Defining Higher Order Thinking
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TEACHERS are being asked to develop more than the basic skills in their classrooms. The variety of labels for these new goals—higher order thinking, critical thinking, problem solving, rational thought, and reasoning—are confusing. Commenting on the confusion, Cuban (1984) notes, “Defining thinking skills, reasoning, critical thought and problem solving is troublesome to both social scientists and practitioners. Troublesome is a polite word; the area is a conceptual swamp” (p. 676). Unfortunately, little progress has been made in clearing up the “conceptual swamp” since Cuban made his statement.

In this article, the focus is on defining higher order thinking and differentiating it from other terms, particularly critical thinking and problem solving. A definition is derived from an investigation of three arenas that contribute to an understanding of higher order thinking: (a) the differing perspectives by philosophers and psychologists as to the nature of higher order thinking; (b) attempts to differentiate lower order and higher order thinking; and (c) a delineation of the relationship between critical thinking and problem solving and what that means in terms of higher order thinking.

Perspectives of Philosophers and Psychologists

Every discipline uses higher order thinking to add to its store of knowledge. However, two disciplines have contributed in special ways to our understanding of higher order thinking: philosophy and psychology. The two disciplines are very different. Their differences extend beyond terminology; they have diverse views regarding such fundamental ideas as the nature of “truth”—how it is defined and how it is found. In a sense, they are reflective of the two cultures identified by C.P. Snow (1964)—the humanities and the sciences—with philosophy associated with the humanities and psychology with the sciences. This diversity has enabled each field to make a significant contribution to the field of higher order thinking.

The contribution of philosophy to higher order thinking extends from the time of Socrates, Plato, and Aristotle. Socrates challenged the “loose” thinking of the youth of his day by asking such questions as: “What is the evidence?” and, “If this is true does it not follow that certain other matters are true?” Since that time, philosophers have believed that critical thought could be used as a moral force to promote the good. Resnick (1987) describes the nature of current philosophical contributions: “Philosophers promote an approach designed to discipline thinking and to guard against the propensities of humans to accept fallacious arguments and draw inappropriate conclusions” (p. 30).

The application of critical thought to pedagogy in our schools was given a major impetus in the middle of this century. According to Cuban (1984), “The work of B.O. Smith in the 1950s and subsequently,
Robert Ennis, have provided a scholarly rationale and specific ingredients for designing school programs to develop critical thought” (p. 670).

The Philosophy for Children Program, developed by Matthew Lipman, represents one way to introduce critical thinking skills. A basic assumption underlying the program is that when philosophical issues are stated in terms that children understand, rather than in the formal jargon of the professional philosopher, children find them intrinsically interesting (Nickerson, Perkins, & Smith, 1985, p. 281). In Lipman’s program, fifth and sixth grade children read and discuss a set of novels. Through these activities, students are encouraged to develop philosophical reasoning skills including commitments to impartiality and objectivity, relevance, consistency, and the search for defensible reasons for behavior.

While Lipman’s program is designed especially to be added to the curriculum, other philosophers incorporate critical thinking into the existing curriculum. For example, Paul, Binker, & Weil’s Critical Thinking Handbook (1990) helps K-3 teachers re-model their lesson plans in language arts, social studies, and science in order to incorporate critical thinking. (Similar handbooks are available for teachers in grades 4-6, 6-9, and high school.) “Critical thinking,” according to Paul et al., “is disciplined, self-directed thinking which exemplifies the perfections of thinking appropriate to a particular mode or domain of thought” (p. 361). Paul identifies the following perfections of thought: clarity, precision, specificity, accuracy, relevance, consistency, logic, depth, completeness, significance, fairness, and adequacy (p. 361).

Whereas the field of philosophy has grown through discourse and argumentation, the field of psychology has evolved from a tradition of experimentation and research. While philosophers are basically interested in the use of logical reasoning and perfections of thinking to decide what to believe and do, psychologists are more concerned with the thinking process and how this process can help people make sense out of their experience by constructing meaning and imposing structure. Psychologists emphasize problem solving rather than reflective thinking and logic.

