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ABSTRACT

For a student to acquire the conceptual systems of a discipline, the designer must reflect that structure or analytic network in his curriculum. The four networks identified for music and used in the development of the Southwest Regional Laboratory (SWRL) Music Program are the variable-value, the whole-part, the process-stage, and the class-member networks. Content analysis and task analysis are two aspects of curriculum design in which analytic networks have figured importantly. Task analysis in curriculum development can be defined on three levels, analytic, systemic, and particular. Task levels can be coordinated with the networks as the examples from the variable-value network indicate. Systemic tasks were generated through the network/task analysis procedure to produce the content of the SWRL Program. As a bonus, evaluation is simplified by the existence of these predetermined tasks. Other advantages include placing a premium on the subject matter competence of the curriculum designer and on the integration of the processes of the discipline rather than their superimposition. (JH)

ANALYTIC NETWORKS IN MUSIC TASK DEFINITION[1]

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It is assumed that any subject-matter discipline is structured in the form of specialized but interrelated conceptual systems. The task of the learner is to acquire certain of these systems. The task of the curriculum designer is to design instruction such that it clearly reflects the structure of the systems while optimizing the probability that the learner will acquire them.

Smith has addressed himself to a study of these systems. He has identified and described five of them and labels them "analytic networks" (1972). Subsequently, Smith and others have invested considerable effort in using the networks for in-depth analysis of the disciplines of science, art, and music. This paper deals primarily with their use in certain aspects of the design of the SWRL Music Program.

ANALYTIC NETWORKS AND MUSIC

Prior to making full use of analytic networks in the design of the SWRL Music Program, it was necessary to ask two questions. The first had to do with whether or not the networks accurately reflect the structure of the discipline. An inquiry into the nature of music led us to an affirmative answer. Four networks were examined (Piper, et al., 1973a). They are the variable-value network, the whole-part network, the process-stage network, and the class-member network. Their relevance for describing the structure of music is illustrated below.

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- Variable-value network. A musical tone may be analyzed in terms of values on certain variables which define sensory properties: pitch, duration, loudness, and tone color. Other variables and values can be used to define more complex elements.
- Whole-part network. A composition may be analyzed as a whole and also as a set of parts or sub-structures. The interrelation of parts and their relation to the whole help to define one aspect of the formal properties of a composition.
- Process-stage network. A composition may be analyzed in terms of its activity as a dynamic thing, moving toward its goals, both temporary and final. This dynamic process helps to define another aspect of the formal properties of a composition.
- Class-member network. A composition may be analyzed for class membership in terms of the degree to which it exhibits characteristics common to a given class of compositions.

The second question had to do with whether or not the networks would be useful in the design of instruction. Extensive inquiry led to an affirmative answer. Analytic networks have figured importantly in two types of analysis prerequisite to the specification of outcomes for the SWRL Music Program, that is, content analysis and task analysis. Since one paper in this set has dealt with content analysis (Greer, 1974), I will limit myself to a description of work done in task analysis.

ANALYTIC NETWORKS AND MUSIC TASK ANALYSIS

Definitions

The first term needing definition is "task." As used here, a task is a statement about a required behavior and the conditions under which the behavior occurs. The part of the statement which treats the conditions is called the input. The part of the statement which treats the required behavior itself is called the output. Input is what is given in the learner's environment. Output is the behavior required of the learner in the context of what is given. Thus we speak of a task frame: input/output.

The second term requiring definition is "task analysis." Task analysis as described here is to be distinguished from empirical methods using observation, interview, or simulation. It is also to be distinguished from the kind of analysis used and recommended by Gagne. By task analysis we mean the process of combining and recombining analytic concepts in all possible input and output combinations, examining each resulting task for its validity with respect to a particular discipline.

Analytic Networks and Task Levels

Smith defines three task levels corresponding to the levels of conceptual content defined within analytic networks: the analytic level, the systemic level, and the particular level. These levels and their relations are illustrated for the variable-value network in Figure 1. A similar figure could be drawn for each network.

	ANALYTIC LEVEL	SYSTEMIC LEVEL	PARTICULAR LEVEL
CONCEPTS	element variable name value	a tone pitch a', b', c', etc.	a particular tone pitch a'
TASKS	Given: an element and a variable name Required: value on the given variable for the given element	Given: a tone and the variable name "pitch" Required: the pitch name for the tone	Given: the tone a' and the name "pitch" Required: "a'"

Figure 1: An illustration of relations between levels of content for concepts and tasks. Only three of the analytic concepts for the variable-value network are listed. Only one of the many possible tasks is illustrated. Similar relations can be illustrated for complex elements such as entire musical compositions.

Analytic level tasks. Analytic tasks are statements in which input and output are stated in terms of analytic concepts. An example of an analytic task is:

Input: element, variable name
Output: value

In this example, conceptual content has been supplied using analytic concepts from the variable-value network. Content could have been supplied using any of the networks defined earlier.

