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LEARNING ABOUT LEARNING

WHAT IS THIS BOOK ALL ABOUT?

WE ARE CONCERNED with educating people and with helping people learn to educate themselves. We want to help people get better control over the meanings that shape their lives. Educating is powerfully liberating; failures in educating are powerfully oppressive. Wherever educating occurs, in schools and out, we think we can help people get better control over the events of educating, and thus over that part of their lives that is being transformed.

"Seek simplicity, but distrust it," claimed Alfred North Whitehead. We share this view, and desire in seeking simplicity to preserve complexity. Sometimes simple ideas are so obvious they are obscure. We will try to illustrate simple but potentially powerful strategies to help students learn and to help educators organize learning material. The two principal educational tools we will discuss are *concept mapping* (see Figure 1.1), which is a way to help students and educators see the *meanings* of learning materials, and *knowledge Vee diagramming* (see Figure 1.2), which is a way to help students and educators penetrate the *structure* and *meaning* of the knowledge they seek to understand. In addition, we will describe some strategies that help students and teachers move toward what we will call *shared* meanings and feelings. This task is ambitious, but our experiences have shown that it is not unattainable. We invite you to join us in an exploration that is still very much in progress, for we (the authors) and our students are continuing our search for ways to become better teachers and/or learners and to help students learn what it means to learn. This process is symbiotic: illuminated by the teacher and student sharing ideas and advanced by their mutual commitment to educating.

In Chapter 2, we will present a full discussion of concept mapping.
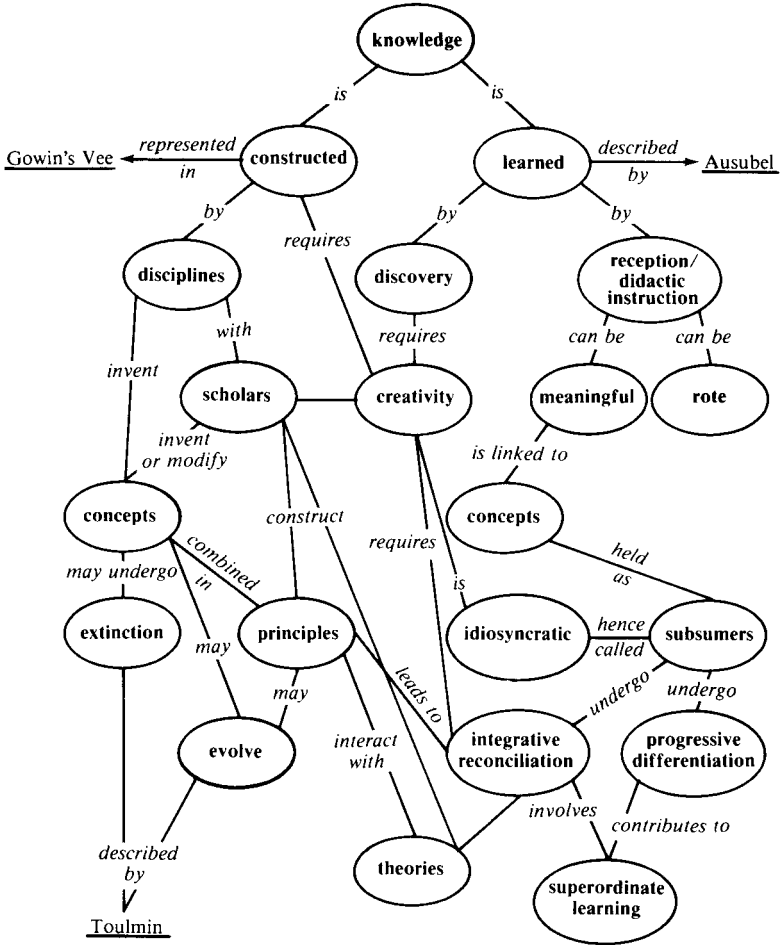
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Figure 1.1 A concept map showing the major ideas presented in this book regarding acquisition and construction of knowledge. Key concepts are shown in ovals; appropriate linking words form key propositions.

