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# **IMPLICATIONS OF INDIVIDUAL AND SMALL GROUP LEARNING SYSTEMS IN MEDICAL EDUCATION**

**Report of a WHO Study Group**

WORLD HEALTH ORGANIZATION

GENEVA

1972

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## CONTENTS

	Page
1. Introduction . . . . .	5
2. Implications of the systematic approach in the design and implementation of courses . . . . .	7
2.1 Indications for the use of the systematic approach . . . . .	9
2.2 Implications for the faculty . . . . .	10
2.3 Effect on work schedules . . . . .	11
2.4 Effect on learning space and facilities . . . . .	11
2.5 Implications for the teacher . . . . .	12
2.6 Implications for the learner . . . . .	13
2.7 Difficulties to be anticipated . . . . .	14
2.8 Needs for research . . . . .	14
3. The design, preparation, and evaluation of learning materials . . . . .	15
3.1 The systematic approach . . . . .	15
3.2 Specifying learning objectives . . . . .	16
3.3 The preparation of learning materials . . . . .	18
3.4 Evaluation . . . . .	20
3.5 General recommendations concerning the production and use of planned learning materials . . . . .	24
4. The future of systematically planned courses for the education of health personnel at all levels . . . . .	25
5. Exchange between faculties and institutes . . . . .	26
6. Conclusions and recommendations . . . . .	27
Annex. Graphic representation of the systematic approach to the design and use of materials for learning . . . . .	29

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AND SMALL GROUP LEARNING SYSTEMS IN MEDICAL EDUCATION**

*Geneva, 23-29 November 1971*

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# **IMPLICATIONS OF INDIVIDUAL AND SMALL GROUP LEARNING SYSTEMS IN MEDICAL EDUCATION**

## **Report of a WHO Study Group**

A WHO Study Group on the Implications of Individual and Small Group Learning Systems in Medical Education met in Geneva from 23 to 29 November 1971. Opening the meeting on behalf of the Director-General, Dr P. Dorolle, Deputy Director-General, welcomed the participants and representatives of other Organizations. He suggested that the use of new educational facilities and improved teaching methods might help to meet the increasing demand for quantity and quality of personnel for health care, particularly in developing countries. However, many questions would need to be answered before embarking upon such a new venture. Thus, it would be necessary to determine what would be the the implications in respect of the curriculum, the working schedule, the learning space and facilities, the roles of the teacher and student, and the organization of systematically planned courses. Therefore, the tasks of the meeting would be to identify the factors that may help to answer these questions, to indicate those areas in which research is most urgently required, and to suggest ways in which WHO can assist countries in developing planned individual and group learning systems and in disseminating learning materials to those institutions that are most in need of them. As this represents a new field of activity within the overall education and training programmes of WHO, the guidance that the meeting could give would be of particular importance.

### **1. INTRODUCTION**

Individual and small group learning, based on systematically prepared materials, is coming to be used increasingly frequently in medical education and training at all levels, and this report represents an attempt to indicate the practical value of the approach in medical education. While the

report places emphasis on medical education, it is equally applicable to the training of other health personnel, both professional<sup>1</sup> and auxiliary.<sup>2</sup>

The materials employed in this approach to learning are generally subdivided into composite, self-contained units, each designed for well defined teaching and learning goals. Depending on these goals, the materials can be given many forms as shown by the examples below :

(a) tested materials for self-instruction (texts, tape recordings, accompanied by illustrations, etc.)

(b) tested problem-solving exercises

(c) simulators to teach specific skills (models, computer simulation with case histories, etc.)

(d) prepared problems for group discussions and/or role playing

(e) collections of excerpts from papers, etc., accompanied by questions highlighting their relevance.

Such learning materials may be designed to fit into an existing course as self-contained units or they may constitute a significant part of a course. An overall improvement in learning efficiency and effectiveness is achieved by the design of learning units that enable the individual student to work at his own pace according to his educational background, interests, and study habits. The student becomes an active participant in his own education, an important principle for learning. In addition, the range of activities can include working in a team, analysis of problems, synthesis of information, and problem-solving; in this way, the student learns skills of importance to the practice of medicine.

The introduction of planned learning material into the curriculum has aided medical institutions to meet the challenge of serious problems, such as the lack of specialist teachers in a given field, pressure of student numbers, and the explosive increase in curricular material. In addition, it can serve to bring about other significant gains : flexibility of timetabling, more efficient use of space and equipment, better control and knowledge of students' progress, greater adaptability to the individual interests and needs of students, and the development of the habit of self-directed study. These are but a few examples of the gains that can be attained.

<sup>1</sup> "Other professional health personnel" are taken here to include all non-medical members of the health team holding professional qualifications, e.g., in nursing and midwifery, sanitation, dentistry, veterinary health, pharmacy, physiotherapy, statistics, or microbiology.

<sup>2</sup> As noted in an Organizational Study made by the WHO Executive Board, "According to the definition accepted by all United Nations agencies, an auxiliary worker is 'a paid worker in a particular field, with less than full professional qualifications in that field who assists and is supervised by a professional worker'. Thus, there may be auxiliary personnel in medicine, nursing, sanitation, etc. Furthermore, there can be different levels within the broad category of auxiliaries, e.g., in nursing, there are auxiliary nurses, nursing aides, etc." (*Off Rec. Wld Hlth Org.*, 1963, 127, 184)

Experience with many of the applications of planned learning materials is still too limited and the evidence for their value too inconclusive to permit firm guidance or recommendations to be offered. There is, therefore, a clear need for continuing experimentation and research.