Tasks stated at the analytic level are extremely general. From the standpoint of specific subject matter disciplines, they are content-free. The example given above can apply equally well to any discipline in which conceptual structures take the form described by the variable-value analytic network.

Systemic level tasks. A task described in terms of analytic concepts may be transformed into a systemic task by substituting systemic concepts

for analytic concepts. The result of such a transformation is a task which is bound by specific subject matter content and is hence a step lower on the scale of abstraction.

The transformation of the analytic task given above into a systemic task will be illustrated in terms of music. First we must have music concepts corresponding to the analytic concepts given. For the analytic concept "element" we may substitute the simplest entity with which the musician deals, that is, a musical tone. For the analytic concept "variable" we substitute the names or characteristics in terms of which tones are defined: pitch, duration, tone color, dynamic level. Values for pitch can be defined in terms of letter names, values for duration in terms of number of beats per tone, values for tone color in terms of instrument identification and values for dynamic level in terms of standard Italian symbols. This transformation can be summarized as follows:

Analytic level concepts	Systemic level concepts (music)
element	a tone
variable name	pitch duration tone color dynamic level
value	pitch = A, B, C, ... duration = 𝅝, 𝅗𝅥, ♩, ... tone color = violin, viola, ... dynamic level = piano, forte, ...

With this transformation we are prepared to write a task at the systemic level.

For the concept "element" we shall substitute "a tone." For the concept "variable name" we select "pitch." With this the analytic task

illustrated above is transformed into:

Input: a tone and the variable name "pitch"
Output: values for the tone on the variable "pitch"

This, of course, is not the only task that could have been written using the given analytic task. In fact, the number of tasks that could have been written is the sum of all possible combinations of systemic concepts taken singly and in groups. This number may be increased by the number of analytic tasks that can be stated using all possible combinations of analytic conepts from all four analytic networks.

Particular level tasks. Systemic tasks are transformed into particular tasks by substituting particular content for systemic content. In the case of the systemic task stated above, "a tone" may be interpreted as an a'. The requirement on the learner is to give the pitch name of the given tone.

"Listen to this tone." (Play "a'") "Tell me its pitch."

Task Analysis in the SWRL Music Program

In the design stage of the SWRL Music Program, the task analytic procedures described above were used to generate a very large population of systemic level tasks. Each resulting task was analyzed by five musicians in terms of its musicality. The criterion used for judging musicality was whether or not the task could be considered important in the performance of one of the following musicianly roles: performance, criticism, or composition. The end product of the judging process was a large population of tasks from which we selected the sample included in the program (Piper, et al., 1973b).

From Task Analysis to Evaluation

One requirement of a good evaluation program is that it be content valid. This means that it should cover what is taught. A minimum strategy for accomplishing this is to key evaluation items to outcomes such that there is an identity relationship between what is intentionally taught and what is evaluated. An optimal strategy would include, additionally, some evaluation items covering incidental learning or strategy generalization.

If the minimum requirement of a content valid test is to have at least one test item corresponding to each outcome, the analytic approach described here accomplishes this. One simply takes an outcome as defined above and adds (1) a description of the environmental conditions, (2) the eliciting instructions, and (3) the criterion level for judging acceptable performance. A test item corresponding to the outcome stated above might read like this: "I am going to play ten tones on the piano. I will pause after each one. You tell me the pitch. You should name eight out of ten correctly."

ADVANTAGES OF THE APPROACH

There are a number of advantages in the use of analytic networks for specification of conceptual content and tasks.

The Discipline

Instruction is based on the structure of the discipline as it is exhibited by the discipline expert. This is true both for conceptual content and for tasks. It puts a premium on the subject matter competence of the persons involved in the design of instruction.

Relation of Process and Content

In the use of analytic networks, process is not something superimposed on the content but is rather an aspect of the very conventions which are used to define the content. Content is functional. Smith describes it this way, "Concepts are not static constituents which an individual merely possesses; they are functioning structures with functional consequences in behavior. In this sense processes are implied by the phrase 'mastery of the concept'" (1972, p. 6).

Operational Outcomes

There is currently much emphasis on the need for accountability based on operationally defined outcomes. The system outlined above allows simple conversion of tasks to operational outcomes.

Clarification of Terms

In educational literature the terms "task," "outcomes," "skill," and "item" are seldom defined unambiguously. In the system described here this is done.

Transfer

Ellis has said that the topic of transfer may be the most important topic in the psychology of learning (1965, p. 5). The topic is given explicit treatment by Smith. Two aspects of transfer are given attention, vertical transfer and lateral transfer. Vertical transfer refers to the effect that the learning of one task has upon the learning of a different task higher in the learning hierarchy. This is defined largely in terms of the underlying skill components which the two tasks have in common.

Lateral transfer refers to the effect that learning one task has upon learning the same task with different but parallel content. This aspect of transfer is referred to in the literature as "learning to learn." The general relations among analytic networks, skills analysis, and transfer are discussed in detail in another paper in this set (Bessemer, 1974).

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