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Metacognition: A Bridge Between Cognitive Psychology and Educational Practice

Although they have their differences, educational practitioners and academic researchers largely agree on a broad goal: to develop in students the kinds of thinking skills that will prepare them to contribute to a democratic society. But the two groups largely speak different languages. While educators frequently talk about critical thinking as an objective, researchers have largely avoided the term, preferring constructs that can be more precisely defined and measured. How do we connect critical thinking to modern research on cognition and learning? The authors propose the construct of metacognition as having the potential to bridge the concerns of educators and researchers whose work is addressed to the development of skilled thinking. Given its growing importance in studies of cognition and learning, teachers would benefit from an understanding of the mechanisms involved in metacognition and how best to foster it.

THEY HAVE THEIR DIFFERENCES to be sure, but today's educational practitioners and the academic theorists and researchers who concern themselves with education would likely agree on a broad

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goal: to develop in students the conceptual skills that will prepare them to contribute to a democratic society. Academics are inclined to decry the growing emphasis on "objective" standardized tests and to endorse "education for understanding" (Gardner, 1999) and development of the learning and thinking skills that will equip students to thrive in tomorrow's society (Bereiter, 2002; Kuhn, in press). Practitioners have long appeared to be of the same mind. The mission statement of the school district in which one of us was recently a teacher reads, ". . . our students will graduate with the knowledge, skills, and values necessary to be successful contributors to our democratic society." These educational goals can be traced back at least as far as Thomas Jefferson, who proclaimed (in a personal communication to W. Jarvis in 1820),

I know no safe depository of the ultimate powers of the society but the people themselves; and if we think them not enlightened enough to exercise their control with a wholesome discretion, the remedy is not to take it from them, but to inform their discretion by education.

The Great Divide

The challenge comes, of course, in trying to implement these lofty goals, and here we find academics and practitioners navigating largely unconnected paths. Academics pursue their agendas isolated from the demands of the classroom, while

practitioners are pressed to find methods that work, and quickly. Even if they had the time and energy to seek them out, research findings are not disseminated in a way that facilitates practitioners' consumption of them. And practitioners are unlikely to do so, having acquired the attitude, conveyed from their preservice training onward, that research studies are not going to be of any direct help—findings are inconsistent and far removed from classroom realities. Scant attention in the preservice curriculum to educational research, and to the tools needed to evaluate it, is perhaps the strongest meta-level message to practitioners as to its value.

Bereiter (2002) argues that this state of affairs needs to change dramatically. Teachers must become collaborators in the research enterprise, in close contact with knowledge building in their field, seeing themselves and being accepted as part of the endeavor. Educational reformers, Bereiter says, "are likely to fail in even their immediate objectives if they do not become more deeply engaged with the unsolved problems of pedagogy" (p. 421).

A major "unsolved problem of pedagogy," we would add, is exactly what are the higher order thinking skills that will equip students to participate in modern democratic society? Practitioners traditionally have ignored the question. "We all know good thinking when we see it," their attitude has been, "so let's focus on finding effective techniques to foster it." Increasingly, it is becoming clear that this stance will not suffice. We cannot effectively teach cognitive skills in the absence of very clear and precise understandings of what those skills are (Kuhn, 1999, in press). Given the prevalence of the "we'll know good thinking when we see it" stance, educators today are more likely to agree on promising educational activities and settings for fostering thinking than on what the thinking skills are that they seek to induce in these settings.

Educators must collaborate with researchers in achieving these understandings, creating the need for a different kind of collaborative role for the academic researcher. In the past, when educators have turned to academics for assistance, the role the academic has been asked to play is that of technician: Here is what we want students to know; can you advise us of the most efficient means for them to acquire it? Instead, both practitioners and

academics need to collaborate not just with respect to devising means but also in better defining ends—the nature of the intellectual skills that need to develop.

The kinds of cognitive skills that educators think about as coming under the heading of critical thinking are amenable to empirical investigation. It is possible to learn something about their nature and about how they develop. In our research we have examined two major families of skills—*inquiry and argument* (Kuhn, in press). The case we make is the same with respect to both. Teachers need a roadmap of what is developing and what needs to develop. In contrast to elementary skills such as classification or number that emerge in all normal children during the early years, skills of inquiry and argument do not necessarily develop, or at least do not develop to the degree we would like. Here the efforts of educators and researchers studying cognitive development truly intersect. Researchers need to be examining forms of development that are unlikely to occur in the absence of appropriate educational environments. At the same time, educators need the developmental knowledge that will inform their efforts.

