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Wholes and Parts in Teaching

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Teachers are utterly dependent on their pupils for success. No matter how knowledgeable and skillful a teacher may be, he can impart knowledge to a pupil only if the pupil cooperates. Knowledge is produced by the knower's private, free, and active exercise of intelligence: knowledge cannot be delivered in finished form by someone else. The phrase "learning by discovery" is redundant, because learning comes only through discovery. Plato, St. Augustine, and St. Thomas Aquinas demonstrated the use of this principle in teaching adults knowledge of absolutes. Here we are more concerned with the use of this principle in teaching children ordinary understandings, skills, and attitudes. Most teachers may agree that they need their pupils' active cooperation. Yet, certain teaching methods that are now gaining widespread popularity conflict with the idea that pupils are intelligent creatures whose active cooperation is necessary to the success of teaching, while some valid methods based on this premise are ignored or misused.

Wholes and parts Why is it that knowledge cannot be delivered from teacher to pupil in finished form? Because what can be delivered is

always one level below what is intended. The explanation is the same whether we are talking about skills, understandings, or attitudes: a teacher must communicate by breaking down his subject matter into smaller pieces and conveying the pieces to the pupil. The teacher depends on the pupil to put the pieces back together for himself in the correct manner. Let's take some examples (1).

To teach the skill of writing, we have pupils practice subskills. Pupils learn to hold a pencil, to shape individual letters, and to make connections between letters. We depend on the pupil to integrate these subskills into the smooth performance of the skill of writing. If a pupil has trouble writing, we point out the things he is doing wrong and have him practice doing them correctly one by one. Then we can only hope that he will be able to work these particulars properly into the total task.

All skills are taught by breaking them into subskills. Swimming is broken down into floating, breathing, arm-stroking, and leg-kicking. Reading is broken into recognizing letters, diphthongs, syllables, and small words. For every skill, teachers require pupils to practice subskills, but depend on pupils to integrate subskills into the smooth performance of the total skill.

To help a pupil understand a generalization ("red"), we deliver some particulars (stoplight, apple, rose). To convey the notion of an abstract concept ("money"), we deliver some concrete examples, (pennies, quarters, dollar bills). To teach the attitude of "respect for the flag," we instruct pupils to keep the flag from touching the ground, we teach them to say the Pledge of Allegiance, and we teach them to sing "The Star-Spangled Banner."

These examples demonstrate a general principle: all skills, understandings, and attitudes are taught by breaking a whole into its parts and having pupils master the parts. In every case the pupil alone can integrate the parts into a single whole. This act of integration is private and cannot be forced or guaranteed by anyone but the pupil himself.

Thus, a whole is greater than the sum of its parts. The whole is not merely the collection of its parts, but also the properly organized integration of them. The whole gives meaning to the parts, and it is the intuitive grasping of this meaning that enables a pupil to integrate the parts. Teacher and pupil have reverse roles: a teacher breaks a whole into deliverable parts and presents them to the pupil, whose task is then to accept the parts, internalize them, and integrate them.

Excessive concentration on the parts can block the internalizing and integrating processes. For this reason rote memorization and recitation must stop before deeper understanding can begin. When we concentrate on the parts we block the view of the whole; likewise, when we focus on the whole we temporarily forget about the parts. Pupils studying a foreign language must memorize vocabulary and grammatical rules. But as long as a pupil must refer consciously to what he has memorized, he will not read or speak

fluently. The breakthrough to fluency (understanding without translation) occurs when the pupil stops paying attention to the subsidiary elements of grammar and vocabulary, and starts paying attention to his internalized sense of meaning. Smooth performance is always crippled by worrying about subsidiary elements in skills, understandings, and attitudes. Analysis and piecemeal mastery of parts can be helpful, but only if the separate masteries are reintegrated into the whole.

A whole can be broken into parts, each of which can be broken into subparts, ad infinitum. Likewise, anything regarded as a whole may later turn out to be only part of a still greater whole. A teacher's task, then, is not only to break a whole into parts for delivery to a pupil, but also to decide which level of the analysis is best for the pupil being taught. More mature pupils are able to understand concepts at a higher level of abstraction and are distracted and frustrated if a teacher requires close attention to particulars at too low a level. Likewise, immature pupils are unable to comprehend subject matter that is presented at too high a level.