It is hoped that the reader will find in this report much that can be of direct help in his work, but it should not be regarded as a practical manual on a systematic approach to education and training. Section 2 aims at giving a balanced survey of the implications of such an approach in relation to the faculty as a whole, the individual teacher, and the student. Timetabling, space, and other requirements have also been considered, and the section ends with a mention of potential difficulties and needs for research. Section 3 is rather more specific and should be studied for its discussion on the various steps of this systematic approach to teaching and learning. Sections 4 and 5 may be of particular interest to those who wish to consider the use of the planned learning material that is already available. Section 6 offers general conclusions and emphasizes the most important of the recommendations in the report, with particular reference to the role of WHO.

## **2. IMPLICATIONS OF THE SYSTEMATIC APPROACH IN THE DESIGN AND IMPLEMENTATION OF COURSES**

In the systematic approach to the planning and implementation of courses (see also section 3.1), the first step is to establish a specification of what the student is expected to be able to do in order to demonstrate that he has learned successfully (specification of learning objectives). This specification is then used to determine the logical sequence of learning steps that will help him to reach these learning objectives. Once this has been done, it is possible to decide how each learning step should be implemented, e.g., through individual learning, group discussion, or laboratory exercises (learning situations). Each of these learning situations can then be planned, giving a specification of the resources (learning materials) to be used, e.g., histological slides and microscopes, texts, films, audiotapes. When the learning materials have been designed, they can be tested on a small number of students to assess their effectiveness in terms of the immediate learning objectives (evaluation), so that improvements can be effected, if necessary, before the materials are offered for wider use. Lastly, evaluation of the entire sequence of learning steps can be undertaken to ensure continuing improvement in teaching, which is used here to mean "offering the student opportunities for learning".

In this section, particular care has been taken to present a balanced survey of both the advantages and the difficulties to be expected when

courses are planned and implemented on the basis of decisions that flow from precise definitions of learning objectives.

Systematically planned courses allow the student to proceed at his own pace and to reach the goals of the course by active participation through his own preferred routes and methods. Such courses lend themselves particularly well to developing an interdisciplinary and integrated approach to learning, which is clearly of great advantage to the study and practice of medicine.

To obtain the full advantage of this approach, however, it is better if the planning and implementation are undertaken at the faculty level rather than by individual departments. Medical school faculties should be aware of the value of a systematic approach to teaching and learning and be willing to develop flexible organizational patterns within the medical school so as to promote interdepartmental interest and cooperation.

It should be the aim of any medical curriculum design to integrate the information from many disciplines and to provide experiences that can develop a full range of important skills and attitudes in the student in an economical manner. The conventional teaching system, often without clearly specified overall teaching objectives and oriented towards departmentalized teaching, makes it difficult to achieve these aims or indeed to know where and how improvements can be made. The use of planned individual and small group learning experiences may aid in the development of a curriculum in which the function of each element can be precisely determined, thus ensuring that all the objectives of the curriculum can be met.

Production of the material entails close cooperation between subject matter specialists and educational experts. Student participation should be secured in the planning, direction, and evaluation of these courses. It has to be recognized that teachers and students will have to play different roles from the traditional ones. The teacher will have to address himself to the individual needs of the student, and the student will be given increased responsibility for acquiring attitudes, knowledge, and competences on his own, and he may even be called upon to assume the role of tutor to other students.

The adoption of specially planned learning materials makes it possible for the content of the course to be made much more explicit than it can be in a conventional system, in terms of subject matter, skills taught, and attitudes that the teacher hopes to develop. Further, systematically planned courses are designed as small self-contained units (modules), which may be revised, altered, or updated as the need arises. Thus, flexibility and adaptability are provided in the planning, and the covert existence of unjustified curriculum content that may have been in the syllabus (e.g., for historical reasons only) is revealed and can be eliminated. In addition, the modular structure of courses can facilitate innovations that may result

from advances in knowledge, new teaching methods, and creative suggestions from staff and students.

## 2.1 Indications for the use of the systematic approach

Planned learning courses are currently employed for a variety of purposes :

- (a) instead of the conventional lecture for the transmission of information;
- (b) to guide in observation-recognition-discrimination exercises;
- (c) to integrate theory and practice in the laboratory;
- (d) to provide problem-solving exercises;
- (e) to provide opportunities for additional study of subjects for which there is no provision in the timetable;
- (f) to assist in revision.

Such courses are employed not only for the teaching of the medical undergraduate but also, to an increasing extent, in postgraduate and continuing medical education. The variety of techniques available for the preparation of a programmed course permits its application in most of the important learning tasks. These range from materials designed for teaching basic information to prepared case studies and role-playing exercises that can assist the student in learning to analyse scientific and clinical problems and in the development of skills of social interaction.

This approach is being applied in a wide range of subject areas in medical education. A preliminary study of questionnaires<sup>1</sup> circulated to faculties of medicine and to student associations indicates that planned course material is used for teaching all the major subjects in the preclinical and clinical parts of the curriculum.

Even in medical schools with apparently adequate conventional teaching, a programmed course for individual and small group learning can enrich the learning environment. Thus, planned learning materials enable students to work in their own time and at their own rate, and to develop and follow their own lines of interest.

The use of individual learning materials can provide a choice in methods of learning. Experience has shown that this variety leads to higher motivation and enhanced achievement by the student, though his optimal method of learning will depend on his own individual characteristics. The use

<sup>1</sup> Questionnaires were sent to deans of some 700 medical schools through the intermediary of the International Task Force on World Health Manpower. At the same time a pilot survey of student opinion was carried out by the International Federation of Medical Student Associations.

of these materials can stimulate the student to become an independent learner by allowing him to evaluate his progress and to supplement his learning where it proves deficient. This stimulus to systematic and self-directed learning will serve him well for the rest of his professional life. Furthermore, learning materials widen the spectrum of learning resources available to the student and allow the development of increased personal contact between staff and students.

