Probing the Subtleties of Subject-Matter Teaching

Building on the effective schools research of the 1970s, studies today focus on teaching for understanding and use of knowledge.

JERE BROPHY

Research on teaching, if interpreted appropriately, is a significant resource to teachers; it both validates good practice and suggests directions for improvement. All too often, however, reviews of the research assume an "out with the old, in with the new" stance, which fosters swings between extremes. Practitioners are left confused and prone to believe that research is not helpful. This summary of the research conducted during the last 25 years attempts not only to highlight the changing implications of research but also to emphasize how the research has built on what was learned before.

Process-Outcome Research

Especially relevant findings come from studies designed to identify relationships between classroom processes (what the teacher and students do in the classroom) and student outcomes (changes in students' knowledge, skills, values, or dispositions that represent progress toward instructional goals). Two forms of *process-outcome research* that became prominent in the 1970s were school effects research and teacher effects research.

School effects research (reviewed in Good and Brophy 1986) identified characteristics in schools that elicit good achievement gains from their students: (1) strong academic leadership that produces consensus on goal priorities and commitment to instructional excellence; (2) a safe, orderly school climate; (3) positive teacher attitudes toward students and expectations regarding their abilities to master the curriculum; (4) an emphasis on instruction in the curriculum (not just on filling time or on nonacademic activities); (5) careful monitoring of progress toward goals through student testing and staff evaluation programs; (6) strong parent involvement programs; and (7) consistent emphasis on the importance of academic achievement, including praise and public recognition for students' accomplishments.

Teacher effects research (reviewed in Brophy and Good 1986) identified teacher behaviors and patterns of teacher-student interaction associated with student achievement gains. This research firmly established three major conclusions:

1. *Teachers make a difference.* Some teachers reliably elicit greater gains than others, because of differences in how they teach.

2. *Differences in achievement gains occur in part because of differences in exposure to academic content and opportunity to learn.* Teachers who elicit greater gains: (a) place more emphasis on developing mastery of the curriculum, in establishing expectations for students, and defining their own roles; (b) allocate most of the available time for activities designed to foster such mastery; and (c) are effective organizers and managers who make their classrooms efficient learning environments, minimize the time spent getting organized or making transitions, and maximize student engagement in ongoing academic activities.

3. *Teachers who elicit greater achievement gains do not merely maximize "time on task"; in addition, they spend a great deal of time actively instructing their students.* Their classrooms feature more time spent in interactive lessons, featuring much teacher-student discourse and less time spent in independent seatwork. Rather than depend solely on curriculum materials as content sources, these teachers interpret and elaborate the content for students, stimulate them to react to it through questions, and circulate during seatwork times to monitor progress and provide assistance. They are active instructors, not just materials managers and evaluators, although most of their instruction occurs during interactive discourse with students rather than during extended lecture-presentations.

The process-outcome research of the 1970s was important, not only for contributing the findings summarized above but also for providing education with a knowledge base capable of

Bruce Keegan and John Ponseigo

By constructing from balsa wood a model of a residential home, students in John Ponseigo's drafting class in Littleton, Colorado, show that they have made knowledge of engineering their own.

moving the field beyond testimonials and unsupported claims toward scientific statements based on credible data. However, this research was limited in several respects. First, it focused on important but very basic aspects of teaching. These aspects differentiate the least effective teachers from other teachers, but they do not include the more subtle points that distinguish the most outstanding teachers.

Second, most of this research relied on standardized tests as the outcome measure, which meant that it focused on mastery of relatively isolated knowledge items and skill components without assessing the degree to which students had developed understanding of networks of subject-matter content or the ability to use this information in authentic application situations.

Research on Teaching for Understanding and Use of Knowledge

During the 1980s, research emerged that emphasized teaching subject matter for understanding and use of knowledge. This research focuses on particular curriculum units or even individual lessons, taking into account the teacher's instructional goals and assessing student learning accordingly. The researchers find out what the teacher is trying to accomplish, record detailed information about classroom processes as they unfold, and then assess learning using measures keyed to the instructional goals. Often these include detailed interviews or portfolio assessments, not just conventional short-answer tests.

Current research focuses on attempts to teach both the individual elements in a network of related content and the connections among them, to the point that students can explain the information in their own words and can use it appropriately in and out of school. Teachers accomplish this by explaining concepts and principles with clarity and precision and by modeling the strategic application of skills via "think aloud" demonstrations. These demonstrations make overt for students the usually covert strategic thinking that guides the use of the skills for problem solving.