We provide both practical advice and theoretical perspective, stressing that people think with concepts and that concept maps serve to externalize these concepts and improve their thinking. In Chapter 3, we show that Vee diagramming based on epistemological study of an event is a simple and flexible way to help students and teachers
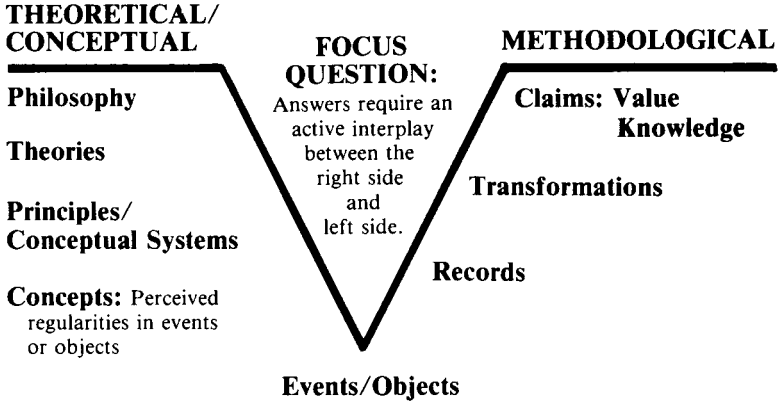
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Figure 1.2 Gowin's Vee heuristic invented to illustrate the conceptual and methodological elements that interact in the process of knowledge construction or in the analysis of lectures or documents presenting knowledge.

grasp the structure of knowledge. It has been our experience that once people have tried applying concept mapping and Vee diagramming to familiar material, they see the value and power in these strategies.

For decades it has been debated whether education is an art or a science. We will not enter into this debate, which is somewhat analogous to the debate regarding heredity versus environment as the determinant of human performance. Whatever the detailed issues may have to say to us, our general premise is that education can be both an art (or craft) and a science and that human potential is influenced by both heredity and environment. Because almost no one today advocates eugenics, the only option available to educators is improvement of the learning environment. The strategies presented in this book are based on and derived from theoretical developments in learning psychology and philosophy in much the same way that many new medical, agricultural, or engineering practices are derived from theoretical advances in the sciences. Without belaboring the issues, we try to illustrate the symbiosis that exists between theory development and advances in educational strategies. We will show this relationship in the course of illustrating strategies for helping students understand how knowledge is constructed by human beings – by students, teachers, and scholars.

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To some of our readers, it may come as a surprise to learn that
knowledge is *constructed*. That people *discover* knowledge is a com-
mon myth. Discovery may play a role in the production of new
knowledge, but it is never more than just one of the activities in-
volved in creating new knowledge. The construction of new knowl-
edge begins with our observations of events or objects through the
concepts we already possess. By *event* we mean anything that hap-
pens or can be made to happen: Lightning is a natural event; wars,
schooling, and atom splitting are events people make happen. By
object we mean anything that exists and can be observed: Dogs, stars,
and humans are naturally occurring objects; houses, pottery, and to-
tem poles are objects humans construct. So we see that the construc-
tion of knowledge can involve both naturally occurring events or
objects and events or objects that humans construct. Knowledge is
not discovered like gold or oil, but rather is constructed like cars or
pyramids. Let us turn now to the role that concepts play in knowl-
edge making.

We define *concept* as a regularity in events or objects designated by
some label. "Chair" is the label we use (in English) to designate an
object with legs, a seat, and a back that is used for sitting on. "Wind"
is the label we use for the event that involves air in motion. Although
it is possible that other animals also recognize regularities in events
or objects, humans seem to be unique in their capacity to invent and
use language (or symbols) to label and communicate these perceived
regularities.[1] Culture is the vehicle through which children acquire
concepts that have been constructed over centuries; schools are rel-
atively recent inventions for (we hope) accelerating this process. Wil-
liam James once suggested that the world of the newborn infant is a
blooming, buzzing confusion. We don't know if this is true, but we
do know that very young infants learn to distinguish the sounds of
mother or father coming to feed them and of other important events
from the noises around them, and that their cries can signal recog-
nition of these perceived regularities in events. This innate capacity
to sort out regularities and to recognize and/or apply labels enables
the infant to acquire speech (which all normal children do by age
three), an incredible feat that is in many respects the most difficult
learning task the individual will ever face. For until children have

1. There is some debate as to whether or not chimpanzees and perhaps other higher
   animals have this capacity, but there can be no debate that humans conceive and
   use concept labels uniquely well.

