A Taxonomy of Knowledge Types for Use in Curriculum Design

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ABSTRACT: This article proposes the use of a taxonomy to help curriculum planners distinguish between different kinds of knowledge. Nine categories are suggested: empirical, rational, conventional, conceptual, cognitive process skills, psychomotor, affective, narrative, and received. Analyzing lessons into the sources of their resident knowledge helps the teacher proceed in a less dogmatic manner, distinguishing between categories of knowledge based upon where that knowledge originates. This taxonomy facilitates a meta-narrative on the nature of knowledge – how it is discovered, invented, decided upon, and so on – and the form that it takes in human experience and learning.

KEYWORDS: Curriculum, curriculum design, taxonomy, lesson planning, knowledge, knowledge types, epistemology, education, learning.

While traditional educational taxonomies may help teachers refine the scope and the accuracy of their assessments, or inventory the domains of human intelligence and their associated disciplines, a taxonomy of knowledge types can draw the focus of instructional planning down to the level of individual knowledge claims, can help teachers avoid fundamental errors of curriculum design and instruction, and can help to create approaches that are inherently more meaningful and authentic.

What we teach, and how we teach it – these are the central issues of curriculum design. Our ability to see clearly and accurately the nature of the content depends among other things upon those formal systems of classification we pick up in the course of our professional study. Yet these systems can mislead us as easily as they can guide us.

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There are a variety of classification schemes and taxonomies in the literature. They have been designed to classify different aspects of the pedagogical landscape, but they are often used carelessly, inappropriately, or as if they are interchangeable from one instrumental role to another. Some schemes were intended to classify formal intellectual disciplines (e.g., Hirst, 1973); some classify the capacities of the human mind to learn (e.g., Gardner, 1993); some classify the complexity and nature of learning objectives for assessment purposes (e.g., Bloom, 1956).

These taxonomic systems all serve distinct and useful purposes. But there is another classification scheme that is worth foregrounding during the process of instructional design, one that provides a ready index to the variety of knowledge types that make up our rich curricular offerings down at the micro-level where lesson planning takes place. It is a taxonomy of knowledge types, implicit in the vast literature of the profession, but not always made explicit for use by teachers. In order to explore this taxonomy of knowledge types, we need to recognize those other taxonomies and classification schemes that compete for our attention, and try to point out how those schemes are intended to speak to different purposes than the one proposed here.

The distinctions I intend to draw are hardly novel, but they need to be restated periodically and in ways that reintroduce them into current contexts and concerns. The distinctions governing different types of knowledge are so fundamental to good teaching, yet so tenuous in practice, that a thoughtful rehash is occasionally warranted. Along the way, I hope to offer a few novel observations and insights. Hirst (1998, p. 384) has noted that an emphasis on forms of knowledge common in the 1960s gave way to an emphasis on social practices in the 1970s and 1980s.

To set the context for this discussion, let us consider the following statements, all of which might be regarded as valid, or true, by at least some people. As you read them, consider why and in what sense each might be considered true:

"When placed in water, rocks sink."
"This is the symbol for five: 5 "
"Five plus five equals ten."
"The word programme is spelled p-r-o-g-r-a-m-m-e."
"Water boils at 212°, and freezes at 32°."
"The Greeks in the time of Pericles discovered the standard for aesthetic beauty."

"A circle has 360°."
"Faith is the substance of things hoped for, the evidence of things not seen."
"The angles of a triangle always add up to 180°."
"If you mix yellow and red paint you get orange."
"Two wrongs never make a right."
"Earnest Hemingway was one of the greatest American writers of the twentieth century."
"In music, an A and an E will sound in harmony, but a C and a D will be discordant."

All of these statements represent knowledge claims seen, by some at least, as valid. But if true, they are true for different reasons, and it makes a difference whether teachers and students understand this. While it may be possible to assert all of these statements as if they are solid, Platonic truths, it is poor practice to do so. Aside from the ethical concerns regarding indoctrination and dogmatic narrowness, if the content of lessons is presented to students as if it has a simple and uniform status as truths to be learned, then learning takes place in a manner that is fundamentally different from learning in which the ontological and epistemic status of those claims is explored. The whole rich texture of our cultural and intellectual landscape is largely dependent upon the diversity of our knowledge claims. Consequently, the potential richness and depth of our teaching is dependent upon the extent to which distinctions between different kinds of knowledge are part of the conversation.