How are the findings of psychologists translated into school programs? One illustration is the work of the National Council of Teachers of Mathematics (NCTM) Commission on Standards for School Mathematics (1989). Their report states: “Problem solving must be the focus of school mathematics” (p.8). They stipulate:

A genuine problem is a situation in which, for the individual or group concerned, one or more appropriate solutions have yet to be developed. The situation should be complex enough to offer challenge but not so complex as to be insoluble. (p. 10)

Elsewhere in the NCTM Commission report, “genuine problems” are referred to as “non-routine.” These problems differ from routine problems or exercises found in mathematics textbooks, where the problem solver knows an algorithm that, when applied, will certainly lead to a solution (Kantowski, 1977, p. 163).

The NCTM Commission adds an additional goal associated with higher order thinking: “Learning to reason mathematically—Making conjectures, gathering evidence, and building an argument to support such notions are fundamental to doing mathematics” (p. 6). The commission urges teachers to reward demonstrations of good reasoning even more than students’ ability to find correct answers (p. 6).

The problem solving strategies derived from psychology and the disciplined thinking represented by philosophical thought both contribute to achieving the goal of learning to reason. However, while each of these skills is necessary, neither is sufficient for a comprehensive understanding of higher order thinking.

Lower and Higher Order Thinking Skills

Is there a difference between lower order and higher order thinking skills? There is general agreement that lower order and higher order thinking skills can be distinguished. However, differences in a learner’s history may mean that a situation that requires higher order thinking by one person may need only lower order thinking by another person. Furthermore, in the classroom, the teaching of basic and higher order thinking skills are likely to be interwoven.

Higher order and lower order thinking have been described in different ways. Maier (1933, 1937) used the terms reasoning or productive behavior in contrast with learned behavior or reproductive thinking. He demonstrated experimentally that the two are qualitatively different types of behavior patterns. Learned behavior, he found, came from contiguous experiences with previous repetitions of the relationships involved
in the learned behavior pattern. Learning the multiplication tables through repeated practice would be an illustration of learned behavior. However, behavior integrations that are made up of two or more isolated experiences are qualitatively different: They arise without previous repetitions and consequently are new. This constitutes "reasoning."

For example, assume a child knows the formula for the area of a rectangle but does not know how to compute the area of a parallelogram. If the child can see how to "convert" a parallelogram to a rectangle of the same area and thus "discover" the formula for the area of a parallelogram, then he or she will have been involved in what Maier calls reasoning. "In order for the term reasoning to have any value, it should designate a process which is not only qualitatively different from learning, but a process of a higher order" (1937, p. 365).

Reasoning, as defined by Maier, is used to solve problems. For Maier (1933), a problem arises when behavior is blocked because a desired end is not at once attainable. According to Maier, the solution of such problems is finding a pattern consisting of parts of past experience that have become integrated. Sometimes finding a solution pattern may require a spontaneous combination of isolated experiences that may never have been previously associated. In such a case, Maier would say, the problem is solved by reasoning or productive thinking. When the solution pattern is made up of past experiences that have been associated, such as recalling an algorithm, then, according to Maier, the problem is solved by reproductive thinking (p. 144). Maier's definitions of reproductive and productive thinking provide a useful distinction between lower order and higher order thinking.

Bartlett (1958), who also distinguishes lower from higher order thinking, gave further definition to higher order thinking. He extends the idea of integrating past experience by using the term gap filling. Thinking, he believes, involves one of three gap-filling processes: interpolation (the filling in of information that is missing from a logical sequence), extrapolation (extending an incomplete argument or statement), and reinterpretation (rearrangement of information to effect a new interpretation). Bartlett defines thinking as "the extension of evidence in accord with that evidence so as to fill up gaps in the evidence: and this is done by moving through a succession of interconnected steps" (p. 75).

According to the Commission on Science Education of the American Association for the Advancement of Science, problem solving activity consists of basic and integrated processes. The basic processes include observing, measuring, inferring, predicting, classifying, and collecting and recording data. The integrated processes include interpreting data, controlling variables, defining operationally, formulating hypotheses, and experimenting. These processes form a hierarchy so that effective use of the integrated processes requires utilization of the basic processes. The integrated processes, with the exception of experimenting, have been defined as problem solving skills by Gagné (Shaw, 1983). The basic processes provide the data or the experiences that the problem solver needs to manipulate and integrate in order to solve a problem. The hierarchy represented by the basic processes and the integrated processes used by the Commission on Science Education suggests a difference between lower order and higher order thinking skills.

