Introduction

The systems approach to the design and analysis of teaching/learning situations is the basis of the great majority of modern educational technology-related developments. However, the terms system and systems approach are themselves jargon terms that can have a variety of interpretations. Let us therefore take a look at these terms in order to define the way in which we are to use them.

In general systems theory, a system is any collection of interrelated parts that together constitute a larger whole. These component parts, or elements of the system are intimately linked with one another, either directly or indirectly, and any change in one or more elements may affect the overall performance of the system, either beneficially or adversely. A simple system is illustrated schematically in Figure 1.
In Figure 1, the system consists of four distinct elements A, B, C, D, which are related to or dependent upon each other as indicated. Note that some interrelationships may be two-way, while others may be one-way only. These elements may themselves be capable of further breakdown into other smaller components, and may thus be regarded as sub-systems of the overall system.

The processes of teaching and learning can be considered to be very complex systems indeed. The input to a given teaching/learning system consists of people, resources and information, and the output consists of people whose performance or ideas have (it is to be hoped) improved in some desired way. A schematic representation of systems of this type is shown in Figure 2.

Figure 2. The 'systems' model of the educational process

In such a system, the teaching/learning process may be so complex that it can only be considered as a 'black box' whose mechanisms are not fully understood. However, research into the nature of the learning process has thrown some light on what happens inside the 'black box'. This has enabled educational technologists to structure the input to systems of this type in such a way as to try to improve the output through increasing the efficiency and effectiveness of the learning process, thus leading to a systems approach to course and curriculum design based on current knowledge of how people learn. Such a systems approach attempts to mould the input to a course in
such a way as to enable the optimal assimilation of knowledge and skills to take place during the learning process, and hence maximize the quality of the output.

A basic system that can be used in the design and development of virtually all types of teaching/learning situations is shown in Figure 3. A number of writers have presented much more sophisticated systems, but these are considered to be unnecessarily complicated for our present purposes.

![Figure 3. A simplified systems approach to course and curriculum design](image)

**The various stages in the systems approach**

Let us now take a more detailed look at the various elements of the basic system shown in Figure 3.
(a) **Consider target population characteristics and topic area**

The range of backgrounds, interests, knowledge, attitudes and skills of students coming on to the course will have a strong influence on course design. Preknowledge and any common misconceptions will have to be catered for in the design of the course (these may, for example, affect sequence, structure and support mechanisms). The broad thrust of the course content will also have to be considered. Consideration will be given to the sort of people which the course is trying to develop. The subject area may have traditional aims and directions, but one may wish to consider the justification of these and/or preparation for future change.

(b) **Estimate relevant existing skills and knowledge of learners**

There may be minimum standards of entry to the course, but this will not always be so. For example, the increasing numbers of non-standard and mature student entrants to higher education will not necessarily have conventional paper qualifications, but may possess skills and qualities which will have an influence on course design. This may have implications for teaching methods, bridging courses, support systems etc.

(c) **Formulate objectives/learning outcomes**

The objectives and learning outcomes of the course or curriculum element will attempt to encapsulate the new skills, knowledge or attitudes which it is intended that the students will acquire. They may be formulated by the learners themselves, by teaching staff, by a validating, examining or professional body, or by some combination of these and other sources.

(d) **Select appropriate instructional methods**

Having specified the objectives and learning outcomes (ie, what we are trying to achieve in the course), we should be in a better position to select appropriate teaching/learning methods through which these have a reasonable chance of being achieved. There are far more teaching methods available to choose from than most people realize. The process of attempting to match appropriate methods to given objectives and learning outcomes is normally done on the basis of a combination of research and experience.
(e) **Operate course or curriculum**

The next element in the system is the actual implementation of the course. This involves all the logistical arrangements associated with running the course, including overall structuring, pacing, implementing the chosen teaching strategies, using appropriate supportive media and materials, and ensuring that all aspects of the course run as smoothly as possible.

(f) **Assess and evaluate**

The combined result of the preceding stages is that students are involved in a learning experience that is planned to develop their knowledge, skills and attitudes, taking into account the individual needs and experience of the learners. Just how effective the pre-planning and subsequent operation has been can be measured by studying student performance in continuing and/or post-course assessments. These assessments should be closely related to the specified course objectives and learning outcomes. Poorly-achieved objectives or learning outcomes should lead the course designers to examine the entire system in order to identify places where improvements might be made. This could involve a change in the objectives/learning outcomes, a revised assessment of students' pre-knowledge, a critical review of the instructional methods used, an examination of the course structure and organization, a consideration of the assessment methods used, or a combination of some or all of these. These deliberations, together with feedback on the course from staff, students, employers, etc, can be used in an evaluation of the entire concept of the course, which should, in turn, form the basis of an on-going cyclical course development process.

**Using the systems approach in practice**

The systems approach to course and curriculum design is no more than an attempt to use a process of logical development and on-going monitoring and evaluation in order to allow continuous evaluation of the course or curriculum to take place. As indicated in the previous section, much more complicated systems approaches to course design do exist, but all of these contain the six core elements shown in Figure 3.

It is, however, worth adding some cautionary remarks about using the systems approach in practice. Although the approach is useful in mapping out the broad flow of
factors to be considered and developed, diagrams such as the system shown in Figure 3 always oversimplify the actual process. For example, Figure 3 has ordered the elements of the system in what is usually the most productive sequence for the initial planning of a course. If, however, we are re-designing a course or trying to build on a teaching/learning scheme already in place, we may enter the system in a different way - through evaluation perhaps, or through an ad hoc or unavoidable alteration to the implementation of the course (e.g. a change in the mode of delivery from full-time to part-time).

In implementing the systems approach, it is important to appreciate that, while the decisions taken at each stage are always affected by earlier decisions, they may themselves necessitate some of these earlier decisions being changed. It is also important to realize that the stages shown are not the only ones possible, and that, once taken, a decision can always be reconsidered. The approach should thus be dynamic, always allowing for second thoughts and the refinement of ideas. For example, although you should certainly make a first attempt to define objectives and learning outcomes very early in the planning, you will invariably need to come back to re-define or add to them once you have worked through some of the later steps.

Two further misconceptions need to be avoided. First, the separateness of the boxes in Figure 3 may suggest that the processes covered by them are also clearly separable. Second, you may be tempted to assume that they can all be considered at leisure, away from the actual hurly-burly of the teaching/learning situation. Neither of these assumptions is necessarily true. While primarily addressing one step, you will almost inevitably have several of the others partly on your mind at the same time. Similarly, while you can sometimes enjoy the luxury of 'armchair curriculum planning', much of the decision-making must take place 'on the hoof', with students, administrators and other academic staff breathing down your neck!

The systems approach can be used at any time when a episode of teaching/learning of any length is being planned. It can be applied to long-term planning for a whole course lasting weeks, months or years, through to daily lesson planning, or even to on-the-spot planning for a learning experience of only a few seconds' duration. It can be applied by a group of teachers designing or adapting a complete course, as
well as by an individual teacher preparing his or her specific course input. The approach can also be used for analyzing a previous teaching/learning experience.

The systems approach does not prescribe or promote any particular teaching methodology (e.g. individualized study or group learning). Rather, it is a vehicle that helps teachers to think more systematically and logically about the objectives relevant to their students and the means of achieving and assessing these. On occasion, analysis may suggest that 'chalk and talk' may be the most appropriate method for achieving some objectives, but no one method will be appropriate for all objectives or for all students. Later booklets will provide detailed guidance on how such analysis can be carried out, thus enabling you to make effective use of the systems approach in planning your work as a teacher.

**Further Reading**