The Classification of Knowledge and Knowing

Fifty years ago, Bloom and his associates built a taxonomy of instructional objectives. They developed separate taxonomies for each of three areas of learning, the cognitive, the affective, and the psychomotor domains. Bloom worked extensively on the cognitive domain. *Bloom's Taxonomy* (1956), as it has come to be known, was an attempt to classify the kinds of performance outcomes one could expect from behaviorally structured lesson planning. That taxonomy was not intended to be a guide to lesson planning, but almost immediately upon its release, and much to Bloom's dismay, teachers in the United States and elsewhere adopted it as a tool for that purpose. Using it to guide lesson planning actually flattens the range of instructional strategies and purposes a teacher is likely to consider.

Prior to Bloom, in the fading days of classical liberal education, a very different kind of classification scheme had been used, one that parsed out the range of knowledge as different intellectual disciplines an educated person was expected to have mastered. Dating from the late middle ages, and tracing its roots all the way back to Plato and Isocrates (Marrou, 1982), the old Carolingian doctrine of the seven liberal arts and sciences listed arithmetic, geometry, music, and astronomy as the four disciplines of the *quadrivium*, plus grammar, rhetoric, and dialectic as the subjects of the *trivium* (Kimball, 1988). While the actual disciplines may vary, the classification of knowledge according to key disciplines has the effect of emphasizing these large, coherent disciplinary conversations as the unit of study.

Until behaviorism redefined the very meaning of education, the most frequent classification schemes used by educators were variants on this list of intellectual disciplines that comprised a liberal arts and sciences education. Under the influence of mass education, these once sacred disciplines were metamorphosed into school subjects. In that guise they had a different character. The sophisticated subtlety of an education for spiritual refinement gave way to a compendium of bluntly defined behavioral objectives. In this fragmented iteration, there was nothing conceivably or remotely sacred about the disciplines. With their higher purposes all but gone, they were then further marginalized to make room for other, more practical school subjects, such as home economics and life adjustment (see Arthur Bestor's classic rant against this trend, 1953). So, that list of once venerated disciplines reemerged in modern times as lists of school subjects and, later, pending further reduction, as lists or canons of specific topics and particles of information a student was expected to master (cf. Hirsch, 1987). Following this trend line, the idea of an organic conversation that embodied a distinct kind of intelligence became increasingly difficult to grasp.

In the earlier, classical view of learning, education was a form of spiritual culture that affected deeply pervasive changes in the learner, a refinement and liberal empowerment of heart and mind. Behaviorists cut out the spiritual side of the discussion altogether (cf. Watson, 1924, pp. 1-19) and redefined education as the learning of specific behavioral patterns. This was an especially attractive theory for stewards of the new mass production-based economy where many citizens were expected to earn their living by means of repetitive physical labor.

Some writers have continued to argue that a cultural education is about crafting something extraordinary from the vast potential of the

human mind by means of formalized cultural systems. One thinks of Hirst's (1973) *Liberal Education and the Forms of Knowledge*, a well-reasoned and insightful defense of the disciplines as humanly constructed systems of formalized knowledge that served to extend the reach and enrich the capability of the human mind. Hirst argued that intelligence emerges in part from our mastery of symbol-based cultural systems such as mathematics, literature, and science, and that these can reasonably be seen as distinct divisions or forms of knowledge. Each has its own domain of investigation, its own methods of inquiry, its own standards of validity, and so forth. Hirst's view struck some critics as a rehash of Platonism, which was in the process of being thrashed on university campuses world wide because of its putative connections to the hegemony of western and bourgeois culture.

There were subtleties to Hirst's argument that were not always appreciated or acknowledged by his critics. Consider the following passage, for example:

> To acquire knowledge is to become aware of experience as structured, organised and made meaningful in some quite specific way, and the varieties of human knowledge constitute the highly developed forms in which man has found this possible. To acquire knowledge is to learn to see, to experience the world in a way otherwise unknown, and thereby come to have a mind in a fuller sense. It is not that the mind is some kind of organ or muscle with its own inbuilt forms of operation which, if somehow developed, naturally lead to different kinds of knowledge. It is not that the mind has predetermined patterns of functioning. Nor is it that the mind is an entity which suitably directed by knowledge comes to take on the pattern of, is conformed to, some external reality. It is rather that to have a mind basically involves coming to have experience articulated by means of various conceptual schemata. It is only because man has over millennia objectified and progressively developed these that he has achieved the forms of human knowledge and the possibility of the development of mind as we know it is open to us today. (Hirst, 1973, p. 255)

Barrow (1994) reinforces Hirst's argument with respect to natural language when he says:

> The conclusion thus seems inescapable that our concern to develop the intelligence of individuals should, in practical terms, manifest itself in a concern to develop their capacity to use language well, in the sense of rationally rather than in the sense of rhetorically or stylistically. (p. 74)

Barrow argues that we think through the medium of language, and that to think better we need to master the language we are using to think with.