Although Resnick (1987) believes higher order thinking skills can be recognized (pp. 2, 3), she shows how basic and higher order skills may be interwoven in the teaching process. Resnick's review of the research demonstrates that higher order thinking skills—"elaborating the given material, making inferences beyond what is explicitly presented, building adequate representations, analyzing and constructing relationships"—are involved in even the most apparently elementary mental activities (p. 45). For example, in order for children to understand what they read, they need to make inferences and use information that goes beyond what is written in the text. Thus the teaching of reading involves an interweaving of basic and higher order thinking skills.

Newman (1990) distinguishes between lower and higher order thinking. His definitions were derived from observations in classrooms and interviews with teachers and department chairs in five high schools selected because of their departmental efforts to emphasize higher order thinking in social studies classes. From this experience he concludes that lower order thinking demands only routine or mechanical application of previously acquired information such as listing information previously memorized and inserting numbers into previously learned formulas. In contrast, higher order thinking, according to Newman, "challenges the student to interpret, analyze, or manipulate information" (p.44). Note the similarity
between Newman’s definition of lower order thinking and Maier’s definition of reproductive thinking; note also the similarity between Newman’s definition of higher order thinking and Maier’s definition of productive thinking.

Newman makes the important point that since individuals differ in the kinds of problems they find challenging, higher order thinking is relative—a task requiring higher order thinking by one individual may require only lower order thinking by someone else. Accordingly, “to determine the extent to which an individual is involved in higher order thinking, one would presumably need to know something about the person’s intellectual history” (p. 45).

The relative nature of higher order thinking is recognized in the NCTM Commission’s (1989) report when they stipulate that a “genuine problem is a situation in which for the individual or group concerned, one or more appropriate solutions have yet to be developed” (p. 10). Thus, to return to an earlier illustration, a child who knows the formula for the area of a rectangle but does not know the formula for the area of a parallelogram would be confronted with a genuine problem if asked to find the area of a parallelogram, while the child who knows the formula for the area of a parallelogram would be confronted by an exercise but not a problem when asked the same question.

In sum, there is a difference between lower and higher order thinking. While the two may be taught together in the classroom, for a given individual the need to use higher order thinking will depend upon the nature of the task and the person’s intellectual history.

**Critical Thinking and Problem Solving**

Inconsistent use of the term critical thinking has contributed to the confusion surrounding the definition of higher order thinking. Critical thinking has been assigned at least three distinct meanings: (a) critical thinking as problem solving, (b) critical thinking as evaluation or judgment, and (c) critical thinking as a combination of evaluation and problem solving.

In the past, critical thinking was used by some writers as synonymous with problem solving. For example, Kemp (1963) used a definition of critical thinking that made reference to five abilities associated with problem solving (p. 321). These same problem solving abilities were used by a committee that designed the evaluation of critical thinking as a part of the American Council on Education cooperative study of evaluation in general education (Allen & Rott, 1969).

More recently, critical thinking and problem solving have been differentiated. Beyer (1985), in an article entitled “Critical Thinking: What is It?” claims that “specialists today appear to agree that critical thinking is the assessing of the authenticity, accuracy and/or worth of knowledge claims and arguments” (p. 271). Beyer concludes his article by stating: “Critical thinking is not problem solving. It is not a cover-all term for all thinking skills” (p. 276).

Probably the most common usage, particularly among philosophers, has been to equate critical thinking with evaluation and judgment. For example, B.O. Smith emphasized the judgmental dimensions of critical thinking, that is, what a statement means and whether to accept or reject it. Robert Ennis elaborated on Smith’s definition by classifying critical thinking into the skill clusters of “clarifying issues and terms, identifying components of arguments, judging the credibility of evidence, using inductive and deductive reasoning, handling argument fallacies, and making value judgments” (Quellmalz, 1987, p. 88). Note that all of these skill clusters are evaluative in nature.

