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ABSTRACT

Recent developments in the field of cognitive psychology, particularly in the area of information processing, have shed light on the way people think in order to make decisions and solve problems. In addition, cooperative learning research has provided evidence of the effectiveness of cooperatively structured group work aimed at problem solving. This paper identifies concepts and findings in the fields of cognitive psychology and cooperative learning relevant to teaching and learning higher-cognitive thinking skills. Special reference is made to a study by Voss, Greene, Post, and Penner (1983) that focuses on political-economic problem solving. Implications are derived from the research to use as criteria for evaluating instructional programs intended to teach students to reason with historical and social scientific knowledge. Particular attention is given to the roles of domain-specific knowledge, including cognitive schemata and metacognitive knowledge in the problem solving performance of expert and novice problem solvers. Three models for teaching students intellectual skills in the social studies curriculum are critiqued with the criteria. The three instructional models are the "jurisprudential approach" to teaching public issues in the classroom (Oliver & Shaver, 1966; Newmann & Oliver, 1970), Beyer's (1987; 1988) thinking skills program, and the economic reasoning model recommended by the Joint Council on Economic Education (Saunders et al., 1984). A 28-item bibliography and two figures are included. (JB)

PROBLEM SOLVING IN SOCIAL STUDIES:
CONCEPTS AND CRITIQUES

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Research and development on teaching and learning higher-cognitive thinking skills (e.g., problem solving, critical thinking, decision making) have increased greatly in recent years. Cognitive psychological research on problem solving has provided the basis for reconceptualizing the problem of teaching students to reason and for charting new instructional approaches (Gagne 1985). From another educational perspective, research on cooperative learning has consistently demonstrated strong, positive cognitive and social effects on student performance and behavior (Slavin, et al., 1985). These two areas of work raise issues that social studies educators should consider as they design instructional programs, develop curricular materials, and endeavor to help students learn higher-cognitive skills and apply historical and social scientific knowledge to problem solving and decision-making tasks.

There are three goals for this paper. First, concepts and findings are identified in the fields of cognitive psychology and cooperative learning relevant to teaching and learning problem solving and other higher-cognitive skills. To clarify the information-processing perspective on problem solving, special reference is made to a study by Voss, Greene, Post, and Penner (1983), one of the few studies which focuses on political-economic problem solving. Second, a set of implications are derived from the research to use as criteria for evaluating instructional programs intended to teach students to reason with historical and social scientific knowledge. Particular attention is given to the roles of domain-specific knowledge, including cognitive schemata, and metacognitive knowledge in the problem-solving performances of expert and novice problem solvers. Third, three models for teaching students intellectual skills in the social studies curriculum are critiqued with the criteria. The three instructional models are the "jurisprudential approach" to teaching public issues in the classroom (Oliver & Shaver, 1966; Newmann with Oliver, 1970), Beyer's (1987, 1988) thinking skills program, and the economic reasoning model recommended by the Joint Council on Economic Education (Saunders et al., 1984).

CONCEPTS AND FINDINGS

Expert and Novice Problem Solvers

Voss, Greene, Post, and Penner (1983) compared the problem-solving thinking of experts and novices in the field of Soviet domestic affairs. The novice problem solvers were taking their first course in Soviet domestic policies, and the expert problem solvers had earned doctoral degrees specializing in the Soviet Union. Specifically, Voss et al. posed the following problem: Suppose that you are the Minister of Agriculture in the Soviet Union, and assume that crop productivity has been consistently low for several years. Your responsibility is to increase crop production. How would you go about solving this problem? (p. 174) Each problem solver thought out loud and was recorded. Detailed protocols made from the recordings were analyzed and diagrammed in terms of the content and reasoning processes used by the problem solvers.

Voss and his colleagues (1983) observed clear differences between the exper'- and the novices. First, the experts began by reviewing the problem and analyzing the context of the problem which then led to a problem representation. This phase sometimes involved a historical analysis of the problem. The experts generally converted the given problem into another, more general problem. For example, some experts converted the stated problem to one of influencing the political apparatus to commit needed resources to improve crop productivity. Another problem conversion treated the problem of low productivity as one of inadequate technological development. In contrast to the experts, the novices skipped the general analysis of the problem's context and quickly identified a set of specific subproblems, such as insufficient fertilizer, insufficient tractors, and harsh climate. The experts' representations of the problem addressed many of the novices' more specific subproblems. In contrast, the novices' efforts to solve their subproblems did not address adequately the larger issues underlying the subproblems.

Second, the experts engaged in much more analysis and evaluation than the novices. The experts' extensive efforts to represent the problem richly accounted for part of this difference. However, the d.fference in reasoning was evident throughout the problem-solving process. For example, experts systematically evaluated solutions. Novices provided little support for their solutions and often did not evaluate their solutions in terms of all critical constraints.

Third, experts identified subproblems differently than novices. Both groups identified subproblems by breaking the general problem as given into pieces. However, experts also identified subproblems in the process of exploring the consequences of various possible solutions. For example, an expert problem solver considering increased agricultural use of capital equipment and petroleum-based fertilizers might realize that political support must be obtained from central planners for the steel and chemical industries. Novices simply did not engage in this kind of reflection.