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constructed this first set of concepts from experience, they cannot
use language to recognize and label regularities like those we call
trees, kangaroos, winter, or birthday parties. So eager are normal
young children to learn new labels, and the regularities they specify,
that their repeated questioning can become annoying to parents or
older siblings. Children then begin to acquire language rules that,
when combined with concept labels, give more precise meaning to
events or objects: the request "Milk!" becomes "Me milk!" and later
"Please give me some milk to drink." By the time children begin
school they have acquired a network of concepts and language rules
that play crucial roles in subsequent school learning. Children also
learn methods for organizing events or objects that enable them to
see new regularities and in turn to recognize the labels that represent
those regularities. And this process continues until senescence or death.

   We are interested in both learning and knowing. They are not the
same. Learning is personal and idiosyncratic; knowing is public and
shared. We are interested in thinking, feeling, and acting – all three
are present in any educative experience and change the meaning of
the experience. Though infant and school child, expert and novice,
apprentice and master may share the same experience, the meaning
of that experience can be radically different. Educating is the process
by which we actively seek to change the meaning of experience. Ed-
ucating can be liberating or oppressive; this book is committed to
making educating more liberating.

THE KNOWLEDGE VEE

In 1977, Gowin invented a heuristic device that we have found to be
increasingly useful in helping people understand the structure of
knowledge and process of knowledge construction (see Gowin 1981).
Figure 1.2 shows a simplified version of Gowin's Vee.

   At the point of the Vee are events or objects, and this in one
respect is where knowledge production begins; it is a good "point"
at which to begin. If we are to observe regularities, we may find it
necessary to select specific events or objects in our environment, ob-
serve them carefully, and perhaps make some kind of record of our
observations. This selection and record-making process will require
concepts we already know; the concepts we possess will influence
what events or objects we choose to observe and what records we
choose to make. These three elements – concepts, events/objects,

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and records of events/objects (which we call facts) – come together and are intimately intertwined as we try to make new knowledge. When students become muddled about new concepts they are trying to learn, the problem is usually right here at the point of the Vee. The students need to be helped to recognize (1) what events or objects they are observing, (2) what concepts they already know that relate to these events or objects, and (3) what records are worth making.

THE FOUR COMMONPLACES OF EDUCATING

An educational experience is a complex event. It involves four distinct commonplaces, which Schwab (1973) described as teacher, learner, curriculum, and milieu. None of these is reducible to any other, and each must be considered in educating. It is the *teacher's* obligation to set the agenda and to decide what knowledge might be considered and in what sequence. The skilled teacher will of course involve the learner in some aspects of the agenda planning (as in Mastery Learning; see Bloom 1968, 1976), but we expect the teacher to have greater competence than the learner in the area of study. The *learner* must choose to learn; learning is a responsibility that cannot be shared. The *curriculum* comprises the knowledge, skills, and values of the educative experience that meet criteria of excellence that make them worthy of study. The expert teacher will be well versed in both the material and the criteria of excellence used in the area of study. The *milieu* is the context in which the learning experience takes place, and it influences how teacher and student come to share the meaning of the curriculum. Gowin (1981) uses the term *governance* instead of milieu to describe those factors that control the meaning of the educative experience. Schools, thirty-student classes, and state-mandated textbooks are examples of governance factors. In many respects, society, teachers, and curriculum control or govern the meaning of experience, but students also play a role – albeit sometimes a perverse one – by devising what Holt (1964) described as students' "strategies for failure."

We will show how concept mapping and Vee diagramming can have a positive influence on teaching, learning, curriculum, and governance. We will also refer to thinking, feeling, and acting, which, along with the four commonplaces, are part of any significant edu-

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cational experience. Bear in mind that all seven of these factors are operative in every educational event.