Defining critical thinking as both evaluation of statements and problem solving is becoming increasingly common. Ennis, a major contributor to the field of critical thinking as evaluation, broadened his definition of critical thinking in the mid-1980s. In the 1981 yearbook of the National Society for the Study of Education, Ennis presents an outline of a conception of rational thinking that “combines creative thinking, critical thinking and problem solving—all skills that are thoroughly interdependent in practice” (Ennis, 1981, pp. 145-146). Note that in this definition Ennis separates critical thinking and problem solving while pointing out their interdependence in practice. In 1987, however, Ennis appears to include problem solving in his definition of critical thinking. He writes: “Critical thinking is reasonable, reflective thinking that is focused on deciding what to believe or do” (Ennis, 1987, p. 10).

Ennis goes on to point out that his definition does not exclude creative thinking. He states that formulating hypotheses, considering alternative ways of
viewing a problem, posing questions, considering possible solutions, and making plans for investigating something are creative acts that would be included in his definition. Although Ennis does not use the term problem solving in his definition of critical thinking, he refers to the usual steps in problem solving as creative acts which are a part of his definition.

Ennis explains that he abandoned his narrower definition of critical thinking “because, although it provides more elegance in theorizing, it does not seem to be in accord with current usage” (Ennis, 1987, p. 11). The importance of usage is evident in the fact that by 1987 three states (California, Connecticut, and New Jersey) had incorporated critical thinking components in their state competency testing programs. Those responsible for such an inclusion were probably thinking of critical thinking in a broader sense than evaluation of statements.

While critical thinking is being equated with problem solving through “common usage,” Facione (1984) developed a theoretical conception of critical thinking that incorporates evaluation and problem solving. Starting with a classical definition of argument as a set of statements, one of which (the conclusion) is presented as implied or justified by the others (the premises), Facione concludes that it is possible to evaluate critical thinking by evaluating the adequacy of the arguments that express that thinking. From this conclusion, Facione proposes an operational understanding of critical thinking: “Critical thinking is the development and evaluation of arguments” (p. 259).

What is new is that Facione defines critical thinking as an active process involving constructing arguments, not just evaluating them. Facione states that constructing arguments includes the usual steps of problem solving: determining background knowledge, generating initially plausible hypotheses, developing procedures to test these hypotheses, articulating an argument from the results of these testing procedures and evaluating the arguments and, where appropriate, revising the initial hypotheses. According to Facione, “Learning argument construction means learning the methodologies that generations of researchers have refined for the specific needs of each discipline” (p. 259).

Whereas Ennis and Facione include problem solving in their use of the term critical thinking, others do not. For example, B.O. Smith, Ennis’s colleague in developing the field of critical thinking, continued to prefer the term higher order thinking, with critical thinking and problem solving being components of separate domains. From an analysis of research studies, Smith and others identified a series of domains of teaching embodied in what they designated as higher order thinking (see Underbakke, Borg, & Peterson, this issue). One domain involves thinking associated with the analysis of arguments. Smith (1991) states, “When this thinking is done in a reasonable reflective manner it may be called critical thinking” (p. 3). A separate domain involves thinking related to problem solving.

**Definition**

The foregoing discussion may help the reader see why Cuban (1984) referred to the defining of thinking skills, reasoning, critical thought, and problem solving as a conceptual swamp. Given the conceptual problems in the field, it is difficult to merge the philosophical base and the psychological base. As a result, the sciences and mathematics are for the most part utilizing a scientific problem solving approach and the humanities are primarily using critical thinking in the evaluative sense. But all disciplines need both types of thinking skills.

For example, increasingly physicians, who have received a rigorous training in the scientific method of problem solving, find themselves confronted with ethical problems that require skill in critical thinking for their resolution. For another example, teachers of social studies need to help students develop the ability to critically evaluate the accounts of historians. They also need to help students develop the ability to generalize and form hypotheses based on relevant data—a problem solving skill. Thus there is the need to develop a conceptualization that will encompass both problem solving and critical thinking in the evaluative sense.