Fallacies in favorite methods We have seen why rote memorization and recitation may be detrimental to a pupil's progress if continued for too long. The pupil's attention remams focused on the parts, and he is prevented from integrating them into awareness of the whole, which is the object of instruction. Almost everyone today agrees that rote learning can be useless or even harmful if carried to excess. But some recent fads in teaching methods depend on rote learning. Large numbers of new teachers have apparently learned by rote that rote learning is bad, without understanding why it is bad and how these popular methods are derived from it.

One popularteclmique is called "small-step learning." The idea is to break up subject matter into the smallest conceivable bits and feed them to pupils bit by bit. Even the most dull pupil can understand these bits; and so, we reason, we can feed a child all the bits, thereby making him understand the big idea.

What happens at best is that the pupil memorizes all the bits and gives them back to us on demand. The real test of understanding is to see whether a pupil can tell us a bit that was not told to him. That would demonstrate that he had integrated the bits we gave him into a greater whole and had generated the new bit out of that whole. But if we give the pupil all conceivable bits in the first place, we cannot rely on the fact that he gives us one back as proof that he understands the whole.

Programmed materials, teaching machines, and other forms of small-step learning are based on rote learning. As already noted, excessive concentration on the parts can cripple the process of integration, while analysis that is too simple for a pupil will bore, frustrate, and mislead him. Small-step learning can help slow learners and may occasionally improve the efficiency of bright pupils who get stuck at some point, but small-step

learning can help only if the size of the steps and the level of delivery are carefully selected for the individual.

Behavior modification is another popular technique that can block higher-level understanding. In using this method, teachers give unruly or inattentive pupils praise, tokens, or pieces of candy for doing small tasks or parts of tasks correctly. Pupils can be rewarded for keeping silent for five minutes, or raising their hands in response to a teacher's question, or getting to class on time.

There are ethical questions about behavior modification that go beyond the scope of this paper. For example, we may criticize behavior modification as a form of materialistic bribery that leads to brainwashing. What concerns us here, however, is that the behavior that is rewarded must be short-term, physically observable, and precisely specified. Thus, behavior modification is a form of small-step learning and is subject to the criticisms developed earlier. Pupils have their attention focused on little pieces instead of what is important, so that integration to a higher level of awareness is blocked.

The same criticisms apply to some current efforts to improve the overall effectiveness of schools. In the arrangement known as "performance contracting," a corporation signs a contract with a school guaranteeing that by the end of a specified period every pupil will achieve a promised level on a standardized test. The corporation receives school-tax money for each child who succeeds, but must refund the money for each child who fails. The profit motive operates to create extra effort and efficiency in teaching. However, all the effort goes into achieving the goals written into the contract.

In performance contracting or in any form of performance-based education, the goals must be stated as specific, observable, short-range behaviors. Performance-based education is the newest version of teaching for the test. The chief flaw is that teachers and pupils are distracted from large-scale, important, general goals when their attention is focused on a list of nitty-gritties that only partially define the goals. The growing new fad called "performance-based teacher education" is especially hazardous to the profession of teaching. Professors who educate teachers are under increasing pressure to focus instruction on the least important, least generalizable elements of teaching. The long-term result of performance-based teacher education will be the production of a generation of teachers who lack professional judgment and flexibility. Instead of professionals who understand the complexities of educational problems, we shall have semiskilled craftsmen who can only reproduce a limited set of behaviors.

Some good methods overlooked We have seen that the teacher's task is to break a whole into its parts and deliver the parts, while a pupil's task is to receive the parts and integrate them. The teacher depends on the pupil to do the integrating, which is of necessity a private act of creative intelligence. No teacher can do the

integrating for a pupil. But teachers can sometimes prod pupils or lead them toward integration.

One way of promoting integration is to shock the pupil by doing or saying something unexpected. For example, pupils who have carefully practiced each procedure to be followed in case of fire may understand and integrate those procedures when the bell rings for an unannounced fire drill. Seventh-grade pupils studying rules of etiquette may suddenly discover how to follow those rules when attending their first school dance.

A less traumatic way of fostering integration is to have the pupil witness the correct performance of the whole, in the hope that he can model or imitate that performance. Thus, a pupil who is practicing pronunciation of foreign phrases begins by paying attention to specific movements of his own lips and tongue, but then watches and listens to a native speaker.

Since integration is internal and private, the best a teacher can do is to prod or lead a pupil toward his own discovery. But shock and modeling are not the only techniques available. We have seen that correct selection of the teacher's level of delivery is important: focusing attention at too low a level cripples integration. Can focusing attention at a level slightly too high promote integration? The answer is yes, but the explanation is complex.

