of intellectual abilities and skills implicitly associated with it:

> .... for something to be recognized as a fact requires some comprehension of the concepts employed and thus of the conceptual framework within which the concepts operate. Similarly with regard to the knowledge of terminology, it does not make sense to talk of the knowledge of terms or of symbols in isolation from the working knowledge of these terms or symbols, that is, from a comprehension of them and thus an ability to apply them. (Pring, 1971, p.90)

Seddon's (1978) appraisal of the cognitive domain dealt critically with the educational issue of communicability and the psychological issue of the cumulative structure of the hierarchy, but also recognized the success of the taxonomy in terms of the considerable impact it has made on educational thought and practice and concluded that it had achieved one of Bloom's criteria for its success:

> The taxonomy must be accepted and used by workers in the field if it is to be regarded as a useful and effective tool.
> (Bloom et al., 1956, p.24)

Green (1964) was critical of the assumption that the goal of teaching is to change students' behaviour. He argued that the goal was to transform behaviour into action, in other words the goal is the capability, competence or understanding that makes rational action possible, an idea since exploited by Gagné and Briggs (1974) in 'Principles of Instructional Design.'

The fact that the taxonomy chose to classify objectives on the basis of intended behaviours without regard for the particular content has also received wide criticism, as Sockett (1971) makes clear:

> "remembering" is unintelligible just as a psychological process (even if we lay aside its counterpart, forgetting) for we remember something, cases of remembering are cases of being right about what was or is the case. We cannot posit remembering in any sense apart from content. If remembering is thought of as content-free we have an empty concept which could not be even part of an educational objective. (p.20)

Furst views as rather more serious the omissions stemming from the separation of the cognitive, affective and psychomotor domains. This artificial separation

prevents some desired outcomes from being encompassed within the cognitive scheme, and he gives examples of those excluded: receptivity and sensitivity, skill in observing and data gathering, 'perceptual' or 'motor' activities, moral concepts, basic democratic values and rationality. But perhaps the most serious omission, for Furst, is the lack of an 'understanding' category. Ormell (1979) also objects to this and does not accept the argument that it was omitted as a major category because it was imprecise and has proposed both a definition and a research strategy for identifying this cognitive element.

Travers (1980) does not see it as a true taxonomy at all, and claims that although the major categories give the appearance of a continuum of complexity, it is more akin to an 'inventory of educational customs.' He feels that it lacks the theoretical under-pinnings of true taxonomies.

However, despite such criticisms, even Furst (1981) acknowledges that:

> A handbook that has had over a million copies sold, been translated into several languages, used worldwide, and cited thousands of times hardly needs extensive documentation on its usefulness. (p.448)

OBJECTIVES: A HISTORICAL PERSPECTIVE

The idea for educational objectives was not a new one, and Bloom et al. acknowledged their debt to many authors, particularly Ralph Tyler, to whom the first volume was dedicated. Davies (1976) traces the influences back to Cicero's six divisions of a speech, which were used by Herbart (1924) in his five stages of preparation for lessons. Earlier, Herbert Spencer (1910) had called for a curriculum based on the 'things it most concerns us to know', given that we do not have sufficient time to master all subjects.

Franklin Bobbitt (1924), professor of education at the University of Chicago, took the idea of objectives a stage further, insisting that, in an age of science, exactness and particularity were demanded. He even went so far as to report a list of objectives for each of the major occupations in Indianapolis, which would be needed by children when they left school. These included, for example, the ability to sharpen, adjust, clean, lubricate, replace worn or broken parts, and otherwise keep household and garden tools and appliances in good order and good working condition.

Werrett Charters (1924) extended this scientific perspective, using techniques of job analysis, to argue that individual tasks should be broken down to enable the student to learn without assistance. He suggested seven steps in the construction of a curriculum. First, the major objectives were to be determined; then, these were to be analysed to the level of working units; the working units were to be arranged in order of importance, first for adults and then for children; the number of items capable of being learned in school were selected; the best methods for teaching these items were to be determined; and, finally, the items were to be assembled in an order according to the nature of the children.