A key explanation for the differences observed by Voss et al. involves the knowledge the problem solvers possessed relevant to the problem. Experts possessed more knowledge than novices about the given problem (e.g., information about the problem situation, constraints, characteristics of an adequate solution), domain-specific knowledge and techniques relevant to the given problem (e.g., alternative economic growth investment strategies, supply-demand graphing techniques), and general approaches to solving the problem (e.g., statistical procedures, use of decision-making charts). Voss et al. further explored differences in knowledge by posing the Soviet agriculture problem for political scientists and economists not specializing in the Soviet Union, graduate students specializing in Soviet affairs, and university chemists. While these highly trained problem solvers tended to be more analytical than the novices, their problem representations and reasoning structures were usually more like those of the novices than those of the experts.

Knowledge Needed for Expert Problem Solving

The research on experts' and novices' problem-solving performances demonstrates the importance for education of understanding how experts' knowledge differs from that of novices. Insight into experts' knowledge has implications for teaching novices, such as students in social studies classes, to reason with historical and social scientific knowledge. Certainly, experts have more concepts and information in their fields of expertise than novices. However, there is more to it than that. Experts possess different kinds of knowledge than novices. This section of the paper considers characteristics of experts' domain-specific knowledge and their more general knowledge of how to solve problems (i.e., metacognitive knowledge) in their areas of expertise.

Domain-Specific Knowledge. Expert social studies problem solvers possess a large store of declarative or propositional knowledge, that is, "knowledge about" historical and contemporary social phenomena (Voss 1989). Declarative knowledge includes definitions of concepts, for example, marginal utility. It includes specific factual information, for example, Alan Greenspan is the current chairman of the Board of Governors of the Federal Reserve System. It also includes generalizations, for example, the Law of Demand. In this respect, expert economic problem solvers possess larger quantities of declarative or propositional knowledge in their long-term memories. If one's declarative knowledge base is relevant to the problems one wishes to solve, it is a valuable resource for solving problems.

Another dimension of expert problem solvers' knowledge is procedural knowledge, that is "knowledge of how to" (Voss 1989). Procedural knowledge requires declarative knowledge (e.g., concepts, facts, generalizations) and the ability to apply it to questions for which answers are not immediately obvious. If confronted with a productivity problem, an expert economic problem solver knows how to define, operationalize, and compute useful productivity indices. If confronted with a set of quantitative data on economic and social conditions prior to the Civil War, an expert problem solver can interpret the data and extract useful information about the problem at hand. Given a change in a nation's birth rates, an expert can predict probable economic, political, and social effects in the coming decades. Experts generally have extensive procedural knowledge in their areas of expertise; novices are likely to have little or none. Procedural knowledge is a qualitative difference in the domain-specific knowledge bases of expert and novice problem solvers in a particular area, such as economics. It helps explain some of the major differences in how experts and novices think in their efforts to solve problems.

Another critical dimension of problem solvers' domain-specific knowledge is its organization. People tend to organize their knowledge in terms of schemata, that is, networks of ideas (Cornbleth 1985; Glaser 1984). For example, Figure 1 is a simple schema which organizes concepts related to productivity. Investment in productive resources (e.g., human capital) can lead to increases in productivity. Increases in productivity can lead to higher rates of return on resources invested and stimulate additional investment. Experts have more schemata than novices, and experts' schemata are generally developed more fully in their areas of expertise. As a result, expert problem solvers represent problems more adequately than novices.

[Insert Figure 1 about here.]

Domain-specific schemata provide useful ways of conceptualizing problems, and they enable expert problem solvers to perceive what knowledge is needed to solve a problem and to access information they already possess in their long-term memories. Simon (1980) described this function of schemata in terms of indexing and cross-referencing a knowledge base held in long-term memory. Consider again the productivity schema shown in Figure 1. An expert has knowledge "indexed" in terms of "investment in capital resources." For example, an economic expert would remember definitions, examples, particular cases of capital investment and their results, various constraints on capital investment, political controversies involving capital investment, and much more. Even more important for problem solving, an economic expert's knowledge of investment in capital goods would be "cross-referenced" with other knowledge. For example, an expert would also probably think of investment in research and development and its relationship to capital investment. He or she might also note the interdependence between the quality of human resources and the effective use of particular kinds of capital. Further, the expert might address the impact of government economic intervention in the form of tax rates and credits on rates of return which could affect the value and probability of capital investment.

A novice's list of economic concepts related to productivity would not be nearly as helpful in thinking about productivity problems as an economic expert's schema. Voss et al. (1983) observed that novices often did not use all the relevant knowledge that they possessed. The lack of adequate schemata is part of the reason their knowledge was not activated. Domain-specific schemata are critical for effective problem solving in economics or any other domain.

Metacognitive Knowledge. Another cognitive difference between experts and novices is their metacognitive knowledge. Metacognition refers to several phenomena: (1) knowledge of what one knows about particular subjects and when and how to use that knowledge; (2) declarative and procedural knowledge of general strategies for thinking about problems, the so-called "weak" methods; and (3) knowledge of how to manage one's thinking, sometimes called cognitive self-management (Nickerson, 1988). These general ways of thinking are less domain-specific than the procedural knowledge discussed and are potentially applicable in a wider variety of problem-solving contexts.