LEARNING AND INSTRUCTION

The philosophical basis of our work makes concepts, and propositions composed of concepts, the central elements in the structure of knowledge and the construction of meaning. The best learning theory that focuses on concept and propositional learning as the basis on which individuals construct their own idiosyncratic meanings is the one proposed by David Ausubel (1963, 1968; Ausubel, Novak, and Hanesian 1978). We will introduce the six key elements of Ausubel's theory as they become relevant to our discussion of the methods we are proposing for improving education and educational research. The primary concept in Ausubel's theory is *meaningful learning,* as contrasted with rote learning. To learn meaningfully, individuals must choose to relate new knowledge to relevant concepts and propositions they already know. In rote learning, on the other hand, new knowledge may be acquired simply by verbatim memorization and arbitrarily incorporated into a person's knowledge structure without interacting with what is already there.

It is important to distinguish between the type of instructional strategy we employ and the kind of learning process in which the student is engaged. Figure 1.3 illustrates that under any instructional strategy, learning can vary from being almost rote to being highly meaningful – from *reception learning,* where information is provided directly to the learner, to autonomous *discovery learning,* where the learner identifies and selects the information to be learned. Much of the educational reform movement of the late 1950s and 1960s was an attempt to get away from rote learning in schools by advancing instructional programs that encouraged discovery, or inquiry learning. Well intentioned as these efforts may have been, they did little to increase the meaningfulness of school learning. The strategies presented in this book are designed to support instructional approaches aimed at increasing meaningful learning.

METAKNOWLEDGE AND METALEARNING

Metaknowledge refers to knowledge that deals with the very nature of knowledge and knowing. Concern with metaknowledge dates to

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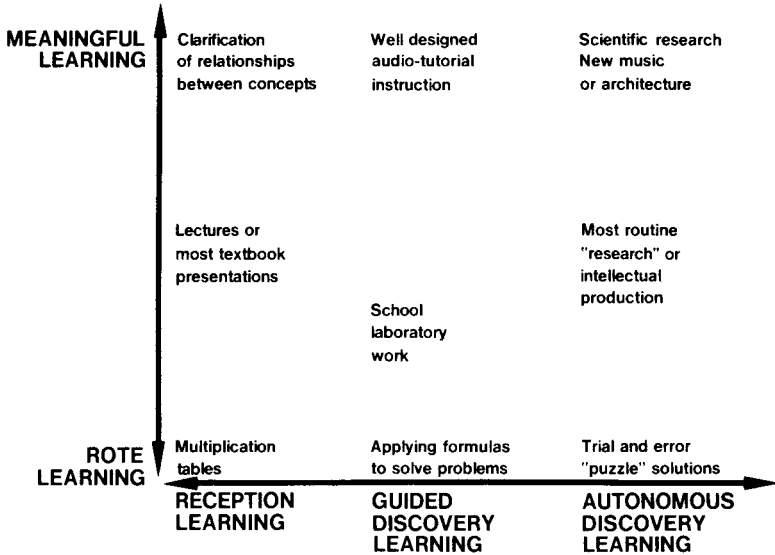| MEANINGFUL LEARNING	Clarification of relationships between concepts	Well designed audio-tutorial instruction	Scientific research New music or architecture
	Lectures or most textbook presentations		Most routine "research" or intellectual production
		School laboratory work	
ROTE LEARNING	Multiplication tables	Applying formulas to solve problems	Trial and error "puzzle" solutions
	RECEPTION LEARNING	**GUIDED DISCOVERY LEARNING**	**AUTONOMOUS DISCOVERY LEARNING**

Figure 1.3 Reception learning and discovery learning are on a continuum distinct from that of rote learning and meaningful learning. Typical forms of learning are shown to illustrate where different representative activities would fit into the matrix (see also Figure 8.8).

antiquity, especially to some of the analyses of Socrates, Plato, and Aristotle. The recent rapid advances in knowledge production in the sciences have led to an interest in "metascience," or the study of how sciences work to produce new knowledge, and this interest has in turn stimulated a renewed interest in and concern with metaknowledge.

We see concept mapping and the Vee heuristic as two useful tools for helping students learn about the structure of knowledge and the process of knowledge production, or metaknowledge. Concept mapping has been used successfully with first-grade children and Vee diagramming with upper elementary school students. We believe teachers should make an explicit effort to help students understand knowledge structure and production.