Tyler's Principles of Objectives

Bobbitt and Charters were recommending a behavioural approach to curriculum design, founded on the specification of educational objectives. These ideas were later applied, by Ralph Tyler, to the realms of test construction when he was faced with the unscientific diagnostic tests used in the biological sciences at Ohio University. He was in favour of having teachers:

> formulate the course objectives, define the objectives in terms of student behaviour, collect situations in which students are to indicate the presence or absence of each objective, and provide the method of evaluating the student's reactions in the light of each objective. (Tyler, 1932)

Tyler was, in effect, proposing an early description of what was later to be called 'criterion reference' testing (see Chapter 4). He went on, in his classic text 'Basic Principles of Curriculum and Instruction' (1949), to detail a series of techniques by which 'materials are selected, content is outlined, instructional procedures are developed and tests and examinations are prepared.' And, as a first step in the systematic and intelligent study of educational programmes, he suggests that 'we must be sure as to the educational objectives aimed at' (1949, p.3). The objectives are not to be confused with things which the instructor is to do, they must be expressed in terms of changes in student behaviour:

> Since the real purpose of education is not to have the instructor perform certain activities but to bring about significant changes in the students' patterns of behaviour, it becomes important to recognize that any statement of the objectives of the school should be a statement of changes to take place in students. (Tyler, 1949, p.44)

He claims that the most useful form for stating objectives is to include both the kind of behaviour to be developed in the student and 'the content or area of life in which this behaviour is to operate' (p.46). The objectives 'to write clear and well-organized reports of social studies projects', 'familiarity with dependable sources of information on questions relating to nutrition' and 'to develop an appreciation of the modern novel', are given by Tyler as models of clear objectives including both behavioural and content aspects, although he does acknowledge that 'to develop an appreciation' may require some further definition.

The 'behavioural objectives' must be defined clearly because they will form the basis for the evaluation procedures, which are an integral part of Tyler's scheme. Choosing and formulating educational objectives and

the learning experiences do not complete the planning cycle for Tyler. Evaluation does this because it 'becomes a process for finding out how far the learning experiences as developed and organized are actually producing the desired results' (p.105). There are two aspects to evaluation. The first implies that evaluation must look at the behaviour of the student, and the changes in behaviour as a result of the process of education. The second implies that evaluation must involve more than a single appraisal. At least, it must consist of both an assessment at the beginning of the course of instruction and an appraisal at the end of the programme in order to determine the changes which have taken place. This is not enough for Tyler who expresses a desire for more testing during the educational programme in order to determine the changes in behaviour step by step. His suggestion finds fertile ground in later years in the form of summative and formative testing.

Mager's Behavioural Objectives

While Tyler advocated the use of objectives in the context of evaluation procedures Bloom and his colleagues concentrated on the precise specification of educational objectives without such an emphasis. It was taken up again in 1962, with the accelerating interest being shown in the programmed learning movement, when Robert Mager published a short book aimed at helping instructors to answer the question 'What is worth teaching?' by demonstrating the steps involved in 'Preparing Instructional Objectives.' Mager claimed that, having read the book:

> Given any objective in a subject area with which you are familiar, in all instances be able to identify (label) correctly the performance, the conditions, and the criterion of acceptable performance, when any or all those characteristics are present. (Mager, 1962/1975, p.3)

This statement presents an immediate outline of the three essential components in a Mager objective: first, the behaviour or performance to be accepted as evidence that the learner has changed; second, the conditions under which the behaviour will be demonstrated; and third, the standards or criteria of acceptable performance against which the success or failure of the learner will be judged. Davies (1976) is correct in assuming that the first component in Mager's scheme includes both of Tyler's dimensions for an objective, the kind of behaviour and the content area. The third incorporates Tyler's demand for evaluation as part of the complete cycle. Thus, Mager is taking on board that aspect explicitly excluded in Bloom's Taxonomy, and as such can be seen as a major advance in the application of behavioural objectives.

In one of the asides in his book (it was a scrambled programmed text, with 'optional material' scattered throughout, which the reader could 'save for a rainy day') he vividly describes what can happen when objectives are not stated clearly. It concerns students who were learning how to operate and repair a large, complex electronic system. The course goal was 'to be able to operate and maintain' the system. Time on the actual machine was limited and in order to increase the practice time students were taught in the classroom. The instructor would point out a component on a diagram and ask what effect it would have on the system if it failed. The students traced back through their individual diagrams and listed the symptoms. Of course, this is the exact opposite to what was expected of the operator, who would observe a symptom and then deduce the possible causes. As Mager said, the students were learning to run forwards by being taught to run backwards!

The correct approach was demonstrated in his analysis of the separate skills and objectives required by the general statement that students were 'able to read electrical meters.'

1. Given a meter scale, be able to identify (state) the value indicated by the position of the pointer as accurately as the construction of the meter will allow.
2. Be able to identify (state) the value indicated by the pointer on meter scales that are linear, non-linear, reversed, or bi-directional.
3. Given a meter with a single scale and a range switch, be able to identify (state) the value indicated by the pointer for each of the ranges shown by the range switch.
4. Given a meter with several scales and a range switch, be able to identify (state) the scale corresponding to each setting of the range switch.
(Mager, 1962/75, p.53)

There are improvements that can still be made to these objectives, for example, by adding to the criterion for reading the value in objective 1. The objectives can also be made too specific and in doing so may lose their value. Adding lighting and room temperature conditions to the objective 'will type a specimen letter, in accordance with office procedures, on an Apple word-processor and obtain one paper copy, with no mistakes, in less than five minutes', will not add a great deal to the usefulness of the objective. Adding details of the type of software running on the machine or the type of printer or even paper (single sheet, continuous roll) will improve its value.

In answering the performance question 'What should the learner be able to do?' Mager suggests that action verbs are going to be more useful than 'fuzzies' or words open to a wide range of interpretation. 'Fuzzies' include such words as: to know, to understand, to really understand, to fully appreciate, to grasp the significance of.

The action words open to fewer interpretations include: to write, to recite, to construct, to solve.

The conditions under which the performance will be demonstrated should clarify what the student brings to the situation and what is provided. Mager suggests a number of examples: given any reference of the learner's choice... ; given a standard set of tools... ; without the aid of a slide rule.... Thus, the statement 'be able to solve problems in algebra' is changed to something along the lines 'given a linear algebraic equation be able to solve (write the solution) for the unknown without the aid of references, tables, or calculating devices.' Finally, the criterion must be made explicit because:

> if we can specify the acceptable performance for each objective, we will have a standard against which to test our instruction; we will have the means for determining whether our instruction is successful in achieving our instructional intent. If, for example, our best experience and wisdom tell us that we must not consider a student competent until that student can perform within a strict time limit, then we know that we will have to instruct and assist that student until the desired performance level is reached. (Mager, 1962/ 1975, p.71)

For Mager the criterion is essentially a measure of the correctness of instruction for a particular student. When the student fails to reach the required level, the instruction is failing as well as the student. The criterion should not be a minimum or barely tolerable criterion, it should describe the desirable performance, although this will depend on the specific circumstances, as Mager says, it may be acceptable for a shipping clerk to occasionally tie a knot that slips, but that level of performance would not be acceptable for a surgeon. The criterion can be expressed as speed, accuracy or quality. A speed criterion is usually given as a time limit within which the performance must occur and accuracy usually indicates the limits eg. be able to tell the time shown on a clock to within one minute. Quality may be reduced to descriptions of accuracy, or it may include a quantitative specification eg. the number of examples to be given in a definition.

Mager's contribution to the development of specific behavioural objectives has been perfectly summarized by Davies:

> Rarely during the history of education has such a small book (62 pages), with so much blank paper, been as influential on both the thinking and practice, loves and fears of both British and American teachers. (Davies, 1976, p.57)

Objectives and the Principles of Instructional Design

Objectives have continued to occupy a central role in systems of instructional design and the components of operational definitions of objectives have been further extended by Gagné and Briggs (1979) from three to five, although they are not widely different from those of Mager and do not 'differ from them in any crucial respect.' Rather, there are differences in emphasis and distinctions which previously had not been highlighted, in particular, the distinction between verbs for 'action' and verbs used to identify the 'learned capability' implied by the behaviour under observation. There are five components in the scheme: action, object, situation, tools and constraints, and capability to be learned. The example of the poor objective 'types a letter' is used by Gagné and Briggs to illustrate the five components.