One could suggest that the most compelling evidence of this argument comes when we examine the history of human cultural systems where we see writ large the effects of human innovation such as the advent of the phonetic alphabet, base ten and place value, a written notation system for music, the rich iconography of Christian art, and so forth. Improvements in the technologies used to think with create dramatic, even breath-taking expansions in the capacity of humans to seek understanding and to express themselves in those domains. And that is why education has traditionally been seen as a way of empowering human beings – not because it equips social elites with the emblems of class privilege, as critical pedagogy often asserts, but because it equips people to think more clearly, through a wider range of conceptual domains and possibilities, and with greater versatility and incisiveness.

Hirst and Barrow are mentioned here as exemplars of one kind of classification scheme, perhaps the most enduring of them all, in which the body of things to be learned is marked off as distinct disciplines and the whole is defended as the substance of a liberal education. This school of thought in its degenerate state is represented by Hirsch's (1987) followers, in whose hands the canon of venerated subject areas has been broken down (disintegrated, actually) into lists of information to be memorized. It is hardly the same thing (nor is it quite what Hirsch had in mind). The challenge is to understand how the mastery of those disciplines – natural language and literature; mathematics; science; the fine arts, and so on – constitute a different kind of human mind than we would otherwise possess in the absence of languages, systems of thought, culture, and social connection in general.

While Hirst pointed outward to the formalized intellectual disciplines, others have pointed inward to the mental structures and capacities that act as their counterpart. There are interesting political nuances underlying the decision to emphasize one or the other. In conservative theories of education the learner is expected to submit to various external authorities – the authority of the teacher, the administration, the rules, and of society, the authority of the textbook and of the canons of knowledge it represents. The learner becomes educated by conforming to the disciplinary demands of these authorized structures, and makes certain sacrifices of individuality as the cost of

perpetuating and participating in a shared intellectual heritage, which in turn is believed to provide the basis for his or her freedom.

In progressive and romantic theories of education the individual becomes the locus of authority and control. In the extreme, the whole system of schooling is expected to conform to the learner's needs and interests. In such schools, learning is a process of self-discovery and self-expression. The learner constructs his or her own knowledge rather than submit to the oppressive influence of authoritative external standards, canons of knowledge, and so forth.

Throughout the latter half of the 20th century we witnessed a breathtaking assertion of democratic prerogative for nearly every member and group in society. Any system of authority and control residing outside the individual was brought under severe scrutiny, its claims questioned, and in most cases eclipsed by arguments that highlighted what the learner – the individual – brought to the occasion. The right of the individual and of subordinated groups to a sovereign existence forced change on all social, economic, political, judicial, ethical, and educational systems. Supporting structures, such as philosophy and psychology, inevitably ended up reflecting these developments. In this sense, classification schemes that in an earlier age may have looked at the various intellectual disciplines were supplanted by classification schemes that looked at the various abilities, capacities, or intelligences that the learner brings to the occasion. That is one way to look at Gardner's (1993) work on multiple intelligences, which helped to establish the belief that our minds are somewhat modular, and that intelligence manifests in a variety of ways, all uniquely configured from individual to individual.

Often, the nuances of Gardner's (1999) work have gotten lost, and the emphasis on the self as sovereign agent is all practitioners were interested in hearing. While Gardner's work is based on competent science and scholarship, in its popular iteration (cf. Armstrong, 1994) it has become a blueprint for turning education into a kind of pedagogical boutique in which the happy consumer – ever unique and special in his or her individuality – can shop around for the kinds of schooling that address his or her special abilities and intelligences. Teachers under the influence of this kind of popularization can be seen trying to design lessons that address all of the learner's intelligences, every lesson a multimedia extravaganza. So, a thematic unit on dinosaurs might include activities in which children count dinosaurs (logical-mathematical intelligence), sing about dinosaurs (musical intelligence), write stories about dinosaurs (linguistic intelligence), act like dinosaurs

(bodily-kinesthetic), and so forth. Gardner never intended this kind of result, but that is how the field has often received his work (see Gardner, 1999, for his discussion of Spectrum Classrooms where all of the intelligences are stimulated in pedagogically appropriate ways).