Perhaps one of the most important potential advantages will be found where financial and/or personnel difficulties make a higher than usual student/staff ratio inevitable (e.g., in developing countries). Such learning materials may here safeguard the quality of instruction. The system can also help to alleviate staffing difficulties by permitting the use, in some of the teaching responsibilities, of less experienced subject specialists and even of senior students. It can also allow a more efficient use of physical facilities (e.g., laboratories, expensive equipment) and patient resources because it enables students to use these facilities at different periods throughout the day. In addition, it will lead to a saving of time spent by staff on routine lectures.

## **2.2 Implications for the faculty**

The following implications have been observed by faculties that have introduced individual and small group learning into their programme of work :

- (a) the need for greater interaction and for more effective collaboration among members of the faculty in order to structure a comprehensive programme;
- (b) the need to provide facilities for mastering techniques of individual and group teaching and learning;
- (c) acceptance of the principle of student involvement in evaluation and constructive criticism;
- (d) less reliance on the formal lecture as a teaching method, and the need to rethink its role in the course;
- (e) the need to design systematically planned courses and relevant learning, as well as evaluation facilities;
- (f) the need for collaboration with other universities to develop and restructure learning material, and the acceptance of learning material that has been produced by others.

These factors and others, which will be discussed in subsequent sections, require a realistic allocation of adequate financial resources and time.

### 2.3 Effect on work schedules

Individual learning systems are not restricted to the assimilation of factual information; work schedules should be arranged to allow for students to be involved in a variety of different activities at any one time. Some of the implications for the curriculum are readily apparent :

(a) The total amount of time spent on teaching need not increase. However, it is likely that tutorial assistance will be required more frequently. In addition, provision will have to be made for those students who elect to study outside normal working hours.

(b) More staff meetings will be necessary to ensure the coordination of activities. Faculty time scheduling is thus likely to be more complex than in conventional systems.

(c) As the individual student should have greater flexibility in the allocation of his time, for instance through booking specific study facilities, general scheduling will have to be more detailed to ensure optimal use of existing resources.

### 2.4 Effect on learning space and facilities

Requirements for learning space and facilities are affected in several ways by the use of planned learning materials. Individual learning permits more intensive use of existing facilities and resources. In comparison, conventional timetabling frequently results in inefficient use of laboratory space, clinical material, and equipment. Experience has shown that there will be an increased need for flexible learning space, as distinct from the conventional lecture room and laboratory. This will include space suitable for individual learning and small group discussions (for groups of up to 15 students). However, the overall needs for learning space may not be greater than in the conventional system.

It has also been found that some students prefer to use planned learning materials in their own homes, if they are given a choice. This may make it possible to economize in the amount and type of space set aside for individual study at the medical school or postgraduate learning centre.

An increased demand may emerge for one or more of the following materials and associated equipment : multiple copies of selected publications; X-ray photographs, pathological and other specimens; audio-visual materials and equipment, such as slides, short films and audio tapes; models, simulators, and — in more sophisticated settings — computer terminals. Permission may be given to students to take away some of the more portable items for study at a time and place of their own choosing.

In all cases it is reasonable to expect an increased demand for admin-

istrative and technical support, over and above that needed for the preparation or modification of learning materials.

## 2.5 Implications for the teacher

In a system of planned learning the teacher will require to place less emphasis on lecturing than on the production of learning materials for individual study and the guiding of individuals and small groups. A teacher engaged in such a system will usually be a member of a team and he may be called upon to undertake any of the functions described below.

### *(a) During the preparation of a course*

As a subject specialist he may be asked to provide content material for the preparation or modification of the programme. He should have sufficient understanding of this systematic approach to be able to collaborate with other workers who will assist him to specify learning objectives and to design as well as evaluate learning material. He may assist in the design and preparation of audiovisual aids where appropriate. In this task he will receive assistance from a department of medical illustration.

### *(b) During the implementation of a course*

He may be called upon to answer specific content questions arising from small groups or individual students and he will need to give support to problem-solving student groups. As he will be responsible for guiding procedure and student interaction rather than for transmitting expert knowledge (which might frustrate the learning objectives of the group) the teacher should preferably be trained in group dynamics and discussion techniques. He will need to provide counselling to students engaged in individual, independent learning methods. Inefficient study habits and emotional problems may have to be remedied. He should assess student progress; so that he can diagnose learning deficiencies and suggest remedial action. As each teacher will have to collaborate in the design and implementation of the curriculum, he must acquire special knowledge and skills concerned with organization, administration, and planning for change.

In all teaching systems, whether old or new, the teacher will act as a model on which the student's future attitudes and performance will be based.

Thus the teacher combines the functions of a manager, group leader, a consultant, and a counsellor. In the conventional teaching systems the gifted teacher, often more or less unconsciously, combined in his person all or most of the above-mentioned functions. In individual and small group instruction, however, these functions may be largely taken over by a team, which can include : subject content experts; educational specia-

lists; audiovisual specialists; tutors — and possibly senior students — trained in skills of social interaction; student counsellors; and coordinators who are responsible for organization, administration, time schedules, etc.

In a properly planned system, the special talents of individual teachers can thus be exploited to the best advantage.

## 2.6 Implications for the learner

In courses based on planned individual and group learning the student must assume active responsibility for his own learning. He is thus active rather than passive in the process of his education. The main differences from conventional teaching systems are :

(a) The student will be responsible for organizing his own study programme, including time scheduling and selection of individual study units, where necessary with the advice of his teacher. He will also be responsible for assessing his own progress. His motivation directs his efforts towards achieving the learning objectives.

(b) He should be able to assist in defining the aims of the course and in evaluating its outcome. He may also become involved in its construction.

