TEACHING FOR

UNDERSTANDING

What Every Educator Should Know

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Preface

Teaching for Deep Understanding is the product of collaboration between a teachers federation (the Elementary Teachers' Federation of Ontario [ETFO]) and a university (Ontario Institute for Studies in Education of the University of Toronto [OISE/UT]). These organizations had collaborated before, but not often and not around such an ambitious set of purposes.

This publication attests to the value of collaboration among academic and practice communities. The synergies are obvious and fundamental. Teachers want to provide the best possible education for their students. In fact, a resolution at the 2002 ETFO Annual Meeting started this project. ETFO members identified a problem with the Ontario elementary curriculum and wanted further study to pinpoint the source and extent of the problem. ETFO approached faculty at OISE/UT, and our research partnership was formed.

The worlds of educational practice and of research, often working in isolation from one another, have been described as "two solitudes," and the distance between them often seems formidable. Not so in this project. And we believe the recommendations growing out of this collaborative effort are much more significant as a result. Educational policy makers, for example, typically consult with members of the teaching and research communities separately in the formation of their policies.

A significant challenge often arising from these parallel consultation processes is to reconcile differences in the advice received. School leaders, admonished to be "data driven" in their decision making, often find the "implications" of research obtuse or remote from the real-life solutions they need to their problems. Recommendations in *Teaching for Deep Understanding* represent the combined advice of both communities. While this eliminates the need to reconcile conflicting advice, it also reduces the sometimes politically attractive possibility of trading off one source of advice against another in the justification of policies supported by neither source. The practical nature of our recommendations should also be congenial to the actual world of teachers, administrators, and others offering leadership in their schools.

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PART I

The Significance and Meaning of "Deep Understanding"

1

Deep Understanding for All Students

The Overriding Goal for Schooling

Kenneth Leithwood
Pat McAdie
Nina Bascia
Anne Rodrigue
Shawn Moore

We root our case for deep understanding as the overarching goal of public schooling in six straightforward claims.

1. Many specific facts have a very short half-life.
2. You can have your cake and eat it too (or you don't need to trade off good test results).
3. The experience of deeply understanding something encourages further learning.
4. Most real-life tasks require serious, self-directed problem solving.
5. The broader context of our lives places a premium on deep understanding for survival.
6. The alternatives are not very compelling . . . If not deep understanding, then what?

OUR CASE FOR DEEP UNDERSTANDING

Schools now live in a policy world populated, for example, by the No Child Left Behind Act, which requires schools to meet annual yearly performance targets, weeks of time consumed by student testing, a narrow focus on literacy and numeracy, the constant threat of school reconstitution if external achievement standards are not met, and a host of other demands for greater public accountability. In this world, deep understanding, on the face of it, seems an unlikely focus for teaching and learning. Rather, the natural press would seem to be toward the achievement by students of ever more specific, explicit, and readily measured outcomes. This book is about why such a direction actually thwarts the aspirations most of us have for our children and what we can do about it. It aims to arm teachers, school and district administrators, teacher union staff, teacher educators, and parents with the knowledge needed to foster deep understanding among students on a large scale.

Our motivation for developing this research partnership was the conviction that deep understanding for all students ought to be—but is not currently—the overriding goal for public schooling. Deep understanding seems like such an obvious purpose for education that, at first blush, making a case for it, as we do in this book, may seem unnecessary. All teachers assume that students' understanding (depth aside) is the purpose of their instruction—certainly, none would claim to be teaching for misunderstanding or shallow understanding.

Whether assumed and obvious or not, there are overwhelming indications that, at all but the most advanced levels of education, deep understanding is rarely achieved by most students. Many of our own adult students, for example, have told us that until they became immersed in their doctoral research, formal education had simply expanded their superficial understanding of an increasing amount of codified knowledge in their chosen fields of study.

The North American Curriculum

It is often said that the purposes of schools are unclear and often contested, in spite of an official curriculum in most states and provinces literally teeming with things to be "covered." This only goes to illustrate, once again, the difficulty of seeing the forest when one is constantly required to focus on the trees.

The Canadian province of Ontario, the context in which we did this work, shares with many states and provinces a similar orientation to accountability. A key feature of this orientation is the proliferation of expectations or standards to be met by students. Their sheer number makes it extremely difficult either to discern the overall image of an educated person in any holistic way or to achieve deep understanding in relation to any one of them. "More is less" when deep understanding is the goal. Using the Ontario curriculum as a case in point, by the end of the eighth grade, elementary school students are intended to encounter, learn, or otherwise come to grips with a total of 3,993 specific expectations (we counted)! On average, there are about 500 specific expectations

It is often said that the purposes for schools are unclear and often contested, in spite of an official curriculum literally teeming with things to be "covered."

for each grade until Grades 7 and 8, where specific expectations jump significantly (to 584 and 586 in Grades 7 and 8 respectively).[1]

If the school day averages five hours and the school year 190 days, students have about 950 hours to meet about 500 specific expectations, or about 1.9 hours for each expectation, at least theoretically. Of course, not all five hours of each day in an elementary school is focused on the curriculum.[2] So the real time per expectation is probably closer to 1.5 hours. From a teacher's perspective, this means 1.5 hours to ensure that all 25 to 35 students in one's class master each expectation, roughly 3 minutes per student. Seems a bit tight, doesn't it?

The curriculum for many North American school systems has often been described as "a mile wide and an inch deep." Small wonder.

In this book, we provide some perspective on the forest that is the North American curriculum. We describe what it feels like to be a teacher shepherding one's students through this forest. Suffice it to say, for the moment, that there is quite a lot of prickly and annoying underbrush to cut through to make much progress with one's charges. And before we dismiss such annoyance as trivial, we should remind ourselves of the central role that student welfare plays in the job satisfaction of our best teachers.[3] If teachers are annoyed and dissatisfied with the curriculum, we should be concerned about the value of that curriculum for our children.

THE CASE FOR DEEP UNDERSTANDING

Arguments about the purposes of schooling are often couched in either highly philosophical or ideological frameworks. We think that neither approach is actually very helpful for engaging a large proportion of either professional educators or policymakers, not to mention the public. So instead, we root our case for deep understanding as the overarching goal for public schooling in six straightforward claims.

Many Specific Facts Have a Very Short Half-Life

It's hardly news that what we hold to be true is always evolving, so we don't think this claim requires much defense. Regarding the physical world, for example, while what we observe directly may seem undeniably factual, our explanations for what we observe and how things got to be that way have gone through at least several paradigm shifts in the space of most of our lifetimes. In the medical world,

[1]The Ministry of Education is currently reviewing the curriculum. The Social Studies/History and Geography curriculum has been revised and is being implemented in 2005–06. However, the expectations have been reduced only slightly; some of the expectations have been combined; and many of the concerns expressed by elementary teachers were not incorporated into the revisions.

[2]There are, for example, snow suits to be contended with, voluntary activities such as Jump-Rope-for-Heart, bomb threats to be dealt with, upset students who require the immediate and full attention of the teacher, bus delays, and so on.

[3]See, for example, Desimone and Le Floch (2004).

recommended treatments for many illnesses change every decade at least in response to rapidly changing understandings about how the body works. As an example from the social sciences, dominant explanations for how people learn have shifted quite fundamentally as behavioristic, information processing, and social constructionist theories have gained and then waned in support among learning theorists; "brain research" has begun to dominate many people's beliefs about how learning occurs. Even our understanding of historical "facts" changes as we adopt different lenses on the past.

That said, some would argue that there is a corpus of facts and concepts that children should master if they are to participate in the human conversation. Advocates of this view, perhaps most notably Hirsch (1987), go so far as to list these facts and argue for their inclusion in the curriculum. Adopting deep understanding as an overriding goal for education does not come into conflict with this position as directly as might seem to be the case. After all, the recommended corpus of facts and concepts likely does dominate the conceptual starting points that many people share in order to unpack the meaning of their present experiences. Furthermore, the curriculum must have some subject matter to understand. But when deep understanding is the goal, subject matter is the stimulus for thought and exploration—not just the facts to be memorized.

You Can Have Your Cake and Eat It Too (or You Don't Need to Trade Off Good Test Results)

For those attracted to a curriculum that emphasizes the mastery of predetermined knowledge and skills, adopting deep understanding as an overriding goal for schools should be particularly compelling. Growing evidence suggests that students benefit from a curriculum that fosters deep understanding; they perform at least as well as and sometimes better than students not so exposed on the tests typically used to assess student progress and hold schools accountable for student performance.

This claim has received support in several recent analyses—see, for example, Weglinsky's (2004) analysis of evidence from both the U.S. National Assessment of Educational Progress (NAEP) and the Third International Mathematics and Science Study (TIMSS). Both sets of data allow for the comparison of student performance on basic skills with performance on critical thinking, higher order thinking skills, and other outcomes associated with understanding. As well, both sets of data provide information about the forms of instruction used by teachers. Across most subjects, both sets of data associate better student performance with forms of instruction that emphasize deep understanding.

A review of evidence from TIMSS, as well as a half dozen other sources, came to a similar conclusion (Tighe, Seif, & Wiggins, 2004). And Ross and McDougall (see Chapter 5 of this volume) conclude from their review of a wide array of additional evidence about mathematics achievement:

> You would expect that students who were taught in traditional ways would do better on traditional objectives, but this is not the way it turns out. In most studies of this type, students who have been taught using the deep understanding approach do better on traditional tests than students who were taught using traditional methods. (p. 36)

The Experience of Deeply Understanding Something Encourages Further Learning

Indeed, with subject matter that is sequential, as in the case of mathematics and some of the sciences, failure to understand prior concepts dramatically reduces a student's ability to come to grips with more complex concepts, the understanding of which depends on those prior concepts.

We also know that one of the strongest motivations for further learning is a sense of success with prior learning. The sense of self-efficacy derived from the experience of success in one's prior learning tasks (e.g., Bandura, 1986) is a central source of motivation and commitment for further learning. Conversely, having only opportunities for superficial understanding robs the student of the satisfaction of insight, thereby diminishing commitment to continue learning.

Most Real-Life Tasks Require Serious, Self-Directed Problem Solving

Although this seems pretty self-evident, we offer a couple of examples to demonstrate the range of this claim. First, the case of Mom and Dad (M & D) and their 13-month-old baby, who is crying loudly at 3 a.m. Thirteen-month-olds don't tell you what's wrong with them. But if you are M & D, stopping the crying soon is definitely one of your short-term objectives. M & D define the problem as "some sort of physical or psychological distress that needs to be alleviated." Nonetheless, they do not have access to an effective and ready-made solution; they have to use what they know—or can find out pretty quickly—to create a solution. In this case, the relevant "domain" knowledge includes something about early childhood development, the signs of teething, possible lactate allergies, and the like. It also includes what they know about the causes of their son acting in this way in the past and their sensitivity to his emotional states. Out of this knowledge, they have to craft and try out a solution, which, if it doesn't work, will need revision and more trial. Dr. Spock's advice can come up short pretty fast in such cases.

The second case is the service adviser at your local car dealership. A customer drives in claiming that there is something wrong with the steering mechanism in her car. The adviser has choices. He could just write up the work order telling the mechanic to fix the steering mechanism, but he knows that 8 times out of 10, the symptoms described by the customer are caused by poor wheel alignment. If he writes up the work order focused on the steering mechanism, the mechanic and the shop will make more money because the customer will be charged for the time it takes, first, to rule out the steering mechanism and then to repair the wheel alignment. In this case, the service adviser walks out to the car and checks himself for uneven tire wear, a sure sign of misaligned wheels. This costs the customer nothing and points the mechanic at the real problem immediately.

Note that both of these example problems are common, require application of quite specific knowledge without which an effective solution is unlikely, and are to be found in both real-life personal and work contexts. Note, as well, that the second example—seemingly mundane and eminently practical—illustrates an ethical dimension to human problem solving. Finally, these cases demonstrate that deep understanding is not only about specific areas of knowledge but also about

problem-solving processes themselves, including what is sometimes referred to as meta-cognition, an understanding of one's own thought processes.