1. **ACTION**. The objective is fine with respect to the action component.
2. **OBJECT**. The object of the performance is clear ie. a letter is to be produced.
3. **SITUATION**. Clearly this requires some improvement: is she given a letter written in long hand to type, or is it on a tape, or even in note from?
4. **TOOLS AND OTHER CONSTRAINTS**. This aspect needs to be developed. What sort of typewriter is to be used, is a carbon required, what is the length of the letter? Obviously, different limits will be set for students at different levels.
5. **CAPABILITY TO BE LEARNED**. 'Types a letter' does not say much about the different human capabilities that may be involved in the process of producing the letter. It could mean that the letter is to be copied, or it could be that the letter is to be composed. These will require very different capabilities.

The poor objective is up-graded along the following lines: given a letter inquiring about the shipping of an order (situation) the student will generate (the learned capability, implying a problem-solving approach) a letter in reply (object) by typing (action), using an electric typewriter, making one carbon of a one-page letter (tools and other constraints).

Hierarchies, Capabilities and Systems

The new component 'capability to be learned' is related to Gagné's hierarchy of learning categories (Figure 3-3) which originally arranged learning into eight different types ranging from the simple to the complex. The most important class of conditions that distinguished one type from another in the hierarchy was the initial

Figure 3-3. Gagné's Hierarchy of Learning Types, based on Conditions of Learning (1965, First Edition).

Type 8.	Problem solving, requires the internal events usually called thinking, which requires as prerequisites:
Type 7.	Principle or rule learning, is the forming a chain of two or more concepts, which requires as prerequisites:
Type 6.	Concept learning, requires a response that identifies an entire class of objects or events, which has as prerequisites:
Type 5.	Multiple discriminations, requires different responses to similar stimuli, which has as prerequisites Type 4 or Type 3.
Type 4.	Verbal association or the learning of chains that are verbal, which has as prerequisite Type 2.
Type 3.	Chaining of 2 or more S-R connections, which has as prerequisite Type 2.
Type 2.	Stimulus-response learning, as found in the work of Thorndike and Skinner, which Gagné felt did not have Type 1 as a prerequisite.
Type 1.	Signal learning, the classical conditioning of Pavlov, the most basic type of learning.

state of each. Gagné (1965) called this its prerequisites. At the higher end of the hierarchy each type has the previous types as prerequisites.

The arrangement of these different types of learning into a hierarchical structure reflects Gagné's behaviouristic S-R origins, which became less relevant with the rise of more sophisticated models of human cognition, particularly the information processing model which he later adopted. Gagné acknowledges this change in emphasis in his preface to the third edition of 'The Conditions of Learning':

> The considerable shift in orientation from its previous edition requires a very different organisation for this one, and has occasioned its being largely rewritten to include much new material. This book, I feel, deserves a preface which is both frank and more than usually detailed. (Gagné, 1976, p.iv)

The hierarchy of learning types was removed and its place was taken by the 'learned dispositions or capabilities' which form the varieties of learning outcomes. There are now five of these (Gagné, 1985): intellectual skills, cognitive strategies, verbal information, motor skills and attitudes and, unlike the learning types, they do not have 'simply ordered relationships with one another.' Their order of presentation is mainly for convenience. However, the higher levels of the old hierarchy are incorporated into the fabric of the new scheme, while the lower half of the hierarchy is ultimately relegated to a single category. Type 8, problem solving, becomes associated with both intellectual skills and cognitive strategies capabilities, while Type 7 (principle or rule learning), Type 6 (concept learning) and Type 5 (multiple discrimination) are incorporated in the intellectual skills capability. Each capability has 'standard verbs' associated with it to describe what will be present when the capability is learned (Figure 3-4).

Intellectual skills involve 'knowing how', or procedural knowledge. They include making discriminations, as when a child learns to make the correct sound associated with a given letter, rather than another sound. Identification, the capability verb for concrete concepts, is in evidence when an individual can respond to a collection of things by distinguishing among them and is able to name the individual items. Putting things into a class and responding to any instance of the class as a member of that class is evidence of a defined concept, and the ability to respond to any instance of a class of situations with an appropriate instance of a class of performances is evidence of a rule being used. Gagné (1985) feels that learning of rules is of vast importance because rules make up the bulk of what is learned in schools. One aspect of problem solving is found when the learner discovers a combination of previously learned rules and combines them to generate a solution in a novel situation.

