Essays on Teaching Excellence

Toward the Best in the Academy

Volume 10, Number 8, 1998-99

A publication of The Professional & Organizational Development Network in Higher Education (www.podnetwork.org).

The Uses of Uncertainty in the College Classroom

Virginia S. Lee, *The University of North Carolina at Chapel Hill*

For many students and even some instructors the unspoken purpose of teaching and learning is the reduction of uncertainty. In a teacher-directed, content-oriented teaching approach--a conceptualization held by many instructors, the primary role of the instructor is the presentation of content in a clear and organized fashion primarily through the traditional lecture (Kember, 1997). According to Perry's well-known stage theory of intellectual development, many college students believe that knowledge consists of right answers and learning the memorization and reproduction of these answers, a notion quite compatible with the teacher-directed, content-oriented approach to teaching (Perry, 1970). An implicit but clear contract exists between teacher and student: "I'll tell you what you need to know, and you show me that you know it."

In contrast, a variety of sources suggest that genuine uncertainty and doubt are the natural provocations for real learning. According to Jean Piaget all human beings are amateur scientists whose cognitive development advances through continuous interaction

with and exploration of our environment. Repeatedly new experiences cause us to question and ultimately modify our existing theories or "schemas" about how the world works and is organized. Similarly the foundation of American pragmatism and the later work of John Dewey, the philosopher and progressive educator, rests on the seminal work of Charles Pierce. An empiricist, Pierce characterized the rhythm of real thinking as corresponding to scientific methods of inquiry. Like Piaget, he asserted that "the action of thought is excited by the irritation of doubt, and ceases when belief is attained". Each belief is at once a "stopping-place [and] a new starting-place for thought" (Pierce, 1878, p. 121).

Psychological research has corroborated the importance of uncertainty to learning at the psychophysiological level. Recent studies in brain dynamics have demonstrated that the brain manifests an inherent variability that increases with the presentation of new stimuli. This psychophysiological uncertainty plays a significant catalytic role in learning, It opens up the organism to experience, causing it to investigate the environment with enhanced receptivity, preparing it for different behavioral actions, and facilitating the central processing and encoding of information received from such renewed exploration. Searching, exploring, and trial-and-error behaviors indicate psychophysiological uncertainty and accompany the appearance of reorganization, stability, and progressive development or learning (Germana & Lancaster, 1995).

While strategies of traditional instruction like the lecture still have their place in the classroom, their exclusive use actually undermines the process of learning and incapacitates student inquisitiveness and initiative, the prime movers of real learning. As a result of traditional schooling, many students believe that uncertainty is undesirable because it implies a lack of understanding and fundamental intelligence. Consequently,

uncertainty becomes a source of anxiety, rather than a natural provocation for learning. Instructors often reinforce these beliefs through the teaching methods and types of evaluation they use. Instead, there is a variety of strategies which instructors can use to incorporate uncertainty into their classrooms as a natural companion to learning.

Discussing the Process of Learning

Because few students will understand the role of uncertainty in learning, teachers should make a point of talking explicitly with their students about the process of learning: its inherent "messiness" and the positive and even essential role uncertainty plays as a stimulus to inquiry and eventual learning. This discussion might include a review of students' prior learning experiences, both formal and informal. Teachers might ask students to recall a time when they taught themselves how to do something, what motivated them to do so, and the nature of the learning experience itself. Most of these experiences will include several components not associated with traditional schooling: strong intrinsic motivation, curiosity, doing, messiness, frequent questioning, trial-and-error, sustained attention, practice, mastery, and deep satisfaction. Instructors should also encourage conversations about students' learning experiences in their own classrooms, the reasons for their design, and the way learning occurs through them. Various classroom assessment techniques can stimulate these discussions as well (Angