



Thoughts On Learning

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The thesis of this article is that what is ordinarily considered learning should more accurately be thought of as a combination of distinct but overlapping components, these being knowledge, skill, understanding, and creativity. These four items can be paired in combinations. My examination of these six combinations leads to the conclusion that they constitute six inequalities. That is, "knowledge does not equal skill," "knowledge does not equal understanding," and so forth down through "understanding does not equal creativity." All are important, however, and all have a place for those involved with the acquisition and/or transmission of education.

Who can deny that knowledge and understanding are different? As one scholar put it, knowledge is the "isness" of things, while understanding is their "whyness." The acquisition of knowledge is the acquisition of facts — of bits and pieces of information. Although they can be astounding, interesting, or stimulating, they are just facts until we process them mentally and put them to some use. Much of formal education is devoted to transmitting facts, then examining to see how well they were learned. Disenchanted educators complain that the educational process frequently conditions students to be "temporary fact receptacles," retaining data through but not beyond examination time. The proportion of total formal education devoted to the transmission of facts has varied over time, with changing perceptions of societal needs and with changing fads.

Compared to understanding, knowledge is relatively easy to acquire. Major requisites are motivation, intelligence, and memory. There are tricks to the knowledge acquisition trade. Repetition, reinforcement, association, competition, and learning games are used routinely in our primary and secondary schools (though less frequently, it would seem, in colleges where teachers either aren't well trained in their use or where it is assumed that it is the students' problem to motivate themselves).

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Skill is the second component of learning. It is the ability to do something — sew a shirt, fix a washing machine, plow a field, or program a computer. Knowledge is often a prerequisite or corequisite to skill, but sometimes not much of it is required. It depends on the complexity of the skill and whether understanding of basic processes is involved. Much of formal education — the proportion has varied widely over time — is devoted to the teaching of skills. Recently, vocational skills have received increased emphasis, and with chronic un- or underemployment expected to plague the 1980's, this trend is likely to continue.

The effective teaching of skills involves many of the methods and strategies involved in transmitting knowledge. Hands-on experience, repetition, and practice would be especially important.

Skills are good for making a living and for providing satisfaction to the person possessing and practicing the skill. It is rewarding to be able to do something well. Everybody should have some, not only to prevent poverty but also for the pleasure, diversion, and satisfaction they bring.

Understanding is the third component of learning. Compared to knowledge and skill, understanding is less tangible, more difficult to quantify, less easily acquired, and much more difficult to communicate to others. It may be abstract — a feeling or an understanding. It generally is inter- or cross-disciplinary. It involves challenging "facts" as they are acquired, collating information from diverse sources, relating bits of information one to another, interpreting, and drawing conclusions from such information and asking new and penetrating questions. Understanding is what the Tin Woodman sought from the Wizard of Oz when he asked for a brain.

There are tricks to the trade of acquiring understanding, but they are far from foolproof. First, knowledge and possibly certain skills are either a prerequisite or a corequisite of understanding. Facts must be at a person's disposal before they can be mixed, fermented, and distilled into understanding and until understanding can mature into wisdom. Some considerable emphasis on knowledge transmission is therefore justified, necessary in fact, during formal education.

Second, knowledge should not be restricted to one or a few intellectual disciplines. It's hard to imagine a truly educated person who knows all about, but only about, advertising or computer science or animal breeding. Although this is an age of specialization, if we are to be wise, we should be more like Leonardo da Vinci or Benjamin Franklin and have a consuming interest in many things. Our knowledge in each area should be growing in quantity and complexity.

Third, there probably is a positive correlation between flaccidity of the body and flaccidity of the mind. Good health and good physical condition are conducive to critical thinking, though the latter is possible without the former — and the former certainly doesn't guarantee the latter.

Fourth, we need to be sensitive to input from all five senses. The majority of the time, we are unaware of their existence and constant communication to us. That is as it should be, since the conscious mind couldn't possibly process, continuously and simultaneously, the input from all of them. Nevertheless, we stand to gain perspective, insight, and pleasure by tuning underused senses more frequently and more critically to what is happening around us.