What, then, needs to develop? A cornerstone of inquiry is the idea of a thesis, or question, and potential evidence that bears on it. There must be something to find out. Entertaining a thesis that is understood as capable of being disconfirmed by evidence reflects rudimentary skill in coordinating theory and evidence. Without this understanding and intention, there can be little point to inquiry. At worst, in the student's eyes inquiry becomes nothing more than demonstration of what one already accepts as true. Skills of argument have received much less attention than those of inquiry, but they are just as important. Children are not natural-born arguers. There are skills that need to develop. Our argument research indicates that young adolescents do not have great difficulty learning how to provide support for a claim. In debating someone who holds an opposing view, however, they find it much harder than do adults to attend to and address their opponent's claim and supporting argument (Felton & Kuhn, 200). In analyses of their argumentative discourse with a peer, we found they engaged in exposition regarding their

own argument almost four times as frequently as they sought clarification of the opponent's argument and four times as frequently as they undertook to critique the opponent's argument. Adults' utterances, in contrast, more often addressed the partner's argument, usually through counterargument. Adolescents appear to interpret the goal of argumentative discourse as prevailing over an opponent by superior presentation of one's own position. This objective, if successfully met, undermines the opponent's position but without addressing the opponent's argument. Deep-level processing of the opponent's argument, in addition to exposition of one's own argument and negotiating the mechanics of discourse, may represent cognitive overload for the novice arguer.

Metacognition and Critical Thinking

Definitions of critical thinking are numerous and wide-ranging. However, one non-controversial claim we can make about critical thinking is that it entails awareness of one's own thinking and reflection on the thinking of self and others as an object of cognition. Metacognition, a construct that is assuming an increasingly central place in cognitive development research, is defined in similar terms as awareness and management of one's own thought, or "thinking about thinking." Metacognition originates early in life, when children first become aware of their own and others' minds. But like many other intellectual skills, metacognitive skills typically do not develop to the level we would like.

In cognitive psychology, metacognitive functions are most often examined under the heading of "executive control." Whatever its exact label, the management of one's own cognition is crucial, as both researchers and practitioners are likely to have observed. It is usually not difficult to teach a child to perform a particular procedure in a particular context. But it is the meta-level of operations that determines whether the child will continue to exercise this skill in other settings once instruction is withdrawn and the child resumes meta-level control of his or her own behavior.

One way of supporting metacognitive development is to encourage students to reflect on and evaluate their activities. Doing so should heighten interest in the purpose of these activities. Why are

we doing this? What was gained from having done it? Questions such as these are less likely to arise when activity is imposed by authority figures without negotiation, and especially when the activities serve as occasions for evaluating students' standing relative to one another—a function that so often steals attention away from any other objective.

Another source of metacognitive development is the interiorization that both Vygotsky and Piaget talked about, which occurs when forms that are originally social become covert within the individual. If students participate in discourse where they are frequently asked, "How do you know?" or "What makes you say that?" they become more likely to pose such questions to themselves. Eventually, we hope, they will interiorize the structure of argument as a framework for much of their own individual thinking. They will think in terms of issues or claims, with facts summoned in their service, rather than the reverse—storing up facts with the idea that some conclusion may emerge from them.

Metacognitive functions can be procedural or declarative. The former invokes awareness and management of one's own thinking. The latter involves one's broader understanding of thinking and knowing in general. It has been studied under the heading of epistemological understanding. Like thinking itself, the understanding of thinking undergoes development. The study of students' developing epistemological understanding has blossomed in the last decade. As a result, we now have a fairly convergent picture of a series of steps that mark development toward more mature epistemological understanding in the years from early childhood to adulthood.

Epistemological Understanding as a Metacognitive Development

Preschool age children are realists. They regard what one knows as an immediate reading of what's out there. Beliefs are faithful copies of reality. They are received directly from the external world, rather than constructed by the knower. Hence, there are no inaccurate renderings of events, nor any possibility of conflicting beliefs, since everyone is perceiving the same external reality. Minds provide everyone the very same pictures of reality.