Metalearning refers to learning that deals with the nature of learning, or learning about learning. Hermann Ebbinghaus (1913) was the first psychologist to devote great energy to this, but he was interested in memory, which led him to study the learning of nonsense

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syllables, or what meaningless information the mind could remember. Systematic study of the learning of meaningful materials is a more recent phenomenon, with the great impetus for such work arising in the 1970s. Our experience with metalearning began when the graduate students who were working with us recognized that the concepts and methods we were using in our research were helping them to "learn how to learn." It occurred to us that it would make sense to teach similar concepts and methods to younger students explicitly to help them learn how to learn. Our early work at Cornell University (Cardemone 1975, Bogden 1977, Moreira 1977) was with college students. More recent work has been with elementary (Kinigstein 1981, Symington and Novak 1982) and secondary students (Gurley 1982, Novak, Gowin, and Johansen 1983).

This book presents our current thinking on and methodologies for educating about metaknowledge and metalearning. We anticipate much activity in this area at Cornell University and elsewhere, and expect to see new ideas and new perceptions promulgated in the future. We caution that so-called memory tricks and other "superlearning" strategies have little or nothing to do with meaningful learning; such promulgations are usually characterized by their avoidance of any discussion of the conceptual nature of knowledge and the processes by which humans construct knowledge. The best metalearning strategies should be accompanied by strategies to aid in metaknowledge learning. Metalearning and metaknowledge are two different but interconnected bodies of knowledge that characterize human understanding. Learning about the nature and structure of knowledge helps students to understand how they learn, and knowledge about learning helps to show them how humans construct new knowledge.

HONESTY AND RESPONSIBILITY IN EDUCATING

We have found that the metalearning and metaknowledge strategies presented in this book have had an unanticipated positive dividend – they promote intellectual honesty on the part of both teachers and students, and this leads to a new sense of responsibility.

Vee diagramming helps us help students to see that in learning, authority resides in the events and objects observed, the validity of the records we choose to make, and the quality or adequacy of the ideas guiding the inquiry. Nobody has absolute authority for making

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knowledge claims, for no person has *the* right concepts and *the* best way of making records. But lest students think that nothing, therefore, is worth learning, Vee diagramming helps them to see that they can play an active role in judging the validity of claims and that learning becomes meaningful when they take responsibility for doing so.

It is a common belief that learning is automatic and without effort, and that it is continuous and cumulative over life. Yet we have reason, and some evidence, to doubt this belief. Learning has been confused with development, and the biological metaphor of autonomous developmental growth is so powerful that it permeates our thinking. Just consider the tremendous variability in human beings. Most people have a word vocabulary of ten to thirty thousand words, yet Shakespeare is responsible for inventing and writing over three thousand separate puns and had a vocabulary ten times greater than that of most people. Some sailors can tie four or five knots, others more than fifty. Weavers and textile artists of all kinds have a vocabulary of concepts, feelings, and facts about cloth and its colors that vastly surpasses the range of labels comprehensible to most of us. Every human activity, when carried to a point of sufficient proficiency, creates its own concepts, labels, words, actions, and ways of working and wondering that simply exclude the rest of us who are untutored in the events, objects, concepts, and facts about that activity.

We need to cherish, celebrate, and comprehend how beautifully various and inventive human beings are. We need to give up the mythology of continuous development according to simple laws of learning. The possibility for growth and variation is so much greater than the central tendency; the data that seem to justify conventional beliefs about learning are data of aggregation, not facts. Shifting our views on individuality and on how we become individuals will have radical and sweeping consequences.

Why do we feel so strongly about this? First, we have records of the ways of thinking and feeling of hundreds of individuals, and no one is exactly like any other. Second, we have created ways to reveal to people new ways of thinking and feeling that are a great surprise to them. Most human beings don't know what they know. Third, we can present an idea to a person in such a way that it truly changes the meaning of experience for that person; without the idea, living would be very different. First-grade children who learn, meaningfully, the idea of the conservation of matter literally see the world