(c) In addition to being an active individual learner, the student will also be an active member of different types of study group. This entails the acquisition of attitudes and skills that will be of the utmost importance for his future work in the health services. Making constructive contributions to the aims of the group, helping his peers, and tutoring his juniors require considerable training in the skills of social interaction. This should result in a change from the competitive attitudes, which are so prevalent in conventional university systems, to attitudes of cooperation with his colleagues. Trained senior students who become members of a department's staff may become group leaders. They will then share responsibilities with the academic and non-academic staff and gain experience in interdisciplinary team work and in tutorial skills.

Within certain limits, the learner is thus able to structure his own work schedule. He is encouraged to pursue his own interests and to work together with his peers. He is constantly aware of the short-term aims of his learning which provide an important motivation for his studies, particularly if he can see that these objectives are *relevant* to his long-term goals.

While this systematic approach calls for the development of an independent attitude, self-criticism, and confidence in his own abilities, not every student will respond to these greater responsibilities in the same way, either in his work as an individual or in his reaction to learning as a member of a group.

## 2.7 Difficulties to be anticipated

A faculty that introduces planned learning methods must anticipate certain difficulties in their implementation. The following are some of the difficulties that have been encountered in practice :

(a) Teachers from a conventional teaching environment need to adjust to the new roles that they will assume in systems of individual and small group learning.

(b) The design and implementation of planned courses, based on specified learning objectives, as well as the preparation and periodical revision of learning material, demand an adequate allocation of staff time. *This is possible only if teaching is accorded academic status and rewards comparable to those of research and clinical practice.*

(c) In the absence of some appreciation of educational principles, teachers find it difficult to make explicit statements of learning objectives and to plan the evaluation of learning material.

(d) Students who have been accustomed to conventional systems may have difficulty in adjusting to the greater freedom and responsibilities of a systematic approach to independent learning.

(e) Initial capital investment will be required for the acquisition of learning materials and associated equipment.

(f) The interchange of materials between centres presents several problems, including acceptability, copyright, and the cost of small-scale publishing.

## 2.8 Needs for research

It will be self-evident that in any innovatory approach there are many aspects that demand special study. Although a great deal of experimental work has already been carried out in other fields and at different levels of education, the emphasis must here be on the need for experience and research in medical education. The Study Group regarded the following as of particular importance :

(a) To investigate the effect of individual characteristics of students in relation to their preference for different modes of learning and to their success in using the preferred modes. This should include a study of the place of individual and team effort in different learning situations.

(b) To explore the problems involved in the assumption of specific roles by the teacher (see section 2.5).

(c) To develop methods that will make the interrelationship between curriculum elements explicit and so facilitate their integration in the curriculum.

(d) To explore the extent to which the student can plan his own programme and to develop ways of assisting him in this process.

(e) To study the problems involved in work scheduling for individual and small group instruction.

(f) To establish the minimum degree of programming required for effective learning in different areas of medical education. This is important for economic reasons, since the degree of programming can vary from simply supplying the student with sets of objectives and with information on resources, to the provision of a tightly structured programme.

(g) To study the cost of the design, production, and implementation of self-instructional materials.

(h) To find the most economical ways and means of designing, duplicating, and distributing materials.

Further areas deemed important for investigation are listed in subsequent sections of this report.

### 3. THE DESIGN, PREPARATION, AND EVALUATION OF LEARNING MATERIALS

#### 3.1 The systematic approach

An important result of research on materials for individual learning has been the realization of the value of a systematic approach to their design and application. This approach will be described in some detail because it has been largely responsible for the success of learning from such materials. In this approach, the first step is a clear statement of the objectives of the learning, that is a description of what the student should be able to do or how he should behave as a result of the knowledge acquired.

Secondly, the constraints, special conditions, difficulties, etc., under which the learning is likely to take place are spelled out. This includes such points as inadequate facilities and staffing problems. With the goals and the setting of the learning clearly defined, a decision is made on the steps and methods through which learning can best take place. Ideas from the fields of educational psychology and audiovisual techniques are taken into account at this stage. The learning materials are then produced, subjected to evaluation, and revised as necessary. They are finally adopted for routine use, but provision is made for their regular

review, taking into account not only their success, but also their continued validity and the relevance of their content and objectives. The success of teaching materials developed in this manner has led to a realization of the potential of this approach for medical education. The first and the last stages—definition of learning objectives and evaluation as an on-going process, intimately linked with learning—seem of particular importance. These and other essential steps of this systematic method are considered below in relation to medical education and training. The various steps may also be represented in graphic form, as shown in the annex (see p. 29).

### 3.2 Specifying learning objectives

#### 3.2.1 *Level at which objectives may be defined*

Objectives may be considered at three different levels, at least :

(a) At the national level : in any one country the objectives of medical education will depend on local needs and local resources available for health care.

(b) At the level of the individual medical school, postgraduate or continuing education centre.

(c) At the level of the single course of instruction or the single learning step within such a course.

In practice, most work on defining objectives still concentrates on the third, least general level.

#### 3.2.2 *Current and potential value of objectives*

##### (a) *Objectives at the level of the course or individual learning unit*

At this level, learning objectives are of direct use to the teacher and the student. For the teacher, they provide the only unequivocal basis for course design, evaluation, and revision. Learning objectives help in the integration of learning units which are to form part of the curriculum and they are essential for the comparison of courses or learning units developed in different teaching centres. Hence, they are prerequisites for the exchange of teaching materials and the resulting improvements in economy and quality of teaching. They will be particularly helpful for junior teachers in the implementation of the curriculum.

For the student, objectives provide motivation for learning, a ready indication of progress in terms of skills and knowledge acquired, and they allow the selection of individual paths through the curriculum. Clearly stated objectives can also save him time that he would otherwise have

to spend on a preliminary inspection of learning materials, especially when these are in forms other than print. Objectives help the student to assume responsibility for his own learning.

*(b) Objectives at the national or institutional level*

While the specification of objectives is at present largely confined to single courses, there is continuous development in this field, and it is possible to consider the definition of objectives of different branches of medical education at the national level as being ultimately an attainable goal. Such a description would allow the provision of medical education at all levels to be continuously matched to the population's needs for medical care. Even the current, tentative approaches to this goal can assist medical schools to design curricula and to incorporate in them sufficient flexibility to accommodate students with different career interests. Indirectly, objectives would assist schools in selecting students and planning the facilities needed for particular courses.

*3.2.3 Some methods of specifying objectives*

A number of methods for defining the objectives of learning exist and several of these have already been applied to medical education. The following are some examples :

*(a)* As a first approximation, objectives may be based on the experience and personal decisions of the individual teacher, in consultation with his immediate colleagues and perhaps with colleagues from other disciplines and centres. The analysis of past examination questions may be a possible starting point as a general summary of the objectives of the course.

*(b)* The assessment of prerequisites for subsequent courses has been used as a means of specifying learning objectives.

*(c)* Learning objectives, particularly for clinical courses, can be derived from an analysis of what the learner will be expected to do in actual practice at a specified stage in his learning career. This analysis will lead to a detailed description of the understanding, knowledge, competences, and attitudes necessary to accomplish these tasks.

*(d)* Analyses of the needs of patients and/or the educational needs of physicians, can lead to the specification of learning objectives for the purposes of continuing medical education.

*3.2.4 Training, research, and development needs*

While the present methods of specifying objectives have led to useful results, much can be done to make the task easier and to ensure that the

resulting sets of objectives are used to greater advantage. Among the most important lines of further work are the following :

(a) Exploring ways and means of involving medical teachers in the development and use of learning objectives.

(b) A search for additional methods of defining learning objectives.

(c) Development of different types and levels of objectives for medical education, illustrated with examples from the field of medicine. It is essential that the terms used should be readily understood by doctors who are not specialists in education.

### 3.3 The preparation of learning materials

#### 3.3.1 *Selecting the method of learning and the medium of presentation*

An idea of the many forms that learning units may take has already been given in section 1. Here it is important to note that the teacher can avoid the premature specification of the materials to be used. If he follows the systematic approach, his decisions will be guided by *what* the materials should teach and *how* they are to support learning. Through its insistence on analysis, this systematic approach has encouraged the evolution of new and valuable ways of teaching. As an indication of the thinking involved, some of the factors considered in the design of learning materials are listed below :

(a) learning objectives;

(b) intellectual and subject matter content;

(c) psychological considerations of learning effectiveness;

(d) need to allow for individual preferences, learning styles, etc. of students;

(e) time and relative effort, as well as cost involved in preparation, duplication, storage, distribution, and use of the learning material;

(f) availability of production facilities;

(g) availability of display equipment;

(h) availability of teachers with the appropriate experience in relation to a specific medium or combination of media;

(i) special properties of individual media.

Although research is needed to establish precisely the properties of media best suited to the attainment of specific types of objective, practical experience indicates that the use of several media is desirable for the achievement of a learning objective.

### 3.3.2 *Team work in production*

The individual teacher (content expert) on his own cannot be expected to carry out all the steps involved in designing and producing learning materials or to deal with the whole subject matter. Consequently the preparation of materials for individual and small group learning is best carried out by a team.

Two quite different types of team need to be considered. The first team might include expert specialists in the various aspects of design and preparation of learning materials. This team can function within the teacher's centre or the teacher may be seconded to another centre where this range of expertise is available.

The second type of team involves a number of subject experts who collaborate from several separate centres to exchange ideas and to produce course materials, which are then available to each of their institutions.

### 3.3.3 *Equipment*

(a) The selection of equipment *must depend on educational needs* and the types of learning material most appropriate for the defined objectives.

(b) Equipment should be as simple as is compatible with the requirements of the learner and with his location, so that the cost in terms of capital outlay and maintenance can be kept to a minimum.

(c) From this it follows that the equipment should be available in simple units, each capable of satisfying specific but limited requirements, rather than as expensive, complex, multipurpose instruments.

### 3.3.4 *Research, development, information, and assistance needs*

While educational psychology and practical experience do provide certain guidelines to the selection of teaching methods and media of presentation, these guidelines are still very imprecise and limited in scope as applied to medical education. Research is needed to produce more precise guidelines, and information on practical experience already gained must be more widely disseminated. Hence the following lines of work are suggested :

(a) Research into the effectiveness of individual teaching methods in helping medical students to attain specific learning objectives.

(b) Research into the relative effectiveness of different methods of presentation of the learning materials (e.g., varieties of audiovisual presentation for the attainment of specific types of learning objectives).

(c) Preparation of a guide to methods of teaching and methods of presentation of learning materials, in relation to the attainment of specific learning objectives in medicine.

(d) Study of factors governing the effectiveness of collaboration between institutions in the production of learning materials.

(e) Encouragement of standardization of equipment to allow for interchangeability of learning materials.

(f) Support for the creation of one or more centres of information on selected, available learning materials and on suitable equipment.

In developing countries especially, support is needed for the training of personnel in the maintenance of equipment.

### 3.4 Evaluation

Evaluation of the educational process is required for 4 main purposes :

- (a) to help the student to assess his progress and guide his learning;
- (b) to enable the teacher to measure his success in terms of student achievement and to assess the realism and appropriateness of the course;
- (c) to provide a basis for revising the course;
- (d) as a guide to the potential usefulness of materials produced at other centres.

Evaluation is not only concerned with measuring educational effectiveness but it should also gather and make available other data on a descriptive basis. These should include :

- (a) relevance of curriculum content and objectives;
- (b) student acceptability;
- (c) adaptability to individual student needs;
- (d) time factors, e.g., learning time, special timetabling requirements;
- (e) logistic factors, e.g., equipment, cost;
- (f) advice to teachers on shortcomings (e.g., unusual terminology), thus enabling them to guide students in the use of the materials;
- (g) a description of how and in what context the materials are to be used.