The first dimension of metacognitive knowledge focuses on the problem solver's awareness of what he or she knows about a subject and the relevance and applicability of that knowledge for understanding phenomena and solving problems. This is sometimes called "conditionalized knowledge" (Bransford, Franks, Vye, and Sherwood 1986). For example, when one hears the quarterly sales and earnings reports of General Motors, Ford, and Chrysler, does the investment-productivity schema come to mind to help explain the relative performances of these corporations? If the local Little League fund-raising barbecue consistently does not generate enough income, is the problem articulated as a problem of insufficient productivity? If a problem solver knows that the investment-productivity schema, among others, is relevant to understanding these phenomena, then he or she possesses conditionalized knowledge about investment and productivity.

The second dimension of metacognitive knowledge is declarative and procedural knowledge of general ways to think about problems and to attempt to solve them. Such general cognitive strategies are often called "weak methods" in contrast to "strong" domain-specific problem-solving strategies, such as cost-benefit analysis (Nickerson 1988). General cognitive strategies are weak in the sense that they do not depend on much domain-specific knowledge and do not lead to solutions with as much certainty as more domain-specific procedures often do. However, general cognitive strategies are applicable in a wide variety of problem-solving contexts across subject domains. For example, in the expert-novice research by Voss et al. (1983), most subjects divided the Soviet agricultural productivity problem into several subproblems and addressed them separately. Newell (1980) identified a variety of general cognitive strategies: generate and test, climb hill, search with heuristics, analyze means-ends, match, hypothesize and match, and satisfy constraints. Nickerson (1985) identified others: work backwards, test extreme cases, and set goal. Both experts and novices use general problem-solving strategies although the choices of strategies vary and utilization of strategies with domain-specific procedures differs.

The third dimension of metacognitive knowledge is cognitive self-management. In the context of the Soviet agriculture problem (Voss et al. 1983), expert problem solvers demonstrated their abilities to manage their thinking in several ways. First, after stating the problem, they did not immediately begin to generate solutions. Instead, they considered the context of the problem, historically or politically, and assessed various dimensions of the problem. Second, they evaluated their tentative solutions in terms of feasibility and probable effectiveness. Novices seldom did more than state solutions. Third, experts identified new subproblems or converted constraints to subproblems during the process of evaluating tentative solutions, which led to revision of their problem representations and to other solutions. There is nothing domain-specific about these problem-solving strategies; they could be used in solving any problem. They indicate the ability to manage one's own thinking (Bransford, Vye, Adams, and Perfetto 1989). Presumably, such metacognitive strategies could be taught to problem solvers.

To summarize, domain-specific knowledge is composed of declarative (i.e., propositional) and procedural knowledge. Aspects of this knowledge are organized as schemata (i.e., networks of ideas). The compcnents of the schemata are index entries for additional information stored in long-term memory. The relationships of the schemata serve to cross-reference knowledge in memory. Conditionalized knowledge, one aspect of metacognitive knowledge, enables one to access and apply domain-specific knowledge and problem-solving procedures (i.e., strong methods) in the context of problematic situations. General cognitive strategies, another aspect of metacognitive knowledge, enable problem solvers to structure problem-solving efforts and to identify tasks which domain-specific knowledge can help to accomplish. Cognitive self-management strategies, the third aspect of metacognitive knowledge, enable problem solvers to monitor and evaluate the effectiveness of their problem-solving efforts and to refocus those efforts when necessary. See Figure 2 for a schematic representation of this problem-solving process. If these kinds of knowledge are available to problem solvers, then their problem representations and solutions are likely to be effective.

Bounded Rationality and Collective Rationality

One's conception of human rationality affects one's conception of problem solving and the prospects for teaching people to solve problems systematically. Shulman and Carey (1984) articulated three alternative conceptions of human rationality: (1) humans as rational; (2) humans as boundedly rational; and (3) humans as collectively rational. The bounded nature of human rationality requires careful consideration of the social contexts in which people solve problems and learn to solve problems.

From the humans as rational perspective, a human thinks logically and acts consistently in terms of his or her own best interests. He or she perceives the world as it is and mentally represents it validly. A human makes mistakes due to incomplete information or logical errors; however, the capacity for rational thought and action increases with additional experience, knowledge, and intellectual skills.

The conception of humans as boundedly rational, that Herbert Simon (1957) articulated, depicts humans as creatures of more modest potential than the humans as rational perspective. As a boundedly rational being, a human has insufficient information processing and short-term memory capacities to formulate and solve most real-world problems. Consequently, a human constructs greatly simplified models of the world that necessarily omit much of the available data. A human thinks and acts rationally with these models, but the effectiveness of the actions is only moderate at best because of the reduced complexity of the models compared to the actual situations. These cognitive limitations, especially for novice problem solvers, make problem solving very difficult.

Shulman and Carey's (1984) conception of humans as collectively rational incorporated the boundedly rational perspective and developed the social context. Humans are boundedly rational; however, their individually insufficient information-processing and short-term memory capacities can be coordinated. Such coordination enables individuals to construct shared models of the world which are more valid than models the same people construct individually. Rational human thought and action based on cooperatively produced models tend to be more effective because the complexity of real-world situations is represented more adequately. From this perspective, a key element in teaching students to solve problems is to teach skills of cooperative problem solving and decision making.

If students are expected to work together cooperatively to manage effectively the limitations of bounded rationality and to solve problems, then they need to have some reason to cooperate. Considerable instructional research over the past twenty years has focused on cooperative learning groups. The findings of that research provide a basis for designing instructional groups to facilitate problem solving and to facilitate acquisition of knowledge and skills necessary to solve problems in a field.