While, as noted earlier, “critical thinking” is coming into common usage, the use of the term to encompass the thinking skills of critical thought and problem solving would not be acceptable to at least some psychologists. Russell (1965) states, “From the psychological point of view, critical thinking is the most dubious of the six labels by which I am attempting to summarize research in thinking” (pp. 374-375).

More recently, Benderson (1990) notes that both philosophers and psychologists have come to view
the teaching of thinking as their own special skill, but their perspectives and their language are intrinsically different. "Philosophers stress the need for critical thinking, while psychologists prefer the term thinking skills" (p. 2). Benderson goes on to quote the psychologist Irving E. Sigel: "I don't like the term 'critical thinking' because it gets confused with literature and critiquing" (p. 3).

Even if psychologists were willing to have their work incorporated under the rubric of critical thinking, would philosophers welcome psychologists and scientists into what has historically been their domain? One indication might be a demographic analysis of presenters at the Tenth Annual Conference on Critical Thinking and Educational Reform held in 1990 under the auspices of the Center for Critical Thinking and Moral Critique. This highly regarded annual conference offered over 300 sessions and was attended by more than 1,200 participants. The position titles of the presenters indicated that 37 were teachers of philosophy, 33 were teachers of English, and 26 were teachers in such fields as art, history, music, political science, sociology, and social sciences. There were eight psychologists, two science teachers, and one mathematics teacher who made presentations. Judging from the titles of the sessions, very few, if any, were devoted to reporting on research studies. In this major conference, the narrow definition of critical thinking as evaluation and judgment was exemplified, not the broader definition advocated by Ennis and Facione. This would suggest that "critical thinking" remains the domain of philosophers.

Therefore, a broader term than critical thinking is needed to include problem solving, critical thinking, creative thinking, and decision making. The term higher order thinking is proposed here as such an encompassing term. A clear and comprehensive definition of higher order thinking has the potential to help educators transcend the split between the sciences' "problem solving" and the humanities' "critical thinking." To this end, the following definition is offered: Higher order thinking occurs when a person takes new information and information stored in memory and interrelates and/or rearranges and extends this information to achieve a purpose or find possible answers in perplexing situations. A variety of purposes can be achieved through higher order thinking as defined above. These would include: deciding what to believe; deciding what to do; creating a new idea, a new object, or an artistic expression; making a prediction; and solving a nonroutine problem.

This definition utilizes insights from psychology going back to Maier's work and including Bartlett's concept of "gap filling" through interpolation, extrapolation, and reinterpretation of information. Critical thinking in the evaluative sense is included in this definition. Suppose, for example, a student is given a statement that presents an argument. In deciding whether or not to believe the argument, the student would need to examine the information given—the claims, the grounds (premises or evidence)—and, based on her or his own experience or information, make judgments regarding such questions as: the reliability of the evidence presented, the possible use of fallacies in the language used, and the appropriateness of the logic applied.

Implications for the Classroom Teacher

The definition of higher order thinking used in this article has several implications for classroom teachers:

1. Learning to be effective in higher order thinking is important for everyone; it is not a frill, nor is it a skill that only "gifted children" can or need to develop. Any time an individual is faced with a perplexing situation or a situation where it is necessary to decide what to believe or do, higher order thinking is necessary.

2. Whether or not an activity requires higher order thinking will depend upon the intellectual history of the learner. If it is possible for a learner to achieve his or her purpose through the recall of information and without a need to interrelate or rearrange this information, then higher order thinking does not occur.

3. In order to evaluate students' higher order thinking skills, it is necessary to present them with a situation or a question that cannot be answered through simple recall of information.

4. The teaching of basic and higher order skills may be closely interwoven in the classroom.

5. Helping children with learning difficulties to develop skills in higher order thinking may be especially important. Research suggests that failure to cultivate aspects of higher order thinking skills may be the source of major learning difficulties even in elementary school (Resnick, 1987, p. 8).

It is not safe and hence not desirable to assume that teachers know, or have been taught, how to teach...
higher order thinking skills. Research is needed on how to teach such skills and how to incorporate the findings from that research into inservice and preservice preparation programs. A clearly delineated definition of higher order thinking is needed in order to develop appropriate research strategies. It is hoped this article will provide an impetus for dialogue leading to this greater clarification.

References