Task Analysis: The Processing Dimension

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TASK ANALYSIS is a skill which can be acquired by any teacher and which can be applied to a wide array of instructional problems. The ability to analyze tasks allows the teacher to look for trends in a student's task performance, and to modify task components during an instructional session, thus giving the teacher some of the "flexibility" that we are so often told is needed. This ability further allows the teacher to design tasks with specific components to match student readiness at any given time.

I view task analysis through the dimension of *cognition*, *process*, and *affect*. Figure 1 illustrates the relationship between cognition and process. In another article I have described the cognitive dimension, moving from the perceptual level, up through coding, to the highest cognitive level, that of concept formation.[1] To my knowledge nothing has been written that relates affective functioning directly to task analysis. This dimension would most likely incorporate such topics as motivation and interest, as well as good mental health practices in general.

This article will attempt to explain my ideas about the *processing* dimension of task analysis. By *processing* I mean the operations through which an individual receives, organizes, and

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transmits information. Any task is composed of three major sets of processing demands:

- INPUT: The student must be able to receive and organize the directions and materials presented to him.
- ASSOCIATION: The student must be able to switch input information into output modes.
- OUTPUT: The student must be able to make the response he has chosen.

Figure 1

The Cognitive and Processing Dimensions of Task Analysis

		COGNITIVE		
		Perceptual	Coding	Conceptual
PROCESSING	Input			
	Association			
	Output			

Output

I will discuss *output* first, because regardless of the nature of the learner's problem it is manifested in his output. There are only a limited number of ways in which we can make responses, and they are summarized in Figure 2.

Figure 2

Output Modes

	Verbal	Nonverbal
Vocal		
Motor		

When we say words, phrases, sentences, or numbers we are broadcasting vocal/verbal output. When we hum a tune or imitate a bird call, we are broadcasting vocal/nonverbal output. Motor/verbal output takes the form of responses that are written in words, phrases, sentences, or numbers. Motor/nonverbal output is any other body response, such as pointing to or underlining the correct answer, pantomiming the answer, raising a hand when the correct answer is seen or heard, or drawing a picture.

Once we have described the output demands of a task it only remains to be seen if the student can deliver an acceptable response within the called-for output format. If he can, all is well. If he cannot, then we want to learn as quickly as possible whether his problem is merely one of being unable to provide the answer in the output format called for, which would truly be an output problem, or whether the problem lies in associational or input areas, or in some combination of these.

Let's take for example an activity where the teacher tells the student to look at the globe and tell the class the latitude and longitude of Savannah, Georgia. The output demand of this task is clearly vocal/verbal. Now suppose the student is unable to give an acceptable response. The teacher then tells him to go to the board and write the coordinates. This the student does successfully. The teacher has switched the output demands of the task, while leaving the cognitive aspect of the task unchanged, and the student has responded successfully. The obverse of this is the student who, when told (but not shown) to write a set of map coordinates and find them on the globe, cannot write them correctly, but can repeat them accurately and can go to the globe, plot them, and tell what he finds at their intersection. In each case the teacher discovered that the students understand the input and are able to arrive at correct solutions, but are unable to respond within the originally prescribed output format. In each case it is entirely possible that the students have difficulties in forming motor plans—in the case of the first student for saying a complex response, and in the case of the second for writing a complex response.

It is also quite possible that what appear as output problems really have a different cause, which I intend to discuss later.

Input

Input is described in terms of the verbal or nonverbal nature of the incoming stimulus sets, in combination with the sensory modalities which must receive and organize them. Input parameters can be described within the matrix contained in Figure 3.

Figure 3

Input Modes

	Verbal	Nonverbal
Auditory		
Visual		
Tactual		
Kinesthetic		

In presenting this matrix before groups and to my colleagues, the only cell they have questioned me about is tactual/verbal. I would consider a Braille character an example of this. Once in a while a task has an olfactory or gustatory input component, but I won't bother to list them as matrix rows. We can just assume they are there if needed.

The directions to most tasks for young school children and for students with learning problems contain procedures which are auditory/verbal. To concentrate on the actual essence of a task when looking at its input demands, however, I usually begin my analysis at the point where the child understands what it is he is supposed to do. Take, for example, a visual discrimination task where the child is given a line of geometric shapes on a sheet of paper, and the teacher says, "See this one? Now look over here and find one just like it and make a line under it." I would describe the input as visual/nonverbal. Obviously the teacher's directions were auditory/verbal, but I would ignore this in my initial analysis in order to concentrate on the actual substance of the activity.