Construction of Meaning

Current research, while building on findings indicating the vital role teachers play in stimulating student learning, also focuses on the role of the student. It recognizes that students do not merely passively receive or copy input from teachers, but instead actively mediate it by trying to make sense of it and to relate it to what they already know (or think they know) about the topic. Thus, students develop new knowledge through a process of *active construction*. In order to get beyond rote memorization to achieve true understanding, they need to develop and integrate a network of associations linking new input to preexisting knowledge and beliefs anchored in concrete experience. Thus, teaching involves inducing *conceptual change* in students, not infusing knowledge into a vacuum. Students' preexisting beliefs about a topic, when accurate, facilitate learning and provide a natural starting place for teaching. Students' misconceptions, however, must be corrected so that they do not distort the new learning.

To the extent that new learning is complex, the construction of meaning required to develop clear understanding of it will take time and will be facilitated by the interactive *discourse* that occurs during lessons and activities. Clear explanations and modeling from the teacher are important, but so are opportunities to answer questions about the content, discuss or debate its meanings and implications, or apply it in authentic problem-solving or decision-making contexts. These activities allow students to process the content actively and "make it their own" by paraphrasing it into their own words, exploring its relationships to other knowledge and to past experience, appreciating the insights it provides, or identifying its implications for personal decision making or action. Increasingly, research is pointing to thoughtful discussion, and not just teacher lecturing or student recitation, as characteristic of the discourse involved in teaching for understanding.

Researchers have also begun to

stress the complementary changes in teacher and student roles that should occur as learning progresses. Early in the process, the teacher assumes most of the responsibility for structuring and managing learning activities and provides students with a great deal of information, explanation, modeling, and cueing. As students develop expertise, however, they can begin regulating their own learning by asking questions and by working on increasingly complex applications with increasing degrees of autonomy. The teacher still provides task simplification, coaching, and other "scaffolding" needed to assist students with challenges that they are not yet ready to handle on their own. Gradually, this assistance is reduced in response to gradual increases in student readiness to engage in self-regulated learning.

Thoughtful discussion is essential in the process of teaching for understanding. Here, Cheri Murphy, a teacher in a Colorado Higher Literacy Project, confers with a student about her writing.

Principles of Good Subject Matter Teaching

Although research on teaching school subjects for understanding and higher-order applications is still in its infancy, it already has produced successful experimental programs in most subjects. Even more encouraging, analyses of these programs have identified principles and practices that are common to most if not all of them (Anderson 1989, Brophy 1989, Prawat 1989). These common elements are:

1. The curriculum is designed to equip students with knowledge, skills, values, and dispositions useful both inside and outside of school.

2. Instructional goals underscore developing student expertise within an application context and with emphasis on conceptual understanding and self-regulated use of skills.

3. The curriculum balances breadth with depth by addressing limited content but developing this content sufficiently to foster understanding.

4. The content is organized around a limited set of powerful ideas (key understandings and principles).

5. The teacher's role is not just to present information but also to scaffold and respond to students' learning.

6. The students' role is not just to absorb or copy but to actively make sense and construct meaning.

7. Activities and assignments feature authentic tasks that call for problem solving or critical thinking, not just memory or reproduction.

8. Higher-order thinking skills are not taught as a separate skills curriculum. Instead, they are developed in the process of teaching subject-matter knowledge within application contexts that call for students to relate what they are learning to their lives outside of school by thinking critically or creatively about it or by using it to solve problems or make decisions.

9. The teacher creates a social environment in the classroom that could be described as a learning community where dialogue promotes understanding.

In-Depth Study of Fewer Topics

Embedded in this approach to teaching is the notion of "complete" lessons carried through to include higher-order applications of content. The breadth of content addressed, thus, is limited to allow for more in-depth teaching of the content. Unfortunately, typical state and district curriculum guidelines feature long lists of items and subskills to be "covered," and typical curriculum packages supplied by educational publishers respond to these guidelines by emphasizing breadth over depth of coverage. Teachers who want to teach for understanding and higher-order applications of subject-matter will have to both: (1) limit what they teach by focusing on the most important content and omitting or skimming over the rest, and (2) structure what they do teach around important ideas, elaborating it considerably beyond what is in the text.

Besides presenting information and modeling skill applications, such teachers will need to structure a great deal of thoughtful discourse by using questions to stimulate students to process and reflect on the content, recognize relationships among and implications of its key ideas, think critically about it, and use it in problem-solving or decision-making applications. Such discourse downplays rapid-fire questioning and short answers and instead features sustained examination of a small number of related topics. Students are invited to develop explanations, make predictions, debate alternative approaches to problems, or otherwise consider the content's implications or applications. Some of the questions admit to a range of possible correct answers, and some

invite discussion or debate (for example, concerning the relative merits of alternative suggestions for solving problems). In addition to asking questions and providing feedback, the teacher encourages students to explain or elaborate on their answers or to comment on classmates' answers. The teacher also capitalizes on "teachable moments" offered by students' comments or questions (by elaborating on the original instruction, correcting misconceptions, or calling attention to implications that have not been appreciated yet).

Holistic Skills Instruction

Teaching for understanding and use of knowledge also involves holistic skills instruction, not the practice of skills in isolation. For example, most practice of writing skills is embedded within activities calling for authentic writing. Also, skills are taught as strategies adapted to particular purposes and situations, with emphasis on modeling the cognitive and metacognitive components involved and explaining the necessary conditional knowledge (of when and why the skills would be used). Thus, students receive instruction in when and how to apply skills, not just opportunities to use them.

Activities, assignments, and evaluation methods incorporate a much greater range of tasks than the familiar workbooks and curriculum-embedded tests that focus on recognition and recall of facts, definitions, and fragmented skills. Curriculum strands or units are planned to accomplish gradual transfer of responsibility for managing learning activities from the teacher to the students, in response to their growing expertise on the topic. Plans for lessons and activities are guided by overall curriculum goals (phrased in terms of student capabilities to be developed), and evaluation efforts concentrate on assessing the progress made.

Clearly, the kind of instruction described here demands more from both teachers and students than traditional reading-recitation-seatwork teaching does.

Reading. Reading is taught as a sense-making process of extracting meaning from texts that are read for information or enjoyment, not just for practice. Important skills such as decoding, blending, and noting main ideas are taught and practiced, but primarily within the context of reading for meaning. Activities and assignments feature more reading of extended texts and less time spent with skills worksheets. Students often work cooperatively in pairs or small groups, reading to one another or discussing their answers to questions about the implications of the text. Rather than being restricted to the artificial stories written for basal readers, students often read literature written to provide information or pleasure (Anderson et al. 1985, Dole et al. 1991).

Writing. Writing is taught as a way for students to organize and communicate their thinking to particular audiences for particular purposes, using skills taught as strategies for accomplishing these goals. Most skills practice is embedded within writing activities that call for composition and communication of meaningful content. Composition activities emphasize authentic writing intended to be read for meaning and response. Thus, composition becomes an exercise in communication and personal craftsmanship. Students develop and revise outlines, develop successive drafts for meaning, and then polish their writing. The emphasis is on the cognitive and metacognitive aspects of composing, not just on mechanics and editing (Englert and Raphael 1989, Rosaen 1990, Scardamalia and Bereiter 1986).

Mathematics. Mathematics instruction focuses on developing students' abilities to explore, conjecture, reason logically, and use a variety of mathematical models to solve nonroutine problems. Instead of working through a postulated linear hierarchy from isolated and low-level skills to integrated and higher-level skills, and only then attempting application, students are taught within an application context right from the beginning through an emphasis on authentic problem solving. They spend less time working individually on computation skills sheets and more time participating in teacher-led discourse concerning the meanings of the mathematical concepts and operations under study (Carpenter et al. 1989; National Council of Teachers of Mathematics 1989, 1991; Steffe and Wood 1990).

Science. In science, students learn to understand, appreciate, and apply connected sets of powerful ideas that they can use to describe, explain, make predictions about, or gain control over real-world systems or events. Instruction connects with students' experience-based knowledge and beliefs, building on accurate current knowledge but also producing conceptual change by confronting and correcting misconceptions. The teacher models and coaches the students' scientific reasoning through scaffolded tasks and dialogues that engage them in thinking about scientific issues. The students are encouraged to make predictions or develop

explanations, then subject them to empirical tests or argue the merits of proposed alternatives (Anderson and Roth 1989, Neale et al. 1990).

Social studies. In social studies, students are challenged to engage in higher-order thinking by interpreting, analyzing, or manipulating information in response to questions or problems that cannot be resolved through routine application of previously learned knowledge. Students focus on networks of connected content structured around powerful ideas rather than on long lists of disconnected facts, and they consider the implications of what they are learning for social and civic decision making. The teacher encourages students to formulate and communicate ideas about the topic, but also presses them to clarify or justify their assertions rather than merely accepting and reinforcing them indiscriminately (Brophy 1990, Newmann 1990).