A further aspect of problem solving is associated

Figure 3-4. Verbs Describing Human Capabilities. (Based on Gagné and Briggs, 1979; Gagné, 1985)

CAPABILITY	ASSOCIATED VERB
Intellectual Skill	
Discrimination	DISCRIMINATES
Concrete Concept	IDENTIFIES
Defined Concept	CLASSIFIES
Rule	DEMONSTRATES
Higher-order Rule (Problem Solving)	GENERATES
Cognitive Strategy	ORIGINATES
Verbal Information	STATES
Motor Skill	EXECUTES
Attitude	CHOOSES

with the cognitive strategies capability, which is represented by the ways that individuals focus their knowledge and skills on problem situations that may not have been encountered before. Gagné calls these strategies ways of 'using one's head.' The 'problem finding' aspect of cognitive strategies, involving both the identification of novel problems and the translation of known rules into forms which provide the solutions, is of major importance.

Verbal information is also known as declarative knowledge and refers to knowledge that is 'verbalizable'. It can take the form of names or labels, single propositions or facts or collections of meaningfully organised propositions. Motor skills require the execution of muscular movements, although a more comprehensive term is 'psychomotor' skills because of the necessary co-ordination of bodily systems. The extent of this category can be seen from the examples Gagné (1985) gives, including executing a dive, using a typewriter and adjusting the internal mechanism of a watch.

Learning results in the creation of internal states that influence choices of an individual's action. These outcomes are called attitudes and are made up of three components: a cognitive component, an affective component and a behavioural component. According to Gagné this capability is demonstrated when a person chooses to behave in one manner rather than another.

Gagné and Briggs have attempted to build a framework which takes account of the three areas of educational objectives (cognitive, affective and psychomotor) and integrates them with the various types of learning to form the human capabilities component, thus producing a more coherent scheme.

The addition of this may be seen as an improvement, but there is one glaring omission; the criterion component does not appear in the scheme. There is no mention of the number of mistakes permitted nor the time limit for completion of the job. Gagné and Briggs take issue with Mager on this point:

> Instructional objectives describe the class of performances that may be used to determine whether the implied human capability has been learned. However, they do not state in quantitative terms what criteria will be used to judge whether any particular performance class has been learned. (Gagné and Briggs, 1979, p.127)

Two reasons are given for this. First, the criteria should be linked to the different types of human capabilities. Second, criteria of performance are related to the techniques of performance assessment, and it could be confusing to become concerned with assessment procedures when objectives are being described. Statements of objectives always imply 'mastery', but the criterion of mastery needs to be separately decided when considering assessment methods. If the proper conditions are provided the frequently used course design criterion of 90 percent of the students achieving 90 percent of objectives is recommended by Briggs and Gagné. This can have the effect of monitoring both student performance and the adequacy of the instruction.

The objectives movement has given rise to what is now known as the 'systems approach' to instructional design, in which educational technology is related to the process of planning, although the term 'systematic approach' is preferred by some authors because of its cyclical nature (MacDonald-Ross, 1973). Rowntree (1982) sees this as consisting of four stages:

1. Identifying purposes, which includes analysing aims, describing the students, determining the objectives and evaluation procedures.
2. Design of learning, during which objectives and subject matter are analysed, learning sequences and strategies are devised, and media,

materials and experiences are selected.

3. Evaluation, when the materials are tried out and monitored.
4. Improvement, during which phase the results of the evaluation stage are reviewed and revisions are made of the products of the previous activities.

Gagné and Briggs (1979) have a similar scheme, but the analysis of objectives is separated from the design of measures of learner performances. This approach to the design of instruction, with its emphasis on the early specification of objectives, is an essential part of the production of programmed instruction and other behaviourally oriented methods of teaching, including Bloom's 'Learning for Mastery' and Keller's 'Personalized System of Instruction.' The success of such systems must be attributable, in part, to this aspect of the design process.

SUPPORT, CRITICISM AND RESEARCH

Instructional objectives attracted widespread criticism and fervent support in equal measure throughout the early years. Popham (1969) reviewed ten reasons which he found to be used by educators to 'escape the practice of stating their objectives behaviourally.' He saw each of the reasons as carrying its own appeal to different sorts of educators, each with its own degree of reasonableness or emotionality, but each being essentially invalid.