No absolute standard of excellence can be set for learning materials, but their incorporation into a curriculum should be considered only if this promises some improvement in the existing teaching, for instance in the quality of the teaching provided, through increased flexibility of learning opportunities, or in saving of the teacher's and/or student's time.

The information on the development and use of learning materials gathered through evaluation has specific uses at each of the main stages

in the construction and implementation of courses based on these materials. Hence evaluation needs to be considered in relation to :

- (a) assessing learning materials *before* adoption for routine use;
- (b) assessing materials and testing students *during* a course;
- (c) assessing the *cumulative* effect of the course.

#### 3.4.1 *Assessment of learning materials before adoption for routine use*

Whether the learning units have been evolved within the teacher's own centre or whether they have been acquired from elsewhere, he should assess their suitability before offering them to his students. This assessment should confirm the effectiveness of the materials, or, if necessary, should provide the information needed to decide on their potential usefulness (see list above).

Learning units can be assessed in two complementary ways :

- (a) by testing with students;
- (b) through review by professional colleagues.

While objective evidence of effectiveness can be obtained by testing what students learn from the units, the opinions of colleagues who are expert in the subjects concerned will yield an assessment of the validity of the content of the materials. Such an assessment may also assist the further development or revision of programmes by establishing additional categories of learners for whom such programmes may also be appropriate and under what circumstances they may then be used. For example, some of the learning units may possibly be of use both to medical students and to students of some of the other health professions.

#### 3.4.2 *Assessment of materials and students during a course*

Learning materials must remain dynamic and subject to continual change according to the experience of both students and teachers. The student's learning should be guided by his needs and by his progress. For these reasons, units of learning are preceded and followed by tests.

##### (a) *Use of tests for selecting material for learning*

Usually a pre-test ensures that the student is ready in all respects to benefit from the learning material. When learning units can be offered at different levels, the pre-tests enable the student to select the level at which he can enter the system. This approach can also be used for those students who may require remedial learning units or those students who may wish to go into specific aspects of a subject in greater depth. Thus pre-testing allows the student maximum flexibility in his learning and makes it possible to compensate for variations in educational background.

It should be understood that the same methods of pre-testing can be applied by the teacher when he wishes to guide students in their learning.

*(b) Immediate post-testing*

This provides both teacher and student with the means of keeping a close check on the progress of learning. As a result, the teacher is made immediately aware of any deficiencies in the teaching offered and is able to remedy them. Accurate knowledge of each student's performance also permits him to offer prompt individual assistance, guidance, or encouragement.

The student is similarly able to evaluate his own progress in terms of mastery of successive steps towards the achievement of the learning objectives of the course and to direct his study better (e.g., proceed to the next unit or first remedy a weakness). Control over his own progress often proves a valuable incentive to learning and helps the student to develop the habit of studying on his own initiative and responsibility.

*3.4.3 Assessment of the cumulative effect of a planned course*

At the end of a planned sequence of learning units, testing helps the teacher to assess the degree to which major objectives have been achieved by his students. It enables him to relate the sequence of learning units to preceding, concurrent, and future learning activities and to check the validity of the objectives of the course. This testing, together with information on the students' attitude to the course, is also essential for any revision of the course.

For the student, testing at the end of a sequence of learning units serves many of the purposes discussed under "Immediate post-testing". In addition it enables him to gauge his progress in relation to the standards that are currently part of the accepted qualification or certification requirements.

In assessing the extent to which individual and small group study has brought about improvements in an entire course of learning, a range of factors should be considered in addition to the performance and attitude of the students (cf. above). Some of the factors that will determine the success or need for improvement of this system are set out below :

*(a) Students*

Amount of study time required to reach the stated objectives in comparison with conventional instruction.

Adaptability of learning materials within the course to individual needs.

Effect on subsequent performance with respect to the long-range learning objectives of medical training.

Effect on study habits.

*(b) Teachers*

Time spent on teaching in relation to conventional instruction.  
 Attitude to the innovations introduced.  
 Provision of learning materials where local subject specialists were not available.  
 Effect on the integration of disciplines within the course.

*(c) Administration*

Amelioration of staff/student ratio difficulties.  
 Effectiveness in the use of clinical material.  
 Attitude of patients.  
 Efficiency in use of available space.  
 Cost factors, including capital and recurrent expenditure.

The cumulative assessment of a course of learning can be presented as a "case history". Such histories, embodying practical experience with individual learning materials, constitute a vital part of research into the acceptability of these materials and optional methods of using them.

*3.4.4 Recommendations for action and research on evaluation*

*(a)* Evaluation of learning materials should be encouraged using agreed criteria, which should include effectiveness, student acceptability, study time, and the equipment required.

*(b)* Data should be collected on the cost-effectiveness of programmes.

*(c)* When a learning unit or a series of such units has been evaluated, the appropriate data should be made available to potential users at other centres.

*(d)* The collection, classification, and distribution of test items linked to specific learning objectives should be supported at a regional level.

*(e)* Publication of case histories describing the use of materials for individual and small group learning should be encouraged, especially where the materials have been in use over a period of time. The information to be included in the case histories should be determined in advance, and the institution concerned should be given financial assistance to gather the data required.

*(f)* Centres for the training of teachers of medicine and other health professions in techniques of evaluation should be supported and/or created.

*(g)* Development of valid and economical methods of testing for the attainment of educational objectives other than the acquisition of factual knowledge (e.g., problem solving ability, changes in attitudes).

*(h)* Comparison of the reliability of various methods of measuring the effectiveness of learning materials.

(i) Research leading to the design of valid and practical methods for long-term assessment of courses.

(j) Research leading to the design of valid and practical methods for the assessment of cost benefits.