This misconstrual is reminiscent of that earlier misapplication in which Bloom's work on instructional objectives was misused. When first published, he was surprised at its reception among teachers, who saw Bloom's taxonomy as a guide to lesson planning rather than (its original purpose) a guide to the classification and diversification of assessment strategies (Anderson and Sosniak, 1994).

The intent here is not to impugn any of these classification schemes – the tradition of liberal arts and sciences, Hirst's defense of the forms of knowledge, Hirsch's inventory of cultural reference points that citizens should know, Bloom's taxonomy, or Gardner's Multiple Intelligences – but rather to recognize that different classification schemes tend to be appropriate for very different and specific purposes, but that they also tend to be appropriated by different pedagogical camps, often for purposes not originally intended by their authors. The authors generally state what those purposes are, and the reader is advised to consider the whole argument.

The following classification scheme has a very limited and specific purpose, which is to help teachers distinguish between different kinds of knowledge at the micro level where instructional design takes place. Under conventional lesson planning protocols, each instructional objective in a lesson targets a specific task in which the learner will be able to know or understand or do something as a result of the lesson. The nature of the knowing or of the doing depends upon the nature of the thing to be known or done. At the moment where the teacher is subdividing a topic into specific objectives, the use of Bloom's (1956) taxonomy as a guide causes the teacher to think mainly (or only) in terms of the degree of abstractness (knowledge vs understanding vs appreciation) but not in terms of the kind of knowledge present. If we recognize that there are different types of knowledge, then we also tend to recognize that there are different instructional strategies appropriate to each. As we proceed, it may be useful to bear in mind the following key claims:

- There are different and very distinct categories of knowledge.
- Each type of knowledge has a different way of entering the human cultural landscape (for example, via discovery, innovation, observation, revelation, and so forth).

- Effective teaching captures and reproduces that method of entry, in some cases by historical reconstruction, by simulation, or by recapitulation of a distinct transformation or transition through a well-defined problem space.

Perhaps an example or two would be helpful. Consider teaching the temperature scales to students using two identical but unmarked thermometers, both placed in a beaker of water. By raising and lowering the temperature students may observe the two red columns rising and falling together. At the freezing point we mark each thermometer; at the boiling point we mark each thermometer. So far, we are dealing with knowledge that is empirical (for example, given by nature, observed with the senses). But now, in our historical recreation, we make a series of decisions: how many degrees will separate freezing and boiling, and where does the scale begin at zero? Fahrenheit modeled his scale after that of a predecessor, Roemer, but wanted finer gradations, and a different starting point to ensure against the awkward use of negative numbers. He ended up with 180° between freezing and boiling, with the freezing point set at 32°. Celsius designed his scale to have 100° of separation between the boiling and freezing points of water, but in its original version he set the freezing point at 100°, and the boiling point at zero. Unlike the empirical portions of thermometry, these are matters of human choice, conventions that become fact only because some humans decided and the rest of us accepted their decisions (for a discussion of the above, see Klein, 1973, pp. 295-321).

For another example, we might consider in mathematics how the binomial theorem can be represented as a puzzle made from wooden blocks (a well known work by Montessori), as a mathematical proof, or as an algorithmic routine for the solving of problems.

Or we might consider how geometrical statements could originate in the concrete form of wooden stakes pounded into the earth, with ropes stretched between them, from which we could make observations about angles, lines, points of intersection, even circles we could generate by marking off the various points on the earth at the end of a rope pulled taut in all directions from a single wooden stake. By drawing pictures of these configurations we undertake an abstraction. By representing the stakes by points and the ropes by lines, we abstract even further, thus introducing a convention of abstraction in order to isolate one portion of the scene (location and length) from any discussion of the wood or the hemp materials used to make the stakes and the ropes. As we work our way into formal geometry from this beginning, we are introducing types of knowledge different from the original grounding

in empirical experience. Soon, we encounter formal conventions of representation, as well as logical relationships, as well as cognitive routines and the formation of complex concepts.

A Taxonomy of Knowledge Types

These are the kinds of distinctions we want to make. So far, this investigation has yielded nine different categories of knowledge: Empirical, Rational, Conventional, Conceptual, Cognitive Process Skills, Psychomotor, Affective, Narrative, and Received. We turn now to an examination of each category.

Empirical Knowledge

Empirical knowledge is knowledge of our physical environment obtained through the use of our senses. Through sight, touch, smell, taste, and tactile sensation we create schemata of our physical world. This is the raw material and foundation of so much of our knowledge. But sensation (acquiring data through our senses) is only part of perception.

To secure empirical knowledge from the undifferentiated, volatile flow of our sensations we learn to isolate those patterns of sensory experience, secure them in memory as distinct mental schemes, and eventually we associate them with symbolic indices, which can then be expressed in words, in drawings, in idealizations, in imitation of some sort, and which can be held in comparison with other things we already know.

The figure-ground investigations by gestalt psychologists early in the twentieth century revealed how the human mind can actively select for specific features or patterns from our perceptual field (for a review, see Hunt, 1993, pp. 280-306). Educators have long recognized that the senses can be educated for greater sensitivity, accuracy, acuity, and consistency with established standards of color, hue, tone, texture, pitch, and so forth. And scientists in the 17th century began to capitalize on the fact that various mechanical instruments could extend the range and sharpen the acuity of our perceptions.

The key to empirical knowledge is that, to become knowledge the pattern of experience must be abstracted from the experience itself and preserved in memory, a process that necessarily involves some kind of symbolization or iconic representation.

Rational Knowledge

Rational knowledge is knowledge of the proportional relationship between the parts of something. Mathematics is the preeminent discipline for experiencing and teaching the nature of rationality, which is why historically the Greeks embraced the learning of geometry with such devotion. Formal logic and set theory also capture this kind of thinking in different kinds of symbolic domains. But then, so too does music, sometimes.

Rational knowledge is abstract, relational, and quantitative. Mastery of formal logic, mathematics, syllogism, set theory, and other modes of rational thinking tends to condition the mind to see the world as a rational construct. Rational knowledge must be thought of as both a type of knowledge and a way of thinking, as both content and process. Once acquired, it becomes an organizing schemata for both perception and concept formation, and the learner comes to see the world as a more or less rational construct.

Conventional Knowledge

Conventional knowledge is knowledge generated by human imagination and agreed upon by a cultural community. Conventions are learned by a process of social induction into their usage, and do not depend upon logic or empirical observation for their validity. Conventions involve an arbitrary association between two or more things that are not otherwise naturally linked.

The meaning of most words and symbols, for example, tends to be assigned by convention. The languages we speak are massive systems of structurally integrated conventions. Words, numerals, musical notations, punctuation marks, and so forth are all assigned by convention. In a different culture, or on a different planet, those symbols could be completely different. So could the practices that govern human conduct. The practice of driving on the left or right side of the road is a convention. Diplomatic protocols, social behavior, rules in a game, manners, and other procedures are often a matter of convention.

The relationship between conventional knowledge and other types of knowledge tends to be extremely complex and deeply integral. Seeing which aspects are a matter of convention and which are derived by other means is not always a simple matter, but it is one of the keys to clear, accurate, and meaningful teaching.

Conceptual Knowledge

Conceptual knowledge is compounds of knowledge built into patterns and other coherent ensembles. Concepts are assemblies (ensembles) of knowledge that form patterns, with the individual parts often coming from more than one of these other domains of knowledge currently under discussion. Patterns can be observed in the world, or they can be constructed by human thought. (After Kant, the distinction is not at all clear).

Concepts generally take the form of an assembly of knowledge built up out of many parts to form a coherent pattern. A concept taken as a whole has an intelligible structure; it is not a mere collocation of associated parts. Knowledge of all of the parts does not constitute knowledge of how those parts acquire coherence together, which is why we are regarding conceptual knowledge as a specific category, a specific type of knowledge.

Concepts are integrating patterns that bind more elemental knowledge together into complex assemblies. Grammatical structures constitute conceptual knowledge; scientific theories entail conceptual knowledge; the design of a specific building when taken as a whole may be seen as a concept.

Cognitive Process Skills

These skills are mental routines, heuristics, algorithms, and other learned processes that are used to tackle particular types of thoughtful acts in particular ways. Cognitive process skills are conventionalized strategies for how to think, specific to particular contexts and purposes.

Much of our thinking is performed by means of cognitive process skills, learned routines that allow us to conduct the business of thought with virtually unconscious ease without having to create or discover new strategies to handle every single contingency. Examples might include a strategy for balancing a checkbook, a formula for scripting short stories, fitting words into a metric structure in poetry or musical phrases into the form of the sonata, a routine for solving binomial equations, heuristic strategies in a game of chance, strategies for taking notes in lecture, strategies for playing chess, a systematic method for conducting science experiments, and so forth.

Obviously, a wide range of cognitive skills is involved in this category from every discipline, and all other modes of knowledge are closely associated with and implicated in cognitive process skills, but as a group these must be regarded as a type of knowledge, a type that is

uniquely procedural, dynamic and potentially transferable across different content areas or knowledge domains.

Psychomotor Knowledge

This entails movements of the body thoughtfully controlled and scripted. Physical skills and routines thus constitute a type of knowledge. The surgeon handling a scalpel, the ball player shooting a lay-up, the typist converting manuscript to print at the keyboard are all engaged in physical routines that had to be learned.

In infancy psychomotor activity is random and uncontrollable. Only gradually does intent and performance come together. Over time, physical actions can become routinized and may be subject to deliberate, controlled modification. Behaviorists have studied physical training carefully. A physical action may be learned by observing it, mimicking it, perhaps with additional scaffolding in the form of coaching, visible examples, physical or verbal guidance of the actions, and so on. If it is a complex action, we can learn it by breaking it into steps and performing each step, then by chaining (linking) the steps into sequences, and by rehearsing the sequence until it becomes automatic. We eventually gain the ability to modify and adapt an action creatively. There are no doubt more holistic strategies and processes as well. However physical actions are learned, the ability to perform controlled, directed movements constitutes a kind of knowledge.

Affective Knowledge

This is intuitive knowledge of one's felt state, the emotional and aesthetic dimensions of human experience (Damasio, 1999). As brain science has explored the role affect plays in making experience intelligible, memorable, and meaningful, the significance of the affective domain has become more fully appreciated. Every experience is attended by an affective state by which it is known to us and by which the human limbic system tags it and catalogs it for memory (Caine & Caine, 1991).

These felt conditions of an internal aesthetic pattern have been named and shaped by cultural conversations, which tie affective states to conventions of aesthetic knowledge. Art generates many of these conversations in which affective experiences are explored and defined, and in some respects standardized. They can only be learned by being experienced, a type of experience that is not easy to arrange.

Most affective experience does not proceed from our interaction with works of art, but from our residence within a given situation and environment. Our visceral, felt reaction to that environment is the stuff affective knowledge is made of. All significant experience, virtually by definition, has an aesthetic quality to it.

Narrative Knowledge

Narrative knowledge is knowledge of the human condition. It is the way the world appears to us through experience, our commonly experienced reactions to life, and the manner in which our peculiar human apparatus of mind, body, and soul manage to integrate experience into a life story. Narrative knowledge is the human perspective. It is the kind of knowledge explored by the humanities. It is the stuff of stories, yes (hence the somewhat odd borrowing of the term narrative for this purpose), but more fundamentally it is the perspective derived from being human and from sharing in the human condition.

Narrative knowledge allows us to see integration, coherence, and meaning in what would otherwise be constant waves of disjointed experience. Narrative knowledge generates the stories we tell ourselves and others to orient us on our journey through life. The humanities are generally seen as the disciplines that explore and explain the human condition, but every cultural system is grounded ultimately in the narrative conditions of discovery, creativity, insight, meaning-making, and authorization. We suggest it as one of the fundamental modes of knowledge because at some basic level it is the very bond of experience that makes everything else in life and in education intelligible.

When the account is given of Archimedes' discovery of the principle of buoyancy, the empirical and the rational aspects are integrated with a narrative account that includes the conditions under which the discovery was made (leaping from his bath and shouting "Eureka!") as well as his excited reaction to the discovery.

It is through the human, narrative aspect that so much learning can be personalized and made accessible, not because it simplifies the account, or diverts our attention from the real content, but because it provides a place to stand and a direction in which to move (perspective and point of view) which the human mind needs in order to orient itself to any situation. Narrative knowledge creates an interface between a learner's vast reserves of personal experience and new domains of learning he or she may attempt to connect with. However, education,

especially after behaviorism, generally fails to tap this powerful form of knowledge.

Received Knowledge

This knowledge is the spiritual side of human experience and life. Clearly, this is knowledge that lies outside the purview of science and scientific methods of investigation and therefore, the comfort zone of public schools, although it is profoundly influential in the lives of people worldwide. Different peoples and cultures claim to have received divine wisdom and guidance in various ways and have understood this knowledge in ways that vary from culture to culture.

