Chapter 4: Teaching for Understanding

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This chapter examines current views of teaching for understanding. First we provide background information, describing the influence of both theory and research on changes in approaches that have led to the recent stress on students as active constructors of their understanding. Then we summarize and compare a variety of programs that incorporate elements of construction and review issues that merit further investigation. Finally, we consider problems entailed in dissemination, especially difficulties teachers might encounter and describe promising attempts to foster their ability to teach for understanding.

WHAT IS TEACHING FOR UNDERSTANDING?

Over the last twenty years, approaches to teaching for understanding have evolved from models which stress information transmission to ones which emphasize student transformation of knowledge. The progression has been from emphasis on teacher directed, well structured, organized delivery of information to emphasis on the role of the individual learner in constructing understanding and the influence of the social environment on that construction. Below we present theoretical and empirical bases for different approaches to teaching, describe educational applications of these approaches, and indicate limitations derived from research and practice that have contributed to the current approaches to teaching for understanding.

Transmission Models

Early approaches.

Several approaches to teaching through the 1960s and 1970s were based on a transmission model of teaching and learning. The view was of a teacher as authority who disseminates knowledge largely through lectures and verbal exchanges; knowledge is an entity that exists and can be transferred to students;
learning is based on the accretion and retention of presented information and skills.

Behaviorism was one of the major theories contributing to this approach. Behavioral learning theory, focusing on behavior rather than mental operations, identified concepts like discrimination learning, generalization gradients, stimulus control, and fading as the operating mechanisms that controlled learning. Early instructional approaches based on behaviorism emphasized the need to structure curricula carefully so that prerequisite behaviors were shaped prior to students attempting to learn newer behaviors. As a result, it was critical that teachers carefully build up behavior through shaping responses, assuring that students gain mastery over early material before attempting to learn more advanced material. The underlying assumptions were that learning is hierarchical; it involves the aggregation of simple behaviors into more advanced behavior complexes and that high rates of success, shaped by positive reinforcement, are necessary for learning.

One of the most widely disseminated programs with comprehensive research bases was DISTAR (Engelmann & Brunner, 1984). DISTAR is an instructional program based on Bereiter and Engelmann’s (1966) attempt to develop a structured reading program to overcome the presumed educational disadvantage that some children have, particularly those coming from what was called ‘culturally deprived’ backgrounds. The program was designed to lead children through highly structured, compressed language experiences to overcome their linguistic disadvantage.

Early applications of computer technologies for schools also were based on behavioral notions. One of the most thorough of these programs was developed by Suppes and Atkinson (Suppes, 1966), later to become the Computer Curriculum Corporation’s drill-and-practice materials. This early work, which is still in very wide use, is based on a model of technology application called computer assisted instruction (CAI). The major strength of CAI to support drill-and-practice is in the ability of software applications to present material, collect achievement data on-line, and then select an appropriate subsequent item based on the student’s individual learning history. In this way, CAI can embody many of the central attributes of direct instruction (e.g., carefully sequenced material, guided practice, immediate and specific feedback).

Research on learning and instruction also was influential in contributing to transmission models of instruction. Gagné (1985) emphasized task analysis where components of final performance were identified and sequenced. Teaching involved hierarchical task analysis of the desired performance via specification of prerequisite knowledge and skills. Understanding involved mastery of lower levels of the task-like skills, before moving on to higher levels like learning principles. Transfer was presumed to be enhanced when tasks had common prerequisites and component elements.
From the realm of practice, a spate of studies conducted in classrooms focused on teacher behavior and its relationship to student achievement. From the work of Heckert and Ahlbrand (1969) and the pioneering linguistic analysis of classrooms by Bellack, Kliebard, Hyman, and Smith (1966), researchers showed that a small number of common elements could be identified with classroom teaching. This research was conceptualized around four behavior complexes—structuring, soliciting, responding, and reacting—that could be found in classrooms in many different countries. These four complexes could be used to subsume a large number of teacher behaviors thought to be associated with effective instruction, that is, instruction that fostered understanding.

Ausubel (1960) proposed a much more cognitive model of learning and memory with implications for structuring information via advance organizers. These ideas went beyond previous notions of learning as accrual of facts and skills. The importance of teachers’ organizing information for learners is also reflected in Rosenshine and Furst’s (1973) model of explicit instruction. The model identified six behaviors associated with student achievement. One was review during which teachers were to check homework, review material, and determine where students were having difficulty. Second was presentation. Here teachers were to orient students to the material to be covered, often using instructional manoeuvres such as advance organizers (Ausubel, 1960) and stating the objectives for the lesson (Mager, 1975). Lesson presentations were structured and teacher controlled with characteristics similar to recitation (i.e., structure, solicit, respond, and react). Third was guided practice, keeping students active and on task, which provided opportunities for students to demonstrate understanding. Here teachers were to ask many questions and evaluate student responses to check for understanding. Fourth was providing feedback during guided practice. The feedback was highly descriptive, precise, and task focused, referring to correct and incorrect features of the response. Fifth was engaging students in independent practice, so that students would overlearn the material, responses would be quick and automatic, and attain a high correct response percentage. Finally, teachers were to conduct a review at the end of the lesson in order to consolidate learning and help students with recall and retrieval from memory.