The Broader Context of Our Lives Places a Premium on Deep Understanding for Survival

This claim is a direct extension of the previous one. Our daily lives routinely demand sophisticated problem solving, and our current point in social history places a premium on the possession of intellectual capital. We are constantly reminded that we now live in a knowledge society fueled by a global economy where intellectual capital is the competitive edge needed to survive and prosper. Furthermore—economics aside—most of us are confronted daily with personal and social challenges made increasingly complex by the increasingly diverse communities in which we live, the changing nature of family structures, and the sheer speed of social change, among many other things. Finding personal meaning in our lives depends on our ability to better understand this context and our preferred roles in it; being successful in doing this, on our own terms, depends on the habits of mind and other internal resources we have developed in part, at least, through our formal education. Deep understanding is crucial in meeting this challenge.

The Alternatives Are Not Very Compelling . . . If Not Deep Understanding, Then What?

If not deep understanding, then what? We know all too well the answer to this question, an answer foreshadowed in our previous claim. It is a superficial grasp of many themes, ideas, and topics, an outcome that serves our thinking and problem solving poorly. Consider the common experience of "cramming" these things into our brains before the big exam. Think about the residue left 24 hours later; perhaps something useful for subsequent games of Trivial Pursuit, but not a lot more.

Our assertion that deep understanding ought to be the goal of education for all students is likely more controversial than the importance we attribute to deep understanding alone.

It is not too much of a stretch to argue that tripping across the top of many topics and ideas, as is fairly common in our schools, not only bores our students to death and deskills our teachers; it also is one of the most scandalous squanderings of scarce public resources we can think of. This feature of our curricula may be to blame for a large proportion of the overwhelming sense of boredom with school expressed by high school students (Olson, 2005).

Why All Students?

Our assertion that deep understanding ought to be the goal of education for all students is likely more controversial than the importance we attribute to deep understanding alone. At least until very recently, our culture implicitly reserved the intention of deep understanding as a goal for only the most academically inclined students.

However, a key explicit value for most North American school systems is equity, a value which suggests that if deep understanding is important for some

students, it ought to be important for all. The most practical form of the question Why all students? is really Why not? What reasons are usually given for not achieving, or not trying to achieve, deep understanding for all students? Can these reasons be justified?

The two most common reasons are that (a) only some students are capable of developing deep understanding and (b) only some students actually need it. In response to the first of these reasons, we have a substantial body of evidence, some of it quite old (e.g., Bloom, 1981), demonstrating that a very high percentage of students are capable of mastering advanced levels of knowledge given suitable educational experiences; in this case, *suitable* means experiences designed in response to their interests, time required for learning, prior knowledge, and ways of processing new information. As to the second reason, the pervasive requirements for problem solving in both personal and work lives indicates, at least to us, that all students actually need deep understanding of a range of topics in the curriculum.

What Next?

In this chapter, we have argued the case for deep understanding among all children as the overriding goal for public schooling. We have also begun to demonstrate why some features of the typical North American curriculum are not helpful in realizing this goal for many children.

The remainder of the monograph

- Provides a rich and varied set of insights from theory and research about how to foster students' deep understanding in the classroom, both in and across the curriculum
- Describes what teaching for deep understanding looks like through illustrative examples, focusing on some subject areas and some cross-curricular teaching goals
- Reports new evidence from a large sample of elementary school teachers about their efforts to help their students develop deep understanding and the conditions that either contribute to or hinder such efforts
- Exposes many of the systemic obstacles that need to be addressed if this goal is to be more fully realized on a large scale
- Offers recommendations for better achieving this goal, recommendations aimed at everyone with a stake in our schools, from teachers, school and district administrators, and faculties of education through to policymakers

As the following chapters make clear, we know quite a lot about how children acquire deep understanding and what can be done to foster it. In one form or another, this has been a sustained focus of research for several decades. It is time we put that research to better use.

Many different people are in a position to help with this task—in fact, are necessary supports to ensure that teaching for deep understanding is a reality. This is why this book is intended for a wide audience—for teachers, principals, district administrators, teacher union staff, university-based teacher educators, and others. As a result, we know that readers will likely come to the book with a stronger knowledge

and interest in some chapters than in others—but we encourage reading across the whole book to understand teaching for deep understanding in a *systemic* way. While some chapters may seem more conceptual than concrete, it is important for readers to sit with and try to absorb the concepts: This is exactly what deep understanding is all about.

Our Agenda

As this overview suggests, our longer term agenda is to prompt action at all levels of the school system. While we are critical of many features of the typical elementary school curriculum, both the intended and the delivered curricula are what concerns us. So responsibility for action, we argue, is widely distributed throughout the system.

State governments, for example, have the responsibility to reshape and align curricula and related policies to encourage a focus on deep understanding for all students. Parents are responsible for giving thoughtful consideration to the importance of deep understanding as a central educational goal, even when accomplishing that goal means engaging their children in educational experiences unlike those they experienced as students themselves. District and school administrators will need to revise and realign their management processes in support of teaching and learning that develops deep understanding among all students. And many teachers will need to invest in the further development of their own content knowledge and pedagogical skill. Unless these distributed responsibilities are assumed in significant degree, the chances of all of our children achieving deep understanding through their school experiences are much reduced.

Education is viewed as a top priority for reform across North America. But many reform initiatives hope to foster greater achievement through a focus on such issues as class and school size, school structure, organizational culture, educational governance, and funding. These are important features to address but only when they play supporting roles to more fundamental changes in the core technology of schools: teaching and learning. Furthermore, many currrent efforts aimed at fundamental changes in the core technology of schooling are highly prescriptive, one-size-fits-all solutions, such as the Comprehensive School Reform (CSR) models.

In spite of the widespread attention CSR models have attracted in districts and schools and the favor they enjoy in policy circles, empirical evidence of their success remains spotty at best from the perspective of all but the most committed advocates. Assisting schools to focus much more of their attention on teaching for deep understanding should be viewed as an alternative to adopting one of the CSR models, or, perhaps more productively, an initiative to be pursued in combination with implementing one or more of the CSR models.

2

Reflections on Depth

Carl Bereiter

For Carl Bereiter, deep understanding means understanding deep things about subjects worthy of our students' attention. In this chapter, he sets the direction and tone for the chapters that follow.

1. How can teachers help students acquire a disposition for depth?
2. How can teachers identify deep things worthy of students' understanding?
3. How can teachers ensure students have intimate contact with those deep things?
4. How can elementary teachers, often responsible for all areas of the curriculum, develop a deep understanding within many disciplines?

Everyone is in favor of depth. We use the term with confidence, even though we cannot define it, and evaluating it is highly subjective. We speak of depth of understanding and depth of feeling. A book or an art work may be deep, and so may be our appreciation of it. In-depth analyses are always on offer. There can be depth of learning in any content area, any complex skill. There is depth in the treatment of concepts, issues, problems, and interpretations. In short, virtually all the more elevated educational objectives can be cast in terms of depth. Having so much educational weight resting on an undefined concept must give us pause, however.

The reason *depth* is so hard to define is that it has meaning only with respect to something specific. You cannot define depth in general terms, the way you can define honesty or fairness. Nevertheless, there may be general principles of teaching for depth. For one thing, it seems essential that students themselves value depth and pursue it through their individual and collective initiative. Although some degree of understanding can come about just through exposure, there is ample evidence from many different domains that difficult things are understood only with effort. The biologist E. O. Wilson said, "Natural selection built the brain to survive in the world and only incidentally to understand it at a depth greater than is necessary to survive" (1988, p. 61). In other words, the pursuit of deep understanding is not something that comes naturally as an expression of normal curiosity. It is an acquired disposition. Possibly deep appreciation can come about naturally in some cases; but educating people's sensibilities would seem to require getting them to pay attention to things they ordinarily overlook. And the right kind of attention probably requires a student who is trying to perceive more deeply.

DEPTH OF UNDERSTANDING

The two most common conceptions of understanding are one I call the *correspondence conception* and one that its advocates call the *performance perspective.* The correspondence conception has been most clearly set forth by Nickerson (1985) "One understands a concept (principle, process, or whatever) to the extent that what is in one's head regarding that concept corresponds to what is in the head of an expert in the relevant field" (p. 222).

The performance perspective, as advanced by David Perkins and his colleagues in Harvard's Project Zero, defines understanding as consisting of the performance capabilities and dispositions that would lead us to credit a person with understanding: ability to explain, to apply, to evaluate, and so on.

What would depth of understanding consist of in these two views? According to the correspondence view, deeper understanding would presumably consist of a closer match to the expert's knowledge. Depth, accordingly, is not an endless continuum but reaches its limit in a perfect match between what is in the head of the student and what is in the head of the designated expert. According to the performance perspective, depth would presumably be gauged by the quality of the performances. However, McTighe and Wiggins (1999) remind us that quality of performance can be influenced by a number of variables, only one of which is understanding. Thus evaluating depth of understanding requires inferences beyond the observed performance, and it is not clear how those inferences are to be made.

. . . the pursuit of deep understanding is not something that comes naturally as an expression of normal curiosity. It is an acquired disposition.

My own definition of depth of understanding is the following: Deep understanding means understanding deep things about the object in question.

When I offer this definition, people tend to shrug or snicker, for the definition sounds circular, avoiding an actual coming to grips with the meaning of depth. But the definition is not circular. Identifying the deep ideas in a discipline, the deeper meaning of a poem or story, the underlying causes of a historical event or a social condition, the deeper issues in a controversy—these are lively concerns of scholars and critics, curriculum committees, and professional associations. In any significant

area, educators can get plenty of help in identifying the deep things worthy of students' attention and understanding. Teaching for depth means bringing students into intimate contact with those deep things.

Of course, what the deep things are may often be in dispute, and there is change over time. The deep things that scientists would agree need to be understood about genetics or the brain are quite different today from what they were 40 years ago. Every major literary work provokes different interpretations that point to different things to be experienced and understood. But these are signs of healthy disciplines. They should not deter us from doing the best we can to help students get to the depths of whatever they are studying.

DEPTH VERSUS BREADTH

Depth has two opposites: superficiality and breadth. Breadth is generally considered to be good and superficiality bad, yet educators know they go together. The realities of time and resources ensure that breadth is usually attained at the cost of superficiality. The survey course—Something-or-other 101—dramatizes the problem. If you get a group of experts in any field together to determine what is essential knowledge for a beginner, they will quickly generate a list too long to cover in any depth. To trim the list would be to imply that some of the scholars had been wasting their careers on matters of limited importance. And so superficiality is the inevitable consequence of too much to learn in the time available.

But there is value in wide-ranging superficial knowledge. The most comprehensive defense of this proposition is to be found in E. D. Hirsch's *Cultural Literacy* (1987). Anyone who is inclined to wax censorious about breadth should read with as open a mind as possible the first two chapters of that book. The part of the argument that connects breadth to depth shows that marginal understanding of a wide range of terms and facts, although of little value in itself, is essential for understanding the kinds of texts—books and quality magazines and newspapers—that do promote depth of understanding. Knowledge of this superficial kind is, curiously, called literacy—as in scientific literacy, historical literacy, and the like. Literacy, in this sense, does just mean a middling level of knowledge, sufficient for the intellectual needs of the educated nonspecialist. In advocating such literacies, we should keep in mind that we are in fact advocating breadth and tolerating superficiality.

Finally, it remains to be said that in some areas, most notably history, depth is impossible without breadth. Deep understanding of any particular topic in history—for instance, the French Revolution—requires understanding its broader contemporary context and also its relation to similar events—other revolutions—that may be distant from it in time and place. In general, we may say that the problems of depth/breadth become more acute the more saturated the field is with factual information. Thus, breadth is more important in history and social studies than it is in science, where a better case can be made for reducing breadth in the interests of depth.

IMPLICATIONS FOR TEACHING

Teaching for Depth = Internalization

This happens when . . .

- We encounter a powerful idea
- We read a powerful book
- We hear a powerful piece of music

Teachers need to find ways to make this happen more often and in more powerful ways–starting by making contact with the deepest wellsprings of the learner's thought and feeling.

Breadth is generally considered to be good and superficiality bad, yet educators know they go together.

Uneasy compromise is the most available way of dealing with the competing demands of depth and breadth. In *How People Learn,* Bransford, Brown, and Cocking (2000) come out strongly for depth but then start to waffle:

> Superficial coverage of all topics in a subject area must be replaced with in-depth coverage of fewer topics that allows key concepts in that discipline to be understood. The goal of coverage need not be abandoned entirely, of course. But there must be a sufficient number of cases of in-depth study to allow students to grasp the defining concepts in specific domains within a discipline.