(k) Investigation of the extent to which institutions or educational systems within developing and developed countries can exchange test materials.

### **3.5 General recommendations concerning the production and use of planned learning materials**

Recommendations relating to the production and use of planned learning materials for individual and small group learning can be classified under three headings : support for operational activities; provision of training; and research. Some of them are especially relevant to the needs of developing countries.

#### *(a) Support for operational activities*

Academic establishments should be encouraged to include teaching activities among the criteria for the appointment and promotion of staff. In addition, it is important to explore various ways and means of raising the academic status of teaching to a level comparable to that of research and clinical practice. The following are examples :

(i) Financial support to enable academic staff to be given sabbatical leave to undertake educational tasks.

(ii) Financial support for medical specialist journals to enable them to carry an increased number of papers concerned with medical education.

(iii) National and international specialist societies might be encouraged to give more attention to medical education, for instance, by including papers on medical education at their meetings.

(iv) Support for existing centres of production of learning materials in order to permit them to make innovations.

(v) Support for the establishment of new centres of production, particularly in the developing countries.

(vi) Support for educational projects designed to provide specialists in training with opportunities for further learning in the specialty of their choice. Such projects could call for the specification of learning objectives in a circumscribed aspect of the subject.

(vii) Part-time appointments specifically for teaching should be offered to members of the clinical staff of teaching centres so that official recognition and time are given to educational of commitments.

(viii) Educational specialists should be offered part or full-time appointments within medical faculties to assist the medical staff in the development and application of learning objectives.

*(b) Provision of training*

Opportunities should be provided for members of the academic staff to acquaint themselves with education theory and practice in order that teaching may become fully recognized as a professional activity. It is also desirable that subject matter specialists and other members of staff concerned with the production of learning materials, particularly from the developing countries, should be seconded to existing centres of learning material production, so that, on return to their own country, they may assist other teachers in developing objectives and planned learning materials.

*(c) Research*

Research is urgently needed on (i) the processes of learning at the level of medical education and (ii) the overall effects of a system of individual and small group learning on staff and students.

#### **4. THE FUTURE OF SYSTEMATICALLY PLANNED COURSES FOR THE EDUCATION OF HEALTH PERSONNEL AT ALL LEVELS**

An adverse staff/student ratio in industrialized countries has been one factor in stimulating the introduction, at undergraduate and post-graduate levels, of planned learning systems using specially prepared materials. Although the main emphasis of this report has been on undergraduate medical education, individual and small group learning systems are just as applicable in the basic training of non-medical members of the health team, and the available evidence suggests that their use is equally valid when the undergraduate phase has been completed.

The staff/student ratio is even more unfavourable in developing countries, so that these learning systems should be at least equally applicable there. Moreover, owing to the explosive demand for more auxiliary personnel and the relatively small number of experienced staff available, the introduction of individual and group learning systems for training such personnel is likely to be of even greater economic and practical value than for the training of professional personnel. However, while there is evidence of the effective use of this system for the education of nurses and other professional health personnel, very little is known so far about its use in the training of auxiliary personnel.

Since students vary in their previous educational background and in their motivations, it is essential that the conditions under which the

system may be applied to best advantage should first be explored. Research in this field is therefore needed. A further question of immediate practical importance is whether the existing learning materials are suitable for use with other health professionals and auxiliary personnel, particularly in developing countries. The mere passive adoption of learning materials from the industrialized countries is not likely to be effective. Developing countries must be selective in the materials that they adopt in order to be sure that they meet the specialized needs of the learner who will later be providing health care for the population among which he will be working. The risk of inappropriate selection will be considerably reduced if both the producer and the consumer clearly define their learning objectives. These should include (a) clear specification of the tasks that the health professionals and auxiliaries should be able to perform as a result of training; (b) identification of the attitudes, knowledge, and skills required for each aspect of their operational responsibilities; (c) a definition of the role of each health professional and auxiliary in relation to the other members of the health team.

In view of the many differences in culture and other factors it is also essential that the consumer should be free to modify and adapt programmed material to local requirements. Within limits, the smaller the module of learning material, the easier and less costly will it be to revise and adapt it to specific learning needs. However, it may prove that learning material in some subject area either cannot be adapted or is not available at all. It will then be necessary to design and prepare learning courses within the country where they are most urgently needed.

Interprofessional training is an interesting recent development, and specially planned material for group learning may here be particularly applicable. Members of the health team should share some common basic knowledge as they should be able to interact with one another in the course of their duties. The provision of appropriate common educational opportunities for the future health professionals and auxiliaries would help them to understand each other's role and thus to break down barriers and enable them to function as an integrated team. There is, therefore, a need for the development of core material for the education of health professional and auxiliary personnel at these basic levels.

## 5. EXCHANGE BETWEEN FACULTIES AND INSTITUTES

The transferability of learning material will depend largely on the compatibility of curriculum learning objectives, requirements of the health services, needs of students, characteristics of institutions, and cultural differences, especially when material is to be transferred between countries.

The following information should be considered in assessing the suitability of learning material produced elsewhere :

(a) objectives of the course or learning material, as well as its place in the curriculum;

(b) pre-entry characteristics of students;

(c) details of use of the materials at their place of origin, including the educational setting of which the particular learning material was a component (whether group discussions, problem-solving assignments, etc., were used in conjunction with the material).

Adaptability of a programme for use at other institutions will in general be greater when the material is made available in small units, each with comparatively limited content and objectives.

Arrangements should be made to ensure wide availability of materials at an acceptable cost. It may well be that distribution can best be facilitated by creating centres from which information on courses is available. Producers would be invited to provide factual data on their programmes. Considerable advantage will result when these centres are able to provide facilities for mutual consultation between producers and potential users.