To the suggestion that 'trivial learner behaviours are the easiest to operationalize, hence the really important outcomes of education will be under-emphasised', he did acknowledge that too many examples of behavioural objectives dealt with the picayune, especially those following Mager's examples, most of which dealt with the lowest level of Bloom's Taxonomy. But the fact that it was possible to make such behaviours explicit should result in their identification as unworthy of educational effort and hence their elimination.

It was also suggested that pre-specification of explicit goals prevents the teacher from taking advantage of opportunities unexpectedly occurring in the classroom. Popham argued that serendipity is always welcome in the classroom, but 'it should always be justified in terms of its contribution to the learner's attainment of worthwhile objectives', otherwise it may fall into the category of ephemeral entertainment for pupils.

There are other educational outcomes which are as important as changes in pupil behaviour, such as changes in parental attitudes, community values, etc. and to this Popham responded that all such modifications should be justified in terms of their contribution toward the pupils' achievements and the desired changes in their behaviours.

It was also suggested that the emphasis on behaviour which can be objectively and mechanistically measured must result in a de-humanizing approach to education. This view was based on the erroneous views of measurement as exclusively examination-based, which ignore the 'extremely sophisticated ways of securing qualitative as well as quantitative indices of learner performance.'

Another reason for not specifying educational objectives was that it was somehow undemocratic to plan in advance exactly how the learner should behave after instruction. Popham retorted that teachers generally have an idea of how they wish to behave, and they promote these goals with more or less efficiency. In any case, 'if schools were allowing students to "democratically" deviate from societal mandated goals' they would cease to receive society's support.

The fact that teachers do not specify their goals in terms of measurable behaviours and since that is the way of the real world perhaps it is unreasonable to expect such a dramatic change, was given as another reason for avoiding educational objectives. Not so, replied Popham, they may not, but they should because 'The way teaching really is at the moment just isn't good enough.'

Certain subjects were seen to offer more scope for the specification of student behaviours than others. In the fine arts and humanities it would be particularly difficult. 'Tough but not impossible', was Popham's reply, and he gave an example that many students must have sympathized with:

> Any English teacher, for example, will tell you how difficult it is to make a valid judgement of a pupil's essay response. Yet criteria lurk whenever this teacher does make a judgement, and these criteria must be made explicit. (Popham, 1969, p.50)

Another reason for not adopting objectives was that if most educational goals were stated precisely, they would be revealed as generally innocuous. Popham acknowledged this potential threat to school people and declared that much of what goes on in the schools is indefensible. If what is happening in schools is trivial, educators should know it and so should those who support it. He called upon teachers to abandon the ploy of 'obfuscation by generality' and clarify what is being done.

'Measurability implies accountability' and as such represents a good reason for many teachers not using the objectives approach. Teachers might actually be judged on their ability to bring about the desired changes, and so they should be, according to Popham.

He sympathized with the final reason, that it is very difficult and time consuming for teachers to generate precise objectives. The answer to this was to reduce the teacher's load to enable her to become a professional decision-maker and not merely a custodian. Alternatively, funds could be diverted to enable objectives to be generated by external agencies, which would produce alternative objectives for all fields and at all grades.

MacDonald-Ross (1973) looked at both the advantages and disadvantages claimed for behavioural objec-

tives. In their favour he concluded that they formed the basis of the only well-worked out method of rational planning in education, encouraging detailed planning and making explicit previously concealed values. They were seen as providing a basis for evaluation and the choice of instructional means, within a self-improving system which achieves internal consistency and the attainment of its initial aims. Objectives act as a medium of communication and can form the basis for individualising instruction.

However, there were certain disadvantages. The most serious were that there was no view as to the origins of objectives and there were no well-defined prescriptions for deriving them. Although it is claimed that behavioural objectives provide the only objective basis for evaluation, MacDonald-Ross felt that they cannot prescribe the validity of test items because they are inherently ambiguous and various items can usually be written for each objective. He also questioned the level of specificity of objectives: just how specific is it necessary to be to define the required behaviours in a course of instruction? He calculated that to move to a level suggested by Mager, if applied to an average educational psychology text, would require 10,000 objectives in a volume of 150,000 words.

A further disadvantage expressed by MacDonald-Ross was the cost involved in the cyclical nature of testing and modifying instruction to attain preset objectives. He supported the common criticism of objectives, that they represent a poverty-sticken view of student-teacher interaction and, at a more philosophical level, agreed with Pask (1972) that lists of behaviours do not adequately represent the structure of knowledge. His views were summarized as a list of 16 objections to objectives, including many that were to be found in Popham's discussion (Figure 3-5).