Well-earned fame should await anyone who finds a coherent way of achieving breadth and depth through the same knowledge-seeking process, a way that does not relegate them to separate compartments of the educational program.

HIGHER ORDER THINKING SKILLS

Despite a certain semantic awkwardness about rising higher to go deeper, many educators feel comfortable equating higher order thinking with depth. Manifestly, deep understanding requires thinking of a high order. But it does not follow that the two kinds of educational objectives are interchangeable. Activities aimed at developing higher order thinking skills (HOTS) are typically of short duration, high in process, but short on content. The main emphases are on idea generation (e.g., brainstorming, lateral thinking) and critical analysis (e.g., logical inference, argumentation and debate, recognition of propaganda). Because there are many HOTS and many areas in which they may be applied, coverage tends to be superficial. Thus, although the objectives of HOTS are consistent with those of depth, the methods typically employed for pursuing them are antithetical. My own belief is that HOTS, multiple intelligences, and the like should be kept in mind in educational planning but should not be constituents of the curriculum (Bereiter, 2002, Chapter 10). Eliminating them will strike a blow for coherence and will free up precious time for the pursuit of depth.

Real Depth

Depth should not be confused with advanced study. An advanced course in physics may be just as superficial as a beginning course: It merely covers more advanced material. Advocates of scientific literacy and other such literacies are correct that nonspecialists do not need advanced courses, but this should not be taken to mean that they do not need greater depth of understanding. After students have learned the layout of the solar system and the movements of the planets; after they have overcome such misconceptions as that up and down are absolute directions and that seasonal change has to do with the distance of the Earth from the sun; after they have delivered all the relevant understanding

At the deepest levels, understanding of an important theory or work of art should change the way we perceive and experience the world.

performances of explaining, interpreting, and applying—what else is there if not more advanced study of astronomy?

In a word, what lies beyond is *internalization.* At the deepest levels, understanding of an important theory or work of art should change the way we perceive and experience the world. It should become part of our personality rather than only something we can bring to mind in appropriate contexts. If we have really internalized the Copernican model of the cosmos, then we should perceive the landscape visible out the window as part of a globe; we should not have to remind ourselves that that is what it is. (This does not preclude our dealing with it as a flat surface or whatever most of the time.) If we have really internalized Shakespeare, it should change the way we respond to expressive language of all kinds.

When applied to problems of understanding, idea improvement entails going deeper, using all the knowledge resources available.

Even the most in-depth of school studies tends to stop well short of internalization. The result is knowledge that may not be inert; it can serve practical and cognitive needs and provide a basis for further learning. But it does not in any fundamental way alter our outlook on the world. It does not make us better people. Every once in a while, something does break through. We encounter a powerful idea or read a powerful book or hear a powerful piece of music that changes us, that radiates through our whole person. Education for depth would find ways to make that happen more often and in more positive ways. Needless to say, such education would not be imposed on the learner. It would make contact with the deepest wellsprings of the learner's thought and feeling; natural processes would take it from there.

IMPLICATIONS FOR TEACHER EDUCATION

Teaching for depth presents a challenge for teacher education. All might agree that student teachers need to experience depth themselves if they are going to teach for it, but what should that amount to in practice? Regarding teacher education courses themselves, arguments for depth far outweigh arguments for breadth. There is very little indispensable content, although outside agencies may be imposing excessive coverage requirements, just as they do with the school curriculum. At the same time, there are big and often difficult ideas in education. Dewey's concept of experience and such modern concepts as self-organization are examples. These tend to be ignored or watered down in education textbooks on the apparent assumption that student teachers are ill disposed to wrestling with difficult ideas. However, if we are at all serious about promoting depth in school learning, we ought to have some confidence that teachers are capable of depth in their professional preparation.

In addition, a case can be made for depth of learning in the subjects future teachers will teach. What this entails has been well formulated by Bransford et al. (2000):

> Teachers must come to teaching with the experience of in-depth study of the subject area themselves. Before a teacher can develop powerful pedagogical tools, he or she must be familiar with the progress of inquiry and the terms of discourse in the discipline, as well as understand the relationship between information and the concepts that help organize that information in the