Wholes have parts, which have subparts, and so on. The phenomenon called "plateau learning" can now be accounted for. When pupils are learning how to type, they make steady gains in speed for a while but then make almost no further gains in speed despite much additional practice. At this point pupils are at a plateau: they must integrate subsidiary skills to a new level of wholeness before additional practice will improve speed. Then, once again speed improves with practice for a while until another plateau is reached. Plateau learning occurs in reading, mathematics, and other areas where skills are involved. The developmental stages described by Freud for personality, by Piaget for cognition, and by Kohlberg for moral reasoning might be regarded as plateaus.

When a pupil has reached a plateau, shock and modeling are two ways of hastening a breakthrough. Another way is to encourage pupils to "play around" with the whole above the plateau even though they have not completely mastered its parts. There is some evidence to suggest that when a pupil plays with a whole, its parts draw together. The reason is that a part derives its significance or meaning from belonging in the whole. Unmastered parts become more understandable when they are viewed in context.

Three paradoxical but useful principles of teaching may now be stated as applications of what has been said here:

1. A skill or a concept of moderate difficulty may be learned more easily when studied only tangentially, as part of a more difficult skill or concept, than when studied directly. For example, pupils who are having difficulty with arithmetic may learn it painlessly when they study mechanical drawing or modern algebra in some of the "new

math" programs. Pupils who have difficulty learning the grammar of a foreign language, or even the standard form of their native language, may improve their scores on grammar tests by stopping the direct study of grammar and learning some conversations by means of audiolingual methods. Pupils or employees can carry out instructions more effectively when told the purposes they serve.

2. Intuitive notation systems can facilitate faster learning of organized subject matter than standard notation systems, even counting the time required for pupils to transfer from the intuitive system to the standard system. For example, pupils learn to read English faster when the phonetically appealing initial teaching alphabet is used than when the ordinary alphabet is used, even counting the time needed laterto change from the initial teaching alphabet to the standard one. As another example, pupils can learn how to program computers by writing programs for a while In the code system that is most intuitively appealing to them: ordinary English (that is, their native language); then, having mastered the general skill of programming, pupils can easily learn and apply new code systems such as FORTRAN and COBOL.

3. Pupils whose basic ideas are mistaken sometimes learn high-level correct ideas faster if encouraged to build a false system based on their mistaken ideas than if the pupils are shown their mistakes and required to start all over with correct ideas. This principle is obviously a corollary of the previous one, since the pupil's mistaken basic ideas are probably intuitively appealing to him. The point is that if a pupil is to gain a sense of depth or logical hierarchy, he will have to master the skill of moving from one plateau of parts to the integration of those parts into a whole at the next plateau. This skill may be mastered more easily if the pupil starts with ideas, even though mistaken, that seem natural to him. For example, in mathematics it is important to know how to reason from axioms to more complex theorems; once this skill is mastered pupils may make rapid progress regardless of which axioms are chosen as starting points. Pupils can learn to construct grammatically correct sentences even if their spelling is incorrect. Indeed, nonsense words can be used as in

> Twas brillig, and the slithy toves
> Did gyre and gimble in the wabe
> [2].

Teachers are utterly dependent on their pupils for success in teaching skills, understandings, and attitudes. Teachers deliver parts, but only pupils can integrate the parts to achieve personal knowledge of the whole, which is the object of instruction. A whole may be only part of a still greater whole. At any level, focusing on parts for too long may cripple the process of integrating them into their whole. Small-step learning, behavior modification, and performance-based education can therefore be detrimental to a pupil's deeper achievement. Shock, modeling, and teaching slightly above a pupil's level can help him master difficult parts and rise to higher plateaus.

Notes

1. The discussion of wholes and parts, personal knowledge, and the manner in which focusing on parts can hinder their integration into a whole is based on Michael Polanyi's theory of knowing, found in his books *The Tacit Dimension* (Garden City, New York: Doubleday, 1966) and *Personal Knowledge* (London: Routledge and Kegan Paul, 1958). Gestalt psychology also supports what is said here: see *Gestalt Psychology* by George W. Hartmann (New York: Ronald Press, 1935). For a more thorough explanation of how knowledge is communicated, and why a teacher cannot deliver knowledge to a pupil in finished form, see "Knowledge, Proof, and Ineffability in Teaching," by Kenneth R. Conklin in *Educational Theory,* forthcoming.
2. Lewis Carroll. *Through the Looking-Glass.* "The Jabberwocky Poem." In *The Annotated Alice,* chap. 1, pp. 191-97. Edited by Martin Gardner. New York, New York: Bramhall House, 1960.