Process-product research.

A large and influential body of work, labelled process-product research, stemmed from a model developed by Dunkin and Biddle (1974). This model offered a classification for factors involved in research on teaching: presage variables (teacher characteristics), context variables (pupil, school, and community properties), process variables (actual activities of classroom teaching), and
product variables (the outcomes of teaching, including what students learn). One type of knowledge this model suggests concerns process-product relations between observable classroom events and student learning. In practice, most process-product studies compared observations of teacher behaviors, usually expressed in terms of frequencies, with standardized measures of student achievement. This tradition was advanced through the work of Gage and his colleagues (Clark, Gage, Marx, Peterson, Stayrook, & Winne, 1979; Gage, 1978), Berliner and the well-known Beginning Teacher Evaluation Study that examined how teachers use time (Berliner, 1979; Denham & Lieberman, 1980), Rosenshine and his colleagues (Rosenshine, 1986; Rosenshine & Stevens, 1986) who advanced what they called the functions of teaching, Brophy and Good (1986), who examined teacher behavior and student achievement, and Hunter (1982) who promoted inservice training approaches. Although similar in focusing on process-product relations, these investigations differed in their educational theory and in their view of psychological principles of learning.

An influential series of process-product studies used achievement test scores to describe differences in behaviors of teachers who consistently produced better student learning. Moreover, experimental studies based on these results produced achievement gains in students. Brophy and Good (1986) summarized some of the main findings of this approach. Teacher behaviors correlated with student achievement included providing opportunities to learn in terms of quantity and pacing of instruction, managing to maximize students’ engaged time and actively teaching rather than leaving students to learn on their own. Such active teaching involved examination of how teachers delivered information in terms of structuring, sequencing, clarity, and enthusiasm. It also entailed frequent questioning of students to check for understanding, providing feedback about correctness, and helping those who answered incorrectly to reach the right answer by rephrasing, prompting and giving clues.

Missouri Math was one example of the process-product approach. Good, Grouws, and Ebmeier (1983) identified patterns that characterized teachers whose students differed on achievement test scores. They developed an instructional program based on the principles of active teaching identified in the process-product research. Teachers are instructed to provide clear illustrations of mathematics concepts and to use demonstrations, concrete examples and illustrations, models and diagrams, and manipulatives. Lessons:

a) begin with an opening which briefly reviews material previously learned and reviews homework;

b) move to a development phase, in which teachers focus on prerequisites and then develop meaning through illustrations, examples and highlighting relationships among ideas, emphasize application, assess student comprehension frequently, and repeat and elaborate as needed;
c) proceed to seatwork to provide uninterrupted successful practice (trying to have students achieve 80 per cent correct responses);

d) usually conclude with assigning homework to take about 15 minutes.

Additionally, the teacher should present weekly and monthly reviews. It is interesting to note that while the approach focuses on the teacher as transmitter of information, aspects of the recommended development phase foreshadow more recent approaches to teaching for understanding that stress meaning-making as the basis for understanding.

Limitations.

The central goal of the rapidly growing research program in transmission models of instruction and related areas through the 1960s and 1970s was to improve teaching and schooling through the development of a scientific basis for teaching. This overarching goal implies that both theoretical and practical criteria need to be attained to judge the success of the research effort. Criticisms of the research at the time focused on both types of criteria, and researchers raised several concerns which eventually led to the emergence of an alternative framework.

One limitation of the research was that it relied on standardized tests as measures of learning; typically such tests tap what has been called inert rather than usable knowledge. That is, they assess isolated knowledge and skills rather than the ability to use knowledge both in and out of school situations. Critics also argued that direct instruction seemed most effective in teaching factual content to low ability students (Peterson & Walberg, 1979) but that it was less successful for promoting problem solving or ‘higher level’ thinking. A second limitation was that while it was successful in distinguishing effective from ineffective teachers, it was less successful in characterizing exemplary instructors. A third related limitation was that it did not sufficiently address subject matter differences. A fourth was that it was not sensitive to the effect of context.

Most importantly, several researchers (e.g., Doyle, 1977; Winne & Marx, 1978) argued that transmission models could not adequately identify mechanisms that accounted for student learning. By the end of the 1970s, theoretical and empirical work on learning had begun to move from primarily behavioral accounts to more cognitive frameworks. Theoretical objections to transmission models were derived from these newer, cognitive learning theories. For example, Winne and Marx (1978) argued that most, if not all, studies in the process-product tradition used mental constructs (e.g., ‘remembering,’ ‘understanding,’ ‘analyzing’) as the presumed mechanisms to account for how a teaching process (say for example, the teacher’s use of higher order questions, or of wait time)
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