Because the experience of divine revelation is rare, access to spirituality begins for most people as an article of faith, and it is only in the subsequent effects of this faith on life experience, as an orienting principle and guide to life, that received knowledge becomes most deeply understood. Even the skeptic might appreciate the preemptive nature of faith when faced with the world as an otherwise stark and meaningless existential void. If not within himself, perhaps in sympathy for others who find the world otherwise difficult to bear.

Are there other types of knowledge? Perhaps, but these have sufficed for the tested uses of this taxonomy so far. Perhaps there are intuitive or inherent forms of knowledge, a naturalistic form, or an existential form, as Gardner (1999) suggests, or other disciplinary variants not here accounted for.

Use of This Taxonomy

My students, pre-service education majors, and I came upon the need for this taxonomy during an exercise in which we work on the design of a historically framed three-year middle school curriculum (Carson, 1998, 2002a, 2002b). Each student is expected to identify a significant event in the history of one of the standard disciplines, that event having taken place during the historical epoch they were also assigned to, and they are to figure out how they would teach that event in such a way that their pupils would experience a transformation of consciousness similar to the one writ large in the cultural-historical record.

Could we, for example, teach about the transformation from alchemy to modern chemistry and the change of human consciousness it brought about? How did it happen? To find out, we had to research the gradations of thought that occur as we move from the first cynical criticisms of alchemy levied by Paracelsus, through the fruitful

speculations of Robert Boyle, into the late 18th century work of Lavoisier and others. Recreating these historical moments, taking on the transformation in the history of knowledge with solid narrative empathy, requires immersion in the historical circumstance and a clear understanding of the relevant knowledge being transformed.

If we can follow the human story closely enough, then we can also experience the shifts in consciousness and understanding that occurred both in the cultural system and in the minds of those who lived through and contributed to those changes. But how do we recreate those stories as lived experiences in the lives of our pupils? That was the challenge. In repeating this exercise year after year, I found that my students were generally able to understand the historical events they explored, at least in occasional and sporadic moments of clarity, but when it came to creating a lesson using standard lesson planning strategies we found that the use of Bloom's (1956) taxonomy or other classification schemes actually broke down their understanding and turned the content back into behaviors to be mimicked or particles of information to be memorized.

Somehow, the conventional approaches to lesson planning managed to dissolve the nuances and subtleties of thought my students had garnered from their careful reading of the historical events. Alternatively, they kept trying to process their reading of the event through an expectation of teaching it using standard lesson planning protocols, and the approach never led them to see clearly the nature of the content they were trying to teach or ways of turning what they had learned into any kind of vivid simulation.

This engendered a frustration that persisted for several semesters. Then we began to realize that part of the value of the historical account was that it was giving us precise ontological insights into the nature of the material we were tracking. It made a difference whether the key transformation was taking place because of an act of reason, an act of keen observation, an experiment, an invention, the development of a new procedure, the advent of a new way of characterizing what was being looked at, and so forth. The way a given quanta of understanding enters the scene very often reveals the kind of knowledge it is, and, significantly, there are different kinds of knowledge. Each knowledge type, we concluded, could be taught in a way that mimics the way it came on the scene originally, and often that is the best way to teach it. Stories, simulations, and other historical reconstructions have proven useful in this regard.

One of our challenges in this exercise was to figure out how to take ordinary knowledge, as represented in the school curriculum, and reinvest it with the dazzling richness it must have had back when it was new on the human scene. How would you, for example, get young learners to appreciate the revolution in thought and culture brought about by the advent of phonetic writing systems? How would you get them to appreciate the amazing simplicity and beauty of base ten and place value, or other mathematical innovations that have changed our mental landscape (see Kline, 1972) when these things are now taken for granted? How would you get them to understand what a profound transformation occurred in human thought by the scientific revolution in the 17th century? Or the challenges to traditional western perspectives Picasso introduced into art? How could you get them to experience for themselves the most profound shifts in perspective that occur throughout the whole dramatic evolution of formal intellectual culture?

The development of a comprehensive, historically based curriculum opens up the possibility of seeing how pivotal developments in the evolution of the world's various cultural systems and intellectual disciplines manifest as an expansion of human consciousness and of the existential possibilities open to humankind. It also forces us to think more carefully about the nature of knowledge. In conducting this exercise, we go back three million years to set the time scale suggested by evolutionary science, examining the long prehistory of humankind, and the gradual refinement of survival strategies, social organization, primitive tool kits and cultural artifacts (Wenke, 1990, is a helpful resource). Following this prelude, we begin the more detailed heart of our story beginning some twelve thousand years ago, at the close of the last ice age. We take the time to explore how people lived all over the planet during the several millennia leading up to the first really dramatic shift in human technology, the agricultural revolution, and how the domestication of plants and animals then precipitated profound changes in social patterns worldwide as the concentrated living conditions of urban life became possible.