According to Slavin (1983), two major dimensions of cooperative, instructional work groups are the incentive structure and the task structure. A group's incentive structure refers to the means by which students are motivated to perform their tasks. For example, rewards for performance can be distributed to individuals or to groups as a whole. Group members may or may not be held individually accountable for their contributions to the group's product. A group's task structure refers to the way in which the group's activities are organized to produce the group's product. For example, the task may be broken down into individual tasks for each group member to perform, or two or more group members may address the same task. Manipulation of the incentive and task structures of problem-solving groups can increase the likelihood that students work together in ways that coordinate their intellectual abilities, thus creating a collective rationality to solve a problem.

Two major features characterize effective cooperative instructional groups. First, the incentive structure is characterized by the distribution of group rewards under the condition that each individual member of a group is individually accountable to the group for his or her own performance (Slavin, 1983, p. 59). If each member is not held individually accountable for his or her own performance, then individual academic performance is usually lower. Since the group reward is a function of each group member's performance, group members tend to monitor each other's contributions to the group effort, encourage each other to perform well, and provide assistance to each other when needed (Slavin, 1983).

Second, the necessary individual accountability can be arranged in two ways through the task structure. One way is to require each member of the group to perform essentially the same task as all the other group members (i.e., an unspecialized task structure) and base the group reward on the sum of the group members' individual performances. For example, students in an instructional group state and represent a problem together. Then, they are individually evaluated to assess their understandings of the problem. Each individual receives an evaluation score and the group's reward is based on the sum of their evaluation scores. A second way that individual accountability can be arranged through the task structure is to require each group member to perform a different task than the other group members (i.e., a specialized task structure) and base the rewards, whether to the group or to individuals, on the coordination of the individual contributions into a whole. For example, students in an instructional group study different topics which they teach to each other prior to a test over all the topics. Each group member takes the test individually and receives an individual reward. The interdependence of the group members encourages cooperation, whether the reward is to the group or to the individuals. The possibility of collective rationality depends on creating both a sense of interdependence and individual accountability. Cooperative learning research provides some approaches which should be transferable to the teaching of problem solving.

PROBLEM-SOLVING INSTRUCTION CRITERIA

Criteria for developing and evaluating instructional programs designed to teach problem-solving and other higher-cognitive skills can be derived from the discussion of the types of knowledge needed for effective problem solving. An effective instructional problem-solving program should teach domain-specific knowledge and procedures in the context of solving problems. In addition to teaching basic historical and social scientific knowledge, students should be taught explicitly to develop schemata to organize their knowledge coherently to promote retention and to make that knowledge more accessible through the cross-referencing function of schemata (Bransford, Sherwood, Vye, and Rieser 1986). Evidence exists that knowledge acquired in the process of attempting to solve domain-specific problems is stored in long-term memory more effectively and is more accessible than knowledge acquired apart from problem-solving activities (Bransford, Franks, Vye, and Sherwood 1986). Using knowledge to solve problems highlights its relevance to problems and requires articulation of connections between various aspects of one's knowledge base.

Metacognitive knowledge and skills should be taught in the context of domain-specific instruction. Students should be taught explicitly how historical and social scientific ideas are related and when and how they can be used to solve civic and personal problems (Bransford, Vye, Adams, and Perfetto 1989). A critical aspect of conditionalized knowledge is the ability to perceive and categorize a problematic situation as a particular type of problem, for example, a productivity problem (Bransford, Franks, Vye, and Sherwood 1986). Such conditionalized knowledge is acquired through experience solving problems; however, explicit instruction facilitates the process.

General cognitive strategies can be fitted to domain-specific contexts. Problem solvers, including students, probably have preferred general strategies. Students will benefit by considering alternative strategies for different types of problems. For example, the general cognitive strategy advocated by the Joint Council on Economic Education (Saunders et al. 1984), is the satisfy constraints model, which is particularly useful when making a choice among a set of alternative actions to achieve a given goal. However, it is less useful when attempting to answer a question about the nature of the empirical world; the generate and test strategy is likely to be more effective.

Students also need to be taught to incorporate domain-specific knowledge and procedures into the general strategies (Perkins and Salomon 1989). For example, it is helpful to decompose the Soviet agriculture problem into political and productivity subproblems. However, if one does not perceive the relevance to the problem of one's knowledge and skills regarding productivity, problem solving is impeded seriously. Cognitive management skills should be taught explicitly. For example, students should be taught the benefits of exploring a problem's historical and contemporary social contexts and representing the problem in different ways (e.g., economic, political, sociological, technological) before formulating solutions.

Problem-solving performance responsibilities should be transferred systematically from the teacher to the student. One approach to this task is to provide students with practice using knowledge and procedures in a variety of contexts (Bransford, Vye, Adams, and Perfetto 1989). For example, productivity problems can be addressed in terms of personal problems, informal group decisions, business settings, and societal issues. A second approach is cognitive apprenticeship (Collins, Brown, and Newman In press; Nickerson 1988). Cognitive apprenticeship is a process of modeling skillful problem solving, coaching students as they attempt to solve problems using domain-specific knowledge and procedures as well as metacognitive knowledge and strategies, and decreasing the level of teacher guidance so that students have increasing responsibility for their problem-solving performance.

