between the preferred input modality of most students and the preferred presentation mode of most professors. Irrespective of the extent of the mismatch, presentations that use both visual and auditory modalities reinforce learning for all students.\textsuperscript{6,14,19,20} The point is made by a study carried out by the Socony-Vacuum Oil Company that concludes that students retain 10 percent of what they read, 26 percent of what they hear, 30 percent of what they see, 50 percent of what they see and hear, 70 percent of what they say, and 90 percent of what they say as they do something.\textsuperscript{21}

How to teach both visual and auditory learners: Few engineering instructors would have to modify what they usually do in order to present information auditorily: lectures and readings accomplish this task. What must generally be added to accommodate all students is visual material—pictures, diagrams, sketches. Process flow charts, network diagrams, and logic or information flow charts should be used to illustrate complex processes or algorithms; mathematical functions should be illustrated by graphs; and films or live demonstrations of working processes should be presented whenever possible.

Inductive and Deductive Learners

Induction is a reasoning progression that proceeds from particulars (observations, measurements, data) to generalities (governing rules, laws, theories). Deduction proceeds in the opposite direction. In induction one infers principles; in deduction one deduces consequences.

Induction is the natural human learning style. Babies do not come into life with a set of general principles but rather observe the world around them and draw inferences: “If I throw my bottle and scream loudly, someone eventually shows up.” Most of what we learn on our own (as opposed to in class) originates in a real situation or problem that needs to be addressed and solved, not in a general principle; deduction may be part of the solution process but it is never the entire process.

On the other hand, deduction is the natural human teaching style, at least for technical subjects at the college level. Stating the governing principles and working down to the applications is an efficient and elegant way to organize and present material that is already understood. Consequently, most engineering curricula are laid out along deductive lines, beginning with “fundamentals” for sophomores and arriving at design and operations by the senior year. A similar progression is normally used to present material within individual courses: principles first, applications later (if ever).

Our informal surveys suggest that most engineering students view themselves as inductive learners. We also asked a group of engineering professors to identify their own learning and teaching styles: half of the 46 professors identified themselves as inductive and half as deductive learners, but all agreed that their teaching was almost purely deductive. To the extent that these results can be generalized, in the organization of information along inductive/deductive lines—as in the other dimensions discussed so far—a mismatch thus exists between the learning styles of most engineering students and the teaching style to which they are almost invariably exposed.