The story becomes more complicated, and the pace of change begins to quicken dramatically as we cross that threshold where language evolves to written form. Humans had long since learned to use signs and symbols for various purposes, but once the invention of symbols becomes a deliberate activity and their use comes under meta-cognitive scrutiny, as it does among the various classical civilizations of India, China, Greece, MesoAmerica, and elsewhere, there is a virtual explosion of

cultural activity. Each new discovery or innovation can have dramatic and far-reaching consequences. That is the story we are attempting to tell.

There is in this approach a strong reflection of Vygotsky's emphasis on tool making and tool use, and in particular the remarkable capacity of human beings to invent tools for the mind and then to use them for often dramatically varied purposes (Van Der Veer & Valsiner, 1994; Vygotsky, 1986, 1978). The historical approach makes us less likely to take the presence of symbols for granted, and to focus pedagogical efforts on helping students understand how this human capacity to invent cultural tools has altered human existence. It also makes it more likely that teachers will reflect on the critical distinction between symbols (which are conventions) and the things those symbols refer to.

As we have pursued this approach we have also found that the way we need to think about instructional design changes. It requires the use of different conceptual tools, such as this taxonomy of knowledge types. I would hasten to add that it is not only in the use of a historically based curriculum that this taxonomy becomes useful, only that when utilizing historical contexts in teaching we are more likely to confront the subtle distinctions between the various kinds of knowledge represented in the subject matter. We do so because we are seeing how that knowledge came into being in the first place.

The literature in science education offers numerous examples of why it is critical to make these kinds of distinctions. In the 1970s and 1980s when the use of discovery learning was being overly generalized, the failure to appreciate the role of symbols, metaphors, models, idealizations, mathematical formulae, and so forth as vehicles for representing phenomena meant that teachers expected students to discover things that were simply not amenable to discovery (Matthews, 1994, pp. 199-213). Hands-on, empirical and kinesthetic learning could effectively prepare the way for receiving these formalized representations of the expert's knowledge structures, but the failure to distinguish between these representations and their referents let to the systematic failure of so-called discovery learning strategies. We learn conventions, including conventions of representation, not by discovery but by having them explained to us, that is, by means of direct instruction.

A Few Cautionary Remarks

Even though knowledge may originate in one of these domains, it can seem to migrate into another. The most common type of apparent migration is from any of these domains into the domain of conventional knowledge. Almost everything that was once learned by observation, by reason, or by revelation has since been catalogued and recorded into books, and is subsequently presented to learners as a convention of knowledge, something that everybody knows. However, viewing all knowledge as convention misses the point of this system, which is to identify various types of knowledge based upon how that knowledge originated, to teach in a manner that simulates that original event of discovery or creation, and preserves the subtle ontological distinctions, which are never again so apparent as they are in those crucial moments of their beginnings.

The second point to bear in mind is that this neat separation of knowledge into different source domains is easy to propose as a theory, but for the real world to conform to any theory it must be coerced. In reality these domains are all intertwined. Some knowledge may be unthinkable except as a fusion of two or more of these domains. Similarly, as we work with this system we recognize the overlap between these domains, such that some knowledge seems equally at home in more than one of these categories. Perhaps the distinction between revealed knowledge and aesthetics, or between rationality and cognitive process skills is not so abrupt after all. The value of this taxonomy lies in its heuristic value, in the kinds of distinctions it encourages the curriculum writer to try to make, even if imperfectly.

Conclusion

We live in a different world from the one our grandparents knew (see Anderson, 1995, for an exploration of the post-modern condition and its cultural enigmas). Students today study cultural systems, not monolithic pretensions to the Truth. They are expected to respect other ways of knowing, which means they must understand what it means to have a world view when many world views are possible. Students today have been conditioned to be cautious toward any hint of dogmatic certainty, but that puts them at risk of becoming cynical. They want to know why we believe in the things we are teaching so they can judge for themselves whether it is knowledge worth having. And they understand that the knowledge we authorize today may be replaced by a different scheme of understanding tomorrow.

By getting the nature of knowledge to be as transparent as possible for learners, we equip them to receive it in ways that are intellectually more honest. We make the culture we teach richer, more human, more authentic, and more comprehensible.

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