When partial copyright release is granted by a producing institution, recipients of the materials will be able to undertake changes to adapt the content to their local needs. However, any major change that would alter the character should be discussed with the original producer and the new learning material must be subjected to evaluation.

In addition, arrangements may be made whereby receiving institutions will be able to produce sufficient copies for use with their own students. Safeguards would be incorporated to ensure maintenance of production and the quality and validity of the content. These considerations and the problem of copyright will clearly require further investigation.

If the recipient is prepared to report the results of any evaluation of the programme, this feedback may lead to further improvement of the materials.

## 6. CONCLUSIONS AND RECOMMENDATIONS

On the basis of the available evidence, the Group considered that the wider introduction of individual and small group learning systems for the education of the health team should receive the full support of WHO. It recognized that there have been notable achievements in this field in terms of design, production, and distribution of learning materials and in the provision of clearinghouse activities by other international and national agencies and institutions. It considered, however, that

there is an urgent need for coordination of effort and recommended that WHO should undertake this important role.

Attention has been focused throughout the report on the need for basic and operational research on many aspects of the systematic approach to teaching and learning. Two important prerequisites for the effective application of these innovations are the training of the teachers in educational methods and the use of all possible means of encouraging teachers to devote time to the preparation of learning material. The Group welcomed WHO's initiative in establishing regional and national centres to help carry out its long-term teacher training programme. It considered that these centres could also play a vital role in undertaking some of the much needed research. The following are the main recommendations of the Group for possible implementation by WHO :

(1) The problems involved in the production of effective learning materials at low cost and in ensuring the transferability of such materials between institutions and countries should be given urgent attention, including active support for subject specialists who are willing to assist in the design and preparation of such learning materials.

(2) A service should be established to provide information on resources and methods and to coordinate research, evaluation, and distribution of learning materials for the education of the health team.

(3) In view of the widespread and increasing need for effective training of auxiliaries in the health field in developing countries, urgent attention should be given to the production and trial of low cost and transferable learning materials for this category.

(4) Since the successful implementation of the whole programme hinges on the training of health staff in the design, evaluation, and effective use of individual and small group learning materials, WHO should promote and support suitable training activities, such as seminars, workshops, and the exchange of personnel.

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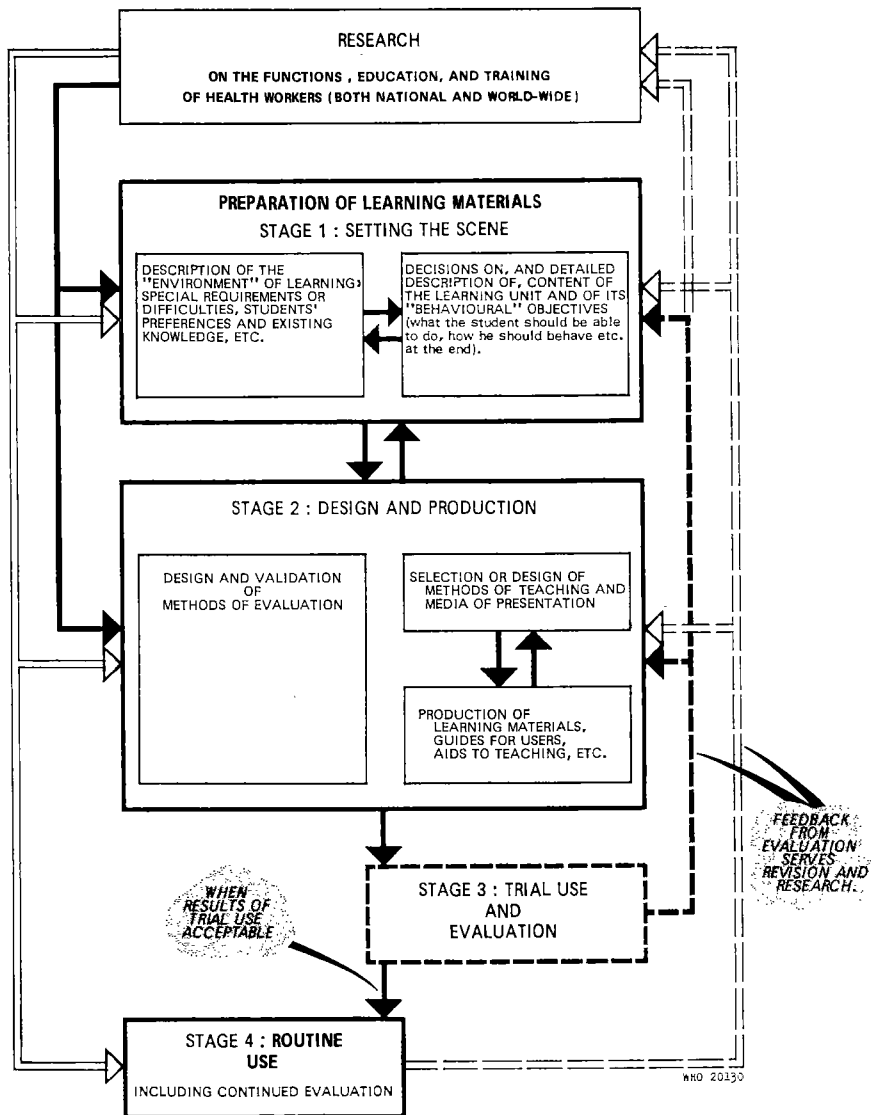
#### ACKNOWLEDGEMENT

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Annex

**GRAPHIC REPRESENTATION OF THE SYSTEMATIC APPROACH TO THE DESIGN AND USE OF MATERIALS FOR LEARNING**



Dependence  $\rightarrow$  In the short term  $\rightarrow$  Dependence  $\rightarrow$  In the long term

Feedback  $\dashrightarrow$  Feedback  $\dashrightarrow$

Note that some tasks and stages are interdependent