Greater Efforts, Greater Rewards

The type of teaching described here is not yet typical of what happens in most schools. For it to become more common, several things must occur. First, researchers need to articulate these principles more clearly. Second, states and districts must adjust their curriculum guidelines, and publishers must modify their textbooks and teachers' manuals. Finally, professional organizations of teachers and teacher educators must build on the beginnings that they have made in endorsing the goals of teaching subjects for understanding, appreciation, and life application by creating and disseminating position statements, instructional guidelines, videotaped examples, and other resources for preservice and inservice teachers. Clearly, the kind of instruction described here demands more from both teachers and students than traditional reading-recitation-seatwork teaching does. However, it also rewards their efforts with more satisfying and authentic accomplishments.

Author's note: This work is sponsored in part by the Center for the Learning and Teaching of Elementary Subjects, Institute for Research on Teaching, Michigan State University. The Center for Learning and Teaching of Elementary Subjects is funded primarily by the Office of Educational Research and Improvement, U.S. Department of Education. The opinions expressed here do not necessarily reflect the position, policy, or endorsement of the Office or Department (Cooperative Agreement No. G0087C0226).

References

Anderson, L. (1989). "Implementing Instructional Programs to Promote Meaningful, Self-Regulated Learning." In *Advances in Research on Teaching*, Vol. 1, edited by J. Brophy, pp. 311-343. Greenwich, Conn.: JAI.

Anderson, C., and K. Roth. (1989). "Teaching for Meaningful and Self-Regulated Learning of Science." In *Advances in Research on Teaching*, Vol. 1, edited by J. Brophy, pp. 265-309. Greenwich, Conn.: JAI.

Anderson, R., E. Hiebert, J. Scott, and I. Wilkinson. (1985). *Becoming a Nation of Readers: A Report of the Commission on Reading*. Washington, D.C.: National Institute of Education.

Brophy, J., ed. (1989). *Advances in Research on Teaching*, Vol. 1. Greenwich, Conn.: JAI.

Brophy, J. (1990). "Teaching Social Studies for Understanding and Higher-Order Applications." *Elementary School Journal* 90: 351-417.

Brophy, J., and T. Good. (1986). "Teacher Behavior and Student Achievement." In *Handbook of Research on Teaching*, 3rd. ed., edited by M. Wittrock, pp. 328-375. New York: Macmillan.

Carpenter, T., E. Fennema, P. Peterson, C. Chiang, and M. Loef. (1989). "Using Knowledge of Children's Mathematics Thinking in Classroom Teaching: An Experimental Study." *American Educational Research Journal* 26: 499-532.

Dole, J., G. Duffy, L. Roehler, and P. D. Pearson. (1991). "Moving From the Old to the New: Research on Reading Comprehension Instruction." *Review of Educational Research* 61: 239-264.

Englert, C., and T. Raphael. (1989). "Developing Successful Writers Through Cognitive Strategy Instruction." In *Advances in Research on Teaching*, Vol. 1, edited by J. Brophy, pp. 105-151. Greenwich, Conn.: JAI.

Good, T., and J. Brophy. (1986). "School Effects." In *Handbook of Research on Teaching*, 3rd ed., edited by M. Wittrock, pp. 570-602. New York: Macmillan.

National Council of Teachers of Mathematics. (1989). *Curriculum and Evaluation Standards for School Mathematics*. Reston, Va.: NCTM.

National Council of Teachers of Mathematics. (1991). *Professional Standards for Teaching Mathematics*. Reston, Va.: NCTM.

Neale, D., D. Smith, and V. Johnson (1990). "Implementing Conceptual Change Teaching in Primary Science." *Elementary School Journal* 91: 109-131.

Newmann, F. (1990). "Qualities of Thoughtful Social Studies Classes: An Empirical Profile." *Journal of Curriculum Studies* 22: 253-275.

Prawat, R. (1989). "Promoting Access to Knowledge, Strategy, and Disposition in Students: A Research Synthesis." *Review of Educational Research* 59: 1-41.

Rosaen, C. (1990). "Improving Writing Opportunities in Elementary Classrooms." *Elementary School Journal* 90: 419-434.

Scardamalia, M., and C. Bereiter. (1986). "Written Composition." In *Handbook of Research on Teaching*, 3rd ed., edited by M. Wittrock, pp. 778-803. New York: Macmillan.

Steffe, L., and T. Wood, eds. (1990). *Transforming Children's Mathematics Education: International Perspectives*. Hillsdale, N.J.: Erlbaum

Jere Brophy is University Distinguished Professor of Teacher Education and Co-director, Institute for Research on Teaching. He can be contacted at Michigan State University, Center for the Learning and Teaching of Elementary Subjects, College of Education, Erickson Hall, East Lansing, MI 48824-10341