Let's take another task. The teacher presents a row of pictures and says, "When I say the name of a letter, I want you to point to a picture that begins with that letter." I would not include these instructions in my analysis of the input, but would begin when she actually presents the task itself—that is, when she says "b," (auditory/verbal), and gives the child the pictures to inspect.

In the task I described earlier, where students were working with a globe, the teacher's directions were within the substance of the task, so I included everything in my input analysis: teacher's directions (auditory/verbal), the globe (visual/nonverbal), and the characters on the globe (visual/verbal). There is, admittedly,

a gray area here between procedural and substantive directions, but it is not a critical one because task analysis is not an end in itself which must remain at all times absolute: it is rather a means to understanding what we are asking a child to do.

An obvious question is: How can I justify ignoring the teacher's procedural directions? What if the child has an auditory handicap? My reasoning is that the common denominator *auditory/verbal input*, which runs through the directions to so many tasks, is so general as to be unhelpful. Whether the child's auditory problem is severe or subtle, we must learn about the *types* of auditory components that are giving him the most trouble.

My method gives us a way of checking this out. After giving him an array of tasks, we can take a close look at the ones he failed and look for common characteristics among their input components. They would all have in common the teacher's auditory/verbal directions, so that would be of no help. If the substantive input of the failed tasks included auditory/verbal material, then that would be another matter: at the very least it would give me a quickly testable hunch about a possible source of difficulty.

This hunch could lead me in two possible directions. I could ask for a formal appraisal of his auditory capabilities or—and to me this is the better direction—I could restructure the failed tasks by modifying or reducing the auditory/verbal input components to see how well he could perform the task without these demands being made on him.

Let us take, for example, the task where the teacher said, "When I say the name of a letter, I want you to point to a picture that begins with that letter." The goal of such a task is to help build sound/symbol relationships. Cognitively speaking, it is a coding task. The child must inspect the pictures, say each one to himself, and revisualize the initial letter of each pictured object in order to pick out the one that begins with the letter presented by the teacher. If a child had difficulty with this task I would immediately switch input modes from auditory/verbal to visual/verbal; in other words, I would show him the letter on the board or on a card. This does not change the cognitive aspect of the task; it merely changes input pathways.

If a student had difficulty with dictation assignments—for example, if the teacher describes a math problem to the class and tells them to take notes and then solve the problem—one of the very first things I'd do would be to present him with the problem in writing, to see if changing input modes would help him. If this

type of move checked out, I'd pass the word along to his regular teacher and suggest that for activities where writing from dictation is a procedural part of the task (and not an end in itself, as a spelling test), she ought to give the student the material in visual form, or to give the child next to him an extra piece of paper and a sheet of carbon paper to make a quick copy for him.

In connection with these types of moves I am often asked whether it is preferable to bypass the handicap as I've just described, or to attempt to remediate it. My answer is that first we've got to discover what the handicapping condition is, and looking at input/output components can often give us some very real clues. Once we have tried switching these processing components, without changing the cognitive nature of the task, and have had a hunch reinforced by the student's increased ability to make acceptable responses, then we can face the question squarely, and make a decision based on the amount of time available for working with him, and the amount of help that must be given his regular teacher. The task analysis technique I am describing here is a means of helping educators to assemble the information needed to make such decisions.

Association

We can describe input with precision because these are the things we give children to look at and listen to. We can do the same with output because these are the responses children make. We cannot see *association*. That is an internal process, and it can only be inferred by looking at input and output demands over a wide range of failed tasks.

There are two major types of associative demands. One is that of changing input stimulus energy, usually auditory or visual, into vocal or motor output energy. Doris Johnson and Helmer Myklebust have borrowed the term *transducing* from the science of physics to describe this type of energy transformation.[2] The other demand is that of retrieving from storage either a visual impression of what was just heard, or an auditory impression of what was just seen. These last two abilities are referred to as *revisualization* and *reauditorization*. When we ask a child to spell a word or draw a map of his bedroom we are asking him to revisualize. When we ask him to "sound out" a word or to tell us what he is looking at we are asking him to *reauditorize*.