To summarize, seven criteria to assess the problem-solving quality of instructional programs in social studies education are derived from information-processing research on problem solving. In terms of domain-specific knowledge, to what extent do the programs (1) teach historical and social scientific content in the context of solving civic and personal problems and (2) teach schemata of the subject matter either directly or through student construction of schemata? In terms of metacognition, to what extent do the programs (3) conditionalize knowledge, (4) teach general problem-solving strategies, and (5) utilize historical and social scientific knowledge while implementing general problem-solving strategies? In terms of transferring problem-solving responsibility from teachers to learners, to what extent do the programs (6) provide practice in using particular subject matter knowledge and procedures in a variety of contexts and (7) model effective economic problem-solving behavior, coach students engaged in civic and personal problem solving, and gradually decrease teacher intervention in student problem solving?

An eighth criterion derived from research on cooperative learning is: To what extent are students organized into cooperative problem-solving groups to coordinate their intellectual resources and partially compensate for their limited individual information-processing capacities? Students who work in well-structured small groups are likely to represent problems more effectively, identify more potential solutions, and evaluate those solutions more thoroughly. Several students working on a problem together are less likely to lose track of important factors than individuals working alone. Not only are more information and perspectives available for evaluating solutions, opportunities for a productive division of labor occur. Certain group members can be assigned to play devil's advocates regarding particular solutions to prompt more thorough consideration of the consequences. A problem-solving group can debate the merits of proposed solutions. In these kinds of discussion, solutions are likely to be tested more thoroughly than they would be by individuals working alone, and problems in implementing the solutions are more likely to emerge.

In order to establish individual student accountability, create a specialized task structure by assigning certain functions to particular students to perform (Cohen 1986). Consider the following examples: assign students special responsibilities for certain intellectual tasks, assign constraints in a problem situation to different students who can look at the problem and proposed solutions in terms of specific constraints, and assign subproblems to one or two students for special consideration and research. Students with special responsibilities for a constraint or subproblem can teach other group members about their special responsibilities and keep those factors effectively available for group consideration as needed. Summarizing responsibilities can be assigned to and rotated among group members as well.

Promote both interdependence and individual accountability by creating an incentive structure that incorporates periodic evaluation throughout the problem-solving process. For example, if subproblems have been assigned to different members of a group, then each group member can teach what he or she has learned about a subproblem to the rest of the group. Evaluate students' understanding and distribute a group reward to each problem-solving group based on the sum of individual test performances to promote conscientious teaching by students and attention to each other. Alternatively, require students to write brief essays on their respective subproblems. After evaluation, a group reward based on the sum of the individual performances should be distributed. These incentive structures assume that teams receive recognition and status based on their team performances (Slavin, 1986).

CRITIQUES OF INSTRUCTIONAL PROBLEM-SOLVING PROGRAMS

Economic Reasoning Model: Joint Council on Economic Education. The Joint Council on Economic Education articulated a model for economic reasoning with suggestions for teaching it in a major publication, A Framework for Teaching the Basic Concepts (Saunders, et al., 1984), first published in 1977 and then revised in 1984. The model is composed of five major components. "(1) State the problem or issue. (2) Determine the personal or broad social goals to be attained and used as evaluative criteria. (3) Consider the principal means of achieving these goals. (4) Select the economic concepts needed to understand the problem and use them to appraise the merits of each alternative.

(5) Decide which alternative best leads to the attainment of the most goals or he most important goals" (Saunders et al., 1984, pp. 6-7). Several million dollars have been spent on implementing the model through several sets of instructional materials: Trade-offs (Agency for Instructional Television, 1978), Give & Take (Agency for Instructional Television, 1982), and Income-Outcome$ (Agency for Instructional Technology, 1986). The following summary critique of the economic reasoning model is based heavily on evaluations of those three video and computer-assisted instruction series.

Teach historical and social scientific knowledge in the context of problem-solving tasks. The JCEE does not recommend specifically that economic knowledge be taught in the context of problem-solving tasks. However, it strongly recommends that students apply economic knowledge to making economic decisions. In practice, economic ideas often are presented in the context of solving problems. Approximately 70% of the episodes and computer programs in the Trade-offs, Give & Take, and Income-Outcome$ series do so.

Teach students to construct or acquire schemata that coherently link historical and social scientific knowledge internally and with personal, civic, and subject matter problems. Again, the JCEE does not explicitly recommend that schemata be used in problem-solving instruction. However, schemata are presented occasionally in JCEE instructional materials to clarify relationships between concepts, principally in the forms of models of the circular flow of economic activity and supply/demand graphs. The use of schemata is not an explicit part of the economic reasoning model.

Teach students to recognize the relevance and use of historical and social scientific knowledge in solving particular kinds of personal, civic, and subject matter problems (ie., conditionalize knowledge). Conditionalizing knowledge is not part of the JCEE economic reasoning model or the recommended instructional procedures. Numerous examples and settings (eg., business, school, family) are used to teach economic concepts and principles, particularly in the Trade-offs series. However, students are not required to articulate conditionalized knowledge.

Explicitly teach general cognitive strategies to guide students' problem solving and to facilitate their application of historical and social scientific knowledge. The economic reasoning model, outlined above, is an example of the "satisfy constraints" general problem-solving model. This general cognitive decision-making strategy is featured in most JCEE instructional materials and is especially appropriate for analyzing policy issues. However, its operationalization in instructional materials is highly variable. It was heavily emphasized in Trade-offs, introduced but used little in Give & Take, and emphasized but confused with another general strategy, the "generate and test" model, in Income-Outcome$.