Not until about age 4 does a knower begin to emerge in children's conceptions of knowing. Children become aware that mental representations, as products of the human mind, do not necessarily duplicate external reality. Before children achieve a concept of false belief, they are unwilling to attribute to another person a belief that they themselves know to be false. Once they attain this understanding, the knower, and knowledge as mental representations produced by knowers, come to life. The products of knowing, however, are still more firmly attached to the known object than to the knower. Hence, while inadequate or incorrect information can produce false beliefs, these are easily correctable by reference to an external reality—the known object. If you and I disagree, one of us is right and one is wrong and resolving the matter is simply a matter of finding out which is which. At this absolutist level of epistemological understanding, knowledge is an accumulating body of certain facts.

Further progress in epistemological understanding can be characterized as an extended task of coordinating the subjective with the objective elements of knowing. At the realist and absolutist levels, the objective dominates. By adolescence typically comes the likelihood of a radical change in epistemological understanding. In a word, everyone now becomes right. The discovery that reasonable people—even experts—disagree is the most likely source of recognizing the uncertain, subjective aspect of knowing. This recognition initially assumes such proportions, however, that it eclipses recognition of any objective standard that could serve as a basis for evaluating conflicting claims. Adolescents typically fall into what Chandler has called “a poisoned well of doubt,” and they fall hard and deep. At this multiplist (sometimes called relativist) level of epistemological understanding, knowledge consists not of facts but of opinions, freely chosen by their holders as personal possessions and accordingly not open to challenge. Knowledge is now clearly seen as emanating from knowers, rather than the known, but at the significant cost of any discriminability among competing knowledge claims. Indeed, this lack of discriminability is equated with tolerance: Because everyone has a right to their opinion, all opinions are

equally right. That ubiquitous slogan of adolescence—“whatever”—holds sway.

Evidence suggests that hoisting oneself out of the “whatever” well of multiplicity and indiscriminability is achieved at much greater effort than the quick and easy fall into its depths. Many adults remain absolutists or multiplists for life. Yet, by adulthood, many adolescents will have reintegrated the objective dimension of knowing to achieve the understanding that while everyone has a right to their opinion, some opinions are in fact more right than others, to the extent they are better supported by argument and evidence. Justification for a belief becomes more than personal preference. “Whatever” is no longer the automatic response to any assertion—there are now legitimate discriminations and choices to be made. Rather than facts or opinions, knowledge at this evaluativist level of epistemological understanding consists of judgments, which require support in a framework of alternatives, evidence, and argument. An evaluativist epistemology provides the intellectual basis for judging one idea as better than another, a basis more powerful than mere personal preference.

Intellectual Values

The evolution just described is a necessary condition for the development of intellectual values. Adolescents who never progress beyond the absolutist belief in certain knowledge, or the multiplist's equation of knowledge with personal preference, lack a reason to engage in sustained intellectual inquiry. If facts can be ascertained with certainty and are readily available to anyone who seeks them, as the absolutist understands, or if any claim is as valid as any other, as the multiplist understands, there is little point to expending the mental effort that the evaluation of claims entails. Only at the evaluativist level are thinking and reason recognized as essential support for beliefs and actions. Thinking is the process that enables us to make informed choices between conflicting claims. Understanding this leads one to value thinking and to be willing to expend the effort that it entails (Table 1).

Our research has found striking differences across cultural groups and subcultural groups within the United States in the responses of parents and children to several questions like this one:

Table 1
Levels of Epistemological Understanding

Level	Assertions	Knowledge	Critical Thinking
Realist	Assertions are COPIES of an external reality.	Knowledge comes from an external source and is certain.	Critical thinking is unnecessary.
Absolutist	Assertions are FACTS that are correct or incorrect in their representation of reality.	Knowledge comes from an external source and is certain but not directly accessible, producing false beliefs.	Critical thinking is a vehicle for comparing assertions to reality and determining their truth or falsehood.
Multiplist	Assertions are OPINIONS freely chosen by and accountable only to their owners.	Knowledge is generated by human minds and therefore uncertain.	Critical thinking is irrelevant.
Evaluativist	Assertions are JUDGMENTS that can be evaluated and compared according to criteria of argument and evidence.	Knowledge is generated by human minds and is uncertain but susceptible to evaluation.	Critical thinking is valued as a vehicle that promotes sound assertions and enhances understanding.