Let's look again at the globe activity I described earlier. It was presented as an output problem because each student knew what he wanted to say or write but was unable to perform the motor movements necessary to do so. Let's assume that the

teacher gave the first student (the one who couldn't say his answer) a wide variety of complex statements to repeat and that the student was successful in repeating them (input: auditory/verbal; output: vocal/verbal). We would then give much less credence to the original output hypothesis because the student showed that he does have the ability to plan and carry out a motor speech pattern. There is no apparent problem either with input or output. There is no apparent problem in transducing incoming auditory energy into outgoing vocal energy. We are left then with a strong hunch that the problem may be one of *reauditorization* because although he can find, point to, and write the globe coordinates, he cannot say them. If this type of performance emerged as a trend over a variety of tasks then the hunch would be confirmed strongly enough to allow the teacher to generate some instructional alternatives. The most obvious one would be to bypass the problem by avoiding this type of processing demand altogether. If a decision is made instead to remediate, the teacher could provide clues to help the student reauditorize material that is presented visually. One move in this direction could be to present the original task in multiple-choice form: "Are they 32N81W, 44N90W, or 62N90W?" In other words, the reauditorizing demand could be changed from one of total recall to one of recognition.

For another example, let's go back to the child who had trouble with tasks involving writing from dictation. If experience shows that he can copy sentences accurately, we can rule out input and output deficiencies, as well as associational deficiencies of the transductional type. A strong hypothesis here would center around his ability to revisualize. Word could be passed along to his regular teacher to give him as many visual clues as possible. Perhaps a list of commonly used words could be taped to a corner of his desk. He might benefit from visual closure tasks, where he is given almost but not quite all of the visual information, and is required to tell what the picture or word is. Children with this problem benefit from multiple-answer tasks where they have a chance to recognize the right answer rather than being forced to revisualize it from scratch. The specialist and the classroom teacher might jointly plan a series of activities for this child that would lead from recognition to revisualization by gradually decreasing the visual clues present in the material. Remember now, this child as I've described him has neither an input nor an output problem. He has an associational problem wherein he has difficulty in retrieving visual impressions of words he hears. He should be given many opportunities to practice visual clo-

sure, just as you are doing when you read this page. Chances are that you didn't spend much time on the second syllable of the word *closure* in the preceding sentence. You got enough information from the *clo-* so that you could pretty well predict what the remainder of the word would be. You were able to perform closure quickly—that is, to revisualize the whole word from the partial information contained in its first syllable.

The Teacher's Directions

As I've said, associational problems can only be inferred by observing performance over a wide array of tasks. This makes it imperative that the teacher be aware of exactly what the student is being told to do, and observe accurately what the student actually does. I've said that I begin my analysis of a task at the point where the teacher has finished giving the procedural directions and is now presenting the actual input content. This does not mean that I ignore the initial directions. I pay close attention to them to see if she can subsequently relate what the children *do* to what she *told* them to do. I once observed a teacher presenting a language lesson to four third-grade children with learning problems. Her directions were something like, "I'm going to say some words. Each time you hear the name of a vegetable I want you to raise your hands." The analysis of such a task is fairly straightforward—input: auditory/verbal; association: revisualization; output: motor/nonverbal. The cognitive demands of the task were at a conceptual level. She went through her list of words and seemed pleased that the children raised their hands at the right time. What she didn't seem to be aware of was that they never raised their hands simultaneously, but did so in a staggered order. It's quite possible that three of them were taking their cues from the fourth. The teacher assumed that the task's input was auditory/verbal, but for three of the children it could easily have been visual/nonverbal (seeing the fourth boy raise his hand). They could have been functioning at a perceptual, rather than a conceptual, level. How easy it would have been to seat the children with their backs to each other for this particular lesson!

In summary, the ability to analyze the informational processing demands of tasks we present to students allows us to systematically detect trends of weakness or strength in their abilities to meet our demands. The rapid acquisition of this type of information then allows us to generate alternative approaches to instructional problems.

NOTES

1. John Junkala, "Task Analysis and Instructional Alternatives," *Academic Therapy*, Vol. VIII, 1 (Fall 1972), 33.
2. Doris J. Johnson and Helmer R. Myklebust, *Learning Disabilities: Educational Principles and Practices* (New York: Grune & Stratton, 1967), 28.

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Life is a bet, like a gambler's
bet his money on games.
Life is the way you make it,
as an artist creates a picture.
Life is doing what makes sense,
not what someone tells you.
Life can be hard, doing things you
do not like to; hard as a rock.
Life can be soft, easy off and
sleeping, like a soft kitten.
On the road of life walk straight,
like a tightrope walker making
sure he does not fall.

David Levin
9th Grade
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