Utilize in-depth historical and social scientific knowledge while teaching students a general problem-solving strategy. The JCEE presents examples in A Framework for Teaching the Basic

Concepts (Saunders et al., 1984) in which several substantive concepts are used simultaneously in applying the economic reasoning model. However, in practice the application of the economic reasoning model tends to be content thin, that is, only one economic idea must be applied with no increasing levels of sophistication. For example, in the Trade-offs series, four episodes focus on productivity with individual episodes devoted to problems involving particular ways to increase productivity (ie., specialization, capital investment, education and training). Students are never required to solve a productivity problem in which alternative means of increasing productivity must be compared and evaluated. The clear goal is to integrate economic knowledge with the economic reasoning model; however, the materials tend not to require that integration.

Provide students with opportunities to use the general strategies and historical and social scientific knowledge in a variety of settings (eg., personal, business, school, community). In the JCEE material reviewed, there are insufficient opportunities to use particular economic knowledge repeatedly in solving problems in various settings. Trade-offs does a fair job in providing alternative settings (eg., productivity applications) but Give & Take and Income-Outcome$ do not. The JCEE recommends that students use the economic reasoning model frequently to develop skill; however, there is no similar recommendation regarding the repeated use of economic ideas.

Systematically transfer responsibility for problem solving from teachers to students through a sequence of modeling, coaching, and fading. Modeling, coaching, and fading are not an explicit part of the instructional recommendations for teaching the economic reasoning model. Trade-offs does a fair job of modeling and coaching (six of fifteen episodes), but Give & Take and Income-Outcome$ do not. The JCEE does not present or apparently utilize any particular set of conditions that must be met for transfer of knowledge and skill to occur.

Organize students into cooperative problem-solving groups to coordinate their intellectual resources and partially compensate for their limited individual information-processing capacities. Cooperative problem-solving groups are not discussed in any way. Whole class discussion is recommended and small group work with computers is assumed, but no recommendations are made for structuring these interactions to promote particular intellectual operations or kinds of interaction. The use of decision-making charts is an acknowledgement of students' limited information-processing capacities; however, social interaction and group decision making are presumed to be sufficiently productive without special effort.

Beyer's Thinking Skills Program

Barry Beyer, long an advocate and developer of social studies instruction for higher-cognitive thinking skills, has conceptualized and operationalized a multi-grade, school-wide thinking skills program in two books, Practical Strategies for the Teaching of Thinking (1987) and Developing a Thinking Skills Program (1988). Beyer's program requires the articulation of various thinking skills (ie., strategies, critical thinking skills, and micro-thinking skills) in terms of their cognitive and metacognitive operations, knowledge related to their use, and personal dispositions needed to apply the operations effectively. The instructional framework he recommends has six phases: (1) introduction, (2) guided practice, (3) independent application, (4) transfer and elaboration, (5) guided practice, and (6) autonomous use. The program is developed much more thoroughly than the economic reasoning efforts of the Joint Council on Economic Education.

Teach historical and social scientific knowledge in the context of problem-solving tasks. Beyer asserts that problem-solving skillfulness and other higher-cognitive skills can lead to more effective learning of subject matter knowledge. However, he explicitly recommends that problem-solving and other higher-cognitive skills be introduced and taught with little subject matter. If students must learn or work with considerable subject matter while learning an intellectual skill, he asserts that they will be distracted from the skill and will not learn it well. According to Beyer, higher-cognitive skills and substantial amounts of subject matter should not be taught at the same time.

Teach students to construct or acquire schemata that coherently link historical and social scientific knowledge internally and with personal, civic, and subject matter problems. Beyer discusses subject matter knowledge only tangentially in his books. The organization of knowledge for teaching or learning is not systematically addressed; there is no mention of schemata although he occasionally uses them in the books.

<u>Teach students to recognize the relevance and use of historical and social scientific knowledge in solving particular kinds of personal, civic, and subject matter problems (ie., conditionalize knowledge)</u>. Again, the utility of subject matter knowledge for problem solving is not systematically addressed. However, Beyer recommends that students be taught to understand the utility of specific higher-cognitive skills and to recognize situations when they can be usefully applied. In Beyer's scheme, intellectual skill knowledge is conditionalized, but conditionalization of subject matter knowledge is not addressed.

<u>Explicitly teach general cognitive strategies to guide students' problem solving and to facilitate their application of historical and social scientific knowledge</u>. Beyer definitely recommends that general cognitive strategies should be taught explicitly. He identifies three general "strategies": problem solving, decision making, and classifying. However, he briefly refers to various "weak" problem-solving methods; they are treated somewhat as "sub-strategies." Beyer clearly focuses on the students' general application across subject fields of various intellectual procedures of varying scope (eg., strategies vs. micro-thinking skills).

<u>Utilize in-depth historical and social scientific knowledge while teaching students a general problem-solving strategy</u>. Beyer does not systematically discuss teaching students to use specific subject matter knowledge with particular higher-cognitive strategies. He expects that improved thinking skillfulness will enable students to work with subject matter in

increasingly sophisticated and substantive ways. However, he does not illustrate this or make specific recommendations. He observes that subject matter can alter the application of intellectual skills and consequently refine them and increase their utility. Again, he provides no illustrations. The unarticulated linkages between thinking skills and subject matter knowledge is a weak dimension of Beyer's program.

Provide students with opportunities to use the general strategies and historical and social scientific knowledge in a variety of settings (eg., personal, business, school, and community). Beyer emphasizes that students must use higher-cognitive skills repeatedly over time in order to develop adequate levels of skillfulness, understanding, and transferability. However, he does not systematically discuss different settings.