Fifth, we need to **exploit** information, mentally to react to it in an active rather than a passive sense. We need, figuratively, to scrutinize information from every angle, to be sensitive to dimensions that ordinarily would escape notice and to recall related information for comparison and contrast. This is hard work, and it takes time. And this means, I think, that neither we nor our students should be so fully scheduled that no time is available for such mental synthesis.

Sixth, an abrupt change in personal circumstances can be a stimulus to the kind of critical thinking that can culminate in increased understanding. The change can be in physical, cultural, or intellectual environment; in family status; in job responsibilities; or in all of the above. For faculty, sabbatical leaves, consultancies, or participation in continuing education might be looked upon to provide this type of change.

Seventh, we should partake of the wisdom of the ages, but we should not accept it without challenge. Such wisdom must be evaluated in the light of what we know and feel. That which passes critical examination can be assimilated; that which fails can be rejected. That which can neither be accepted nor rejected **in total** can be consigned to mental purgatory, for later reassessment in the light of new knowledge and understanding.

These seven points hopefully are catalysts that can facilitate the acquisition of understanding. They cannot manufacture it. To a large extent, understanding is self-generating and self-authenticating. It is to be coveted. It adds to if not defines the humanity of man. If it accompanies aging (which is not automatically the case), then it must make aging easier to accept.

Creativity, the last component, doesn't fit as well into the list; for although knowledge, skill, and understanding can be added to, nurtured, and developed, I'm not at all certain that is the case for creativity. Likewise, I know of few tricks in the creativity acquisition trade. Bertrand Russell commented that many truly gifted and innovative multidisciplinary scholars enjoyed a childhood in which there was little pressure for conformity and maximum freedom to pursue even unusual and bizarre interests, but this doesn't help when we and our students are past adolescence. Certainly there must be provision of time for creativity to be expressed. Faculty whose calendars are filled with committee meetings are not likely to be the ones providing the bold new insights upon which future science can build. As Sir Michael Sadler said, "The ideas come — not when I am

under great strain or threadbare with over work, but after a period of rest (including physical exercise and distraction of thought) following on a period of very hard work and of grappling with real unsought difficulties. The ideas come to me unsought, and I find them in my mind exactly as I might find a half-crown that somebody had put into my pocket while my coat was hanging up in my absence" (*Nature* 172:1035, 1953).

Even with the provision of adequate time, true creativity is a rare commodity. Some have it, some don't, it would appear; and the majority of us are in the latter group. There may be neuroanatomical and neurophysiological bases for differences among persons in creativity. Research indicates that the left cerebral hemisphere, dominant in most people, is "wired" to process verbal and analytical input, processing and output, while the right hemisphere is responsible for intuitive insights and rare "great leaps forward" (Sagan, 1977, *The Dragons of Eden*, Random House, N.Y., N.Y. pp. 153-185). Creative thinkers might be right hemisphere dominated.

Truly creative thinking must be a tremendous responsibility and a tremendous source of satisfaction. When we think we have identified it or its potential in a student, it should certainly be fostered and encouraged, possibly by the use of a nontraditional curriculum or degree program.

The question remains as to the pertinence of these thoughts on learning to college teachers of agriculture. I think there are two points of application. First, the fact that we are teachers should not disguise the fact that we also should be learners. In fact, it makes little difference how good at teaching a person **has been**. If his knowledge, skill, and — particularly — understanding are not expanding, his teaching is doomed to become dogmatic, stagnant, and ineffective. We should personally define the components of learning so that we can more effectively participate in them.

Second, we should personally define learning so that we can more effectively guide it in our students. We should consciously determine the approximate proportion of each class that is "knowledge", the proportion that is "skill" and the proportion that is "understanding." We should question how our examinations, our advising, and our informal student contacts can foster in students the motivation for thorough and effective learning. And, granting the need for better teaching so effectively documented in this and other professional journals, we should recognize that the basic responsibility for learning rests with the learner. We can threaten, cajole, entertain, or trick our students into some learning, but until they assume an active rather than a passive role, it may be largely for naught. Albert Einstein said that education is what is left over after a person forgets everything he learned in school. Active learners likely will find much more of such "residual" education than will the passive variety of student.