Many social issues, like the death penalty, gun control, or medical care, are pretty much matters of personal opinion, and there is no basis for saying that one person's opinion is any better than another's. So there's not much point in people having discussions about these kinds of issues. Do you strongly agree, sort of agree, or disagree?

Reasons respondents offer for disagreement are similar and refer to values of discussion in enhancing individual and/or collective understanding, solving problems, and resolving conflicts. Reasons offered for agreement, however, tend to be of two distinct types. Some participants respond along these lines, suggestive of the multiplist level of epistemological understanding: "It's not worth it to discuss it because you're not going to get anywhere; everyone has a right to think what they want to." Others take this position, suggestive of the absolutist's equation of knowledge with right answers: "It's not worth it to discuss it because it's not something you can get a definite answer to."

Parents and children within the cultures and subcultures we have studied respond similarly to one another. Middle school and high school students

in American ethnic subcultures, however, show some movement away from their parents' response patterns in the direction of those of their American peers. These results suggest that parents do matter in transmitting intellectual values to their children. At the same time, children to a significant degree construct these values anew in a context of their peer culture, especially when the values of the culture outside the home deviate from those within the home.

The transitions from realist to absolutist to multiplist epistemological understanding don't seem to require a great deal of tending by those wishing to scaffold children's development. Unless the child's experience is unusually restricted, children become aware that people's beliefs vary and they must figure out a way of understanding this state of affairs. The vast majority take at least a brief dip, and more often a prolonged one, into the well of multiplicity. The last major transition, however, from multiplist to evaluativist, is another story. It is helping young people climb out of the multiplist well that requires the concerned attention

of parents and educators, especially if it is this progression that provides the necessary foundation for intellectual values.

The goal will not be achieved by exhortation—by telling students that a particular activity is valuable, or even how or why it's valuable. A more promising adult role involves introducing young people to activities that have a value that becomes self-evident in the course of engaging them and developing the skills the activities entail. By serving as a guide, or coach, as students engage in such activities, the adult models his or her own commitment to the activity and belief in its worth. As students' skill and commitment and self-direction increase, the coach's role diminishes.

Much of what we ask students to do in school simply does not have these characteristics. We have been experimenting with involving middle school students in activities that we believe have this crucial characteristic of revealing their intrinsic value as they are engaged in them. These activities fall under the broad headings of inquiry and argument and entail the skills that have been described previously. We are able to follow students' progress microgenetically as they develop these two families of skills. Through their involvement in such activities, we hope students will discover for themselves that there is something to find out and a point to arguing, sufficient to make the effort worthwhile. It is only their own experiences that will lead them to the conviction that inquiry and reasoned argument offer the most promising path to deciding between competing claims, resolving conflicts, solving problems, and achieving goals.

Conclusion

The growing reliance on standardized testing of basic skills, with higher and higher stakes, poses a grave danger to the quality of education. We need better definitions of what it means to be an educated person (Bereiter, 2002; Kuhn, in press).

The skills of inquiry and argument, we believe, should be central to such definitions. If so, it is essential to understand more about these skills. But these skills need to be understood not just as performance tools; it is essential that the broader meta-level structure develop that reflects understanding of how, when, and why to use them. This is the critical thinking ability that educators and researchers want to see students acquire.

We suggest that cognitive development researchers and educators can and must collaborate in constructing these more adequate definitions of the ends toward which the educational enterprise is directed. Fewer and fewer cognitive development researchers remain content to preoccupy themselves with narrow agendas while ignoring the larger, more difficult questions that the education of children poses. At the same time, educators for the most part are discouraged by the professional challenges facing them, would like to be part of the knowledge-seeking process, and appreciate the importance of evidence as a basis for policy (Feuer, Towne, & Shavelson, 2002). Without being naïve about the obstacles involved, we would conclude that both groups seem poised for meaningful collaboration.

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