Systematically transfer responsbility for problem solving from teachers to students through a sequence of modeling, coaching, and fading. Beyer recommends a systematic process of transferring responsibility for the use of higher-cognitive skills from teachers to students. Beyer observes that people do not transfer their knowledge and skill easily or efficiently and that extensive instructional effort is needed to enable students to utilize their new-acquired thinking skills in more than one subject area and in out-of-school contexts. Beyer's instructional framework is designed with this difficult transfer task clearly in mind: introduction, guided practice, independent application, transfer and elaboration, guided practice, and autonomous use. The framework is consistent with the criterion derived from the problem-solving research.

Organize students into cooperative problem-solving groups to coordinate their intellectual resources and partially compensate for their limited individual information-processing capacities. Beyer does not discuss the use of student groups in learning and utilizing higher-cognitive skills. Whole class discussion is assumed and small group work is acceptable; however, there are no recommendations regarding how to structure student interaction.

Jurisprudential Model

The jurisprudential approach to social studies education in secondary schools was developed at Harvard University in the late 1950s and early 60s (Oliver and Shaver, 1966). The approach asserts that the multicultural nature of our society and our form of representative democratic government guarantee that public conflict and political controversy will dominate as a major feature of our collective lives as citizens. Since the central purpose of social studies is preparation for citizenship, the approach was promoted as a missing essential ingredient in traditional secondary social studies courses.

The jurisprudential approach to the resolution of public issues offers an analytical model composed of a conceptual framework and several intellectual processes designed to facilitate the development of thoughtful dialog on public issues. The development of the analytical model and its trial implementation resulted in a set of high school curriculum materials known as the Harvard Social Studies Project. These curriculum materials were intended to be infused into existing middle and high school history, government, and problems of democracy classes in order to foster improved preparation for the public issues demands of citizenship in our modern democracy. The following is an analysis of how well the jurisprudential approach and materials meet the eight criteria for effective problem solving instruction derived from recent research on cognitive psychology and cooperative learning.

Teach historical and social scientific knowledge in the context of problem-solving tasks. The jurisprudential approach rates high on this criterion. Efforts to promote critical thinking about public issues are apparently always grounded in either recent or distant historical events (eg., the Civil Rights struggles of the 1960s, Boston Tea Party, the Trail of Tears). In addition, social science concepts are not only heavily used as analytical tools but they are also explicitly identified in the issues being considered.

Teach students to construct or acquire schemata that coherently link historical and social scientific knowledge internally and with personal, civic, and subject matter problems. The explicit use of schemata is wholly neglected by the jurisprudential approach despite the fact that its major purpose is to promote critical thinking about public issues based on an analytical model designed to help students analyze issues' ethical/moral values basis, definitions of terms, and factual support. Students, however, are apparently never explicitly taught the analytical model, but are supposed to learn it by using it repeatedly to frame and dissect political issues. The concepts and processes of the model are never augmented by the use of diagrams, webs, or other graphic means of depicting interrelationships or organizing the meanings generated through the use of the analytical model.

Teach students to recognize the relevance and use of historical and social scientific knowledge in solving particular kinds of personal, civic, and subject matter problems (i.e., conditionalize knowledge). The whole point of Oliver and Shaver's jurisprudential approach is the internalization of the analytic model for future citizenship use. "Instruction was aimed at teaching the students to apply the analytic model to a series of controversial cases embedded in broader societal issues, organized largely on a topical basis" (Oliver and Shaver, 1966, p. 255). Despite the aim of teaching for transfer, it appears from their research that students had difficulty integrating the analytical model into their normal mode of thinking and applying it to new complex issues. Students generally did not perceive the basic value issues that recur over time in the context of specific public issues (Oliver and Shaver, 1966, p. 272).

Explicitly teach general cognitive strategies to guide students' problem solving and to facilitate their application of historical and social scientific knowledge. The jurisprudential approach is primarily concerned with the clarification of evaluative and legal issues. To do this , the student is taught how to go about clarifying value commitments, how to justify a value position, how to handle problems with definitions, and how to judge a factual claim (Oliver & Shaver, 1966 p.115-6). These operations, taken together, forma strategy for analyzing historical and contemporary public issues.

Utilize in-depth historical and social scientific knowledge while teaching students a general problem-solving strategy. Specific historical cases, social scientific concepts (eg., social status) and principles of U.S.Government are always used in the instructional procedures and materials for teaching the jurisprudential approach.

Provide students with opportunities to use the general strategies and historical and social scientific knowledge in a variety of settings (eg., personal, business, school, community). Oliver and Shaver restrict the jurisprudential model to the analysis of public issues. Within this domain students apply the model and key historical and social science ideas to various historical and contemporary political problems.

Systematically transfer responsibility for problem solving from teachers to students through a sequence of modeling, coaching, and fading. There is no built-in attempt to try to transfer responsibility for the use of the analytical model through such techniques as modeling, coaching, or fading.

Organize students into cooperative problem-solving groups to coordinate their intellectual resources and partially compensate for their limited individual information-processing capacities. Curriculum materials modeled on the jurisprudential approach appear to be oriented toward whole group instruction. Teachers could modify the nature of the assignments and the reward system to incorporate cooperative learning techniques but this has not yet been done.