The Research

It has been suggested that objectives contribute to student successes because they provide a detailed description of precisely what it is that the student must learn during instruction. Duchastel and Merrill (1973) reviewed the evidence accumulated to answer the question: Does communicating behavioural objectives to students facilitate learning? In studies which investigated the straight comparison between students with and students without objectives they concluded that five studies demonstrated a significant effect due to the availability of behavioural objectives, and five found no difference, for tests of immediate retention. For delayed retention the results were also inconclusive.

Melton (1978) points out that a substantial number of researchers have recorded experiments that lend support to the claim that behavioural objectives enhance relevant learning when presented to students, whilst others show no such enhancement. One aspect, explored by Engel (1968), was that students must be aware of the objectives and must read them for there to be a positive effect. The difficulty of the objectives may also be a factor, according to Brown (1970), for if the objectives are extremely difficult the majority of students will fail to master them and it will be difficult to discriminate between the performance of students who do and do not receive the objectives. These and other results led Melton to the conclusion that there were five conditions under which objectives would be ineffective:

1. If students ignore the objectives provided, either because they are unaware of them, or because prior experience suggests that it is not important to take note of them.
2. If the objectives are too general, or too ambiguous, to be of particular assistance.
3. If the objectives are of extreme facility or difficulty. (The structure of readability of instructional material may be closely related to this condition.)
4. If the objectives of particular interest are only a small proportion of those provided to students.
5. If students are conscientious, or so highly motivated, that they achieve the objectives regardless of whether or not they are specified. (Melton, 1978, p.294)

Although most research had involved the effects of objectives on relevant learning, Melton pointed to the controversy concerning the effects of objectives on incidental learning. Morse and Tillman (1972) had found that behavioural objectives enhanced relevant learning without detracting from incidental learning against unspecified objectives. Whereas, Duchastel (1972, 1977) demonstrated that providing objectives had a detrimental effect on incidental learning. Confounding these observations, Rothkopf and Kaplan (1972, 1974) found the provision of behavioural objectives enhanced both relevant and incidental learning. Melton reasoned from the experimental details in these studies that the effect of the objectives will depend on when they are presented to the student and how they are used during study. When objectives are given prior to study and are read by the students before commencing their study the objectives would act as orienting stimuli, enhancing relevant learning but depressing incidental learning. Objectives read after the period of study would act as reinforcing stimuli, enhancing relevant learning but not at the expense of incidental learning.

When the interaction of objectives and the type of learning was investigated only one study out of seven found objectives to be more effective with one type of learning (knowledge) than with others, and this was not sustained on the retention test.

When learner characteristics were considered, there was some evidence of interactions between such characteristics and provision of objectives, with middle ability

students benefitting more from objectives than either high or low ability students. Kueter (1970) found behavioural objectives to be less effective for personality traits of submissiveness, self-control, considerateness, conscientiousness, or low ergic tension. Objectives appear to reduce the level of anxiety for some students (Merrill and Towle, 1971).

Investigations of the hypothesis that students who receive objectives will take less time in learning were few but two demonstrated a great reduction in learning time if the learners had control over how and when they learned. Mager and Clark (1963) reported a reduction in training time of 65 percent, with the learners being better equipped than graduates of the traditional course. Learners were provided with 24 pages of detailed objectives, classes were cancelled and the students were told that they would have complete control over their learning and could ask for instruction when they required it. In a further experiment a saving of 50 percent in learning time was observed. Smith (1970), in a more controlled experiment, did not support previous findings and Duchastel and Merrill caution that studies reported by Mager and Clark are heavily confounded by the student control variable.

Although the research has demonstrated some benefits for courses in which objectives are specified for the benefit of both students and teachers, it must be remembered that the specification of objectives is usually one part of what is now known as the 'systems approach' to course design. Evaluations of the benefits of objectives in isolation can only measure the effects of one of several components, whereas the basis of the systems approach is its synergism. As such, it makes sense to evaluate the total system, as well as the contributions of the individual parts. The programmed instruction 'system', which gave the initial impetus for behavioural objectives, was discussed in the previous chapter. In the following chapter the major mastery 'systems' will be evaluated.

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