Conclusion

Recent developments in the field of cognitive psychology, particularly in the area of information processing, have shed light on the way in which people think in order to make decisions and solve problems. In addition, cooperative learning research has provided evidence of the effectiveness of cooperatively structured group work aimed at problem solving.

Based on these recent developments in cognitive psychology and cooperative learning, a set of criteria were derived for designing and evaluating problem solving and decision-making instruction. The criteria urge educators to teach domain specific knowledge and procedures as an integral part of solving problems. That is, work with students to solve problems which are posed as a part of the introduction of significant subject-relevant content. The criteria also remind us to use metacognitive strategies, such as general cognitive strategies and thinking about how you are thinking, in order to help students learn to recognize when their newly acquired strategies and knowledge may be applied. Finally, the criteria urge educators to make full use of the model-coach-fade framework and the power of cooperative learning strategies in order to improve the potential of all students acquiring the skills and information and being able to transfer their new learning to a variety of new situations.

The analyses of the Joint Council on Economic Education's instructional programs, Barry Beyer's work on critical thinking, and Oliver and Shaver's jurisprudential approach to teaching public issues showed that our field's best efforts to teach higher order thinking lack some of the qualities posed by the criteria. The use of the criteria expose shortcomings which, in many cases, might be easily remedied. A task for the future is to build upon and refine existing programs and approaches to incorporate all of the features implied by the criteria. Until this is done, social studies will not have adequately tested the limits of its potential to develop the higher level thinking skills of our nation's future citizens.

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Figure 1
Investment-Productivity Schema

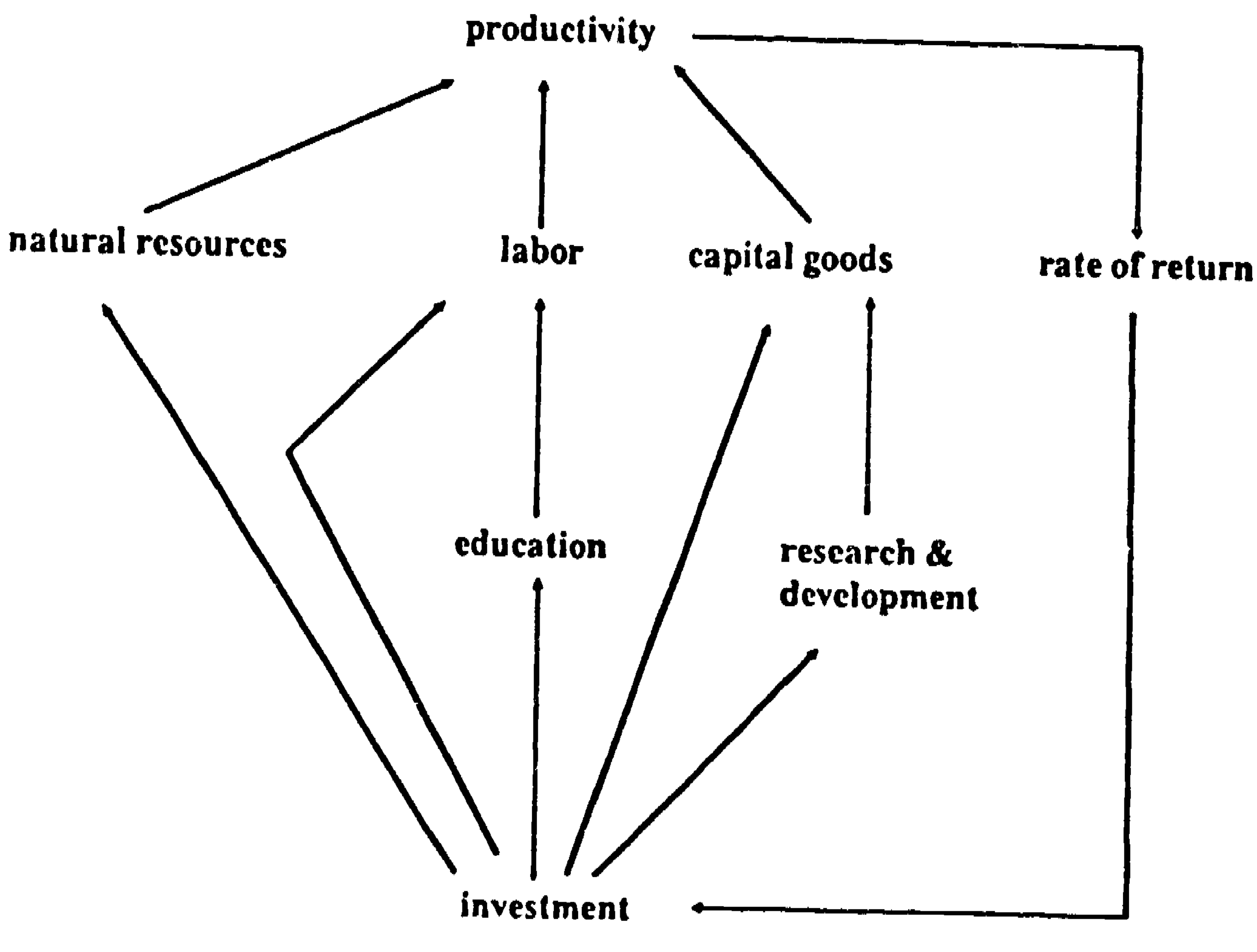

Figure 2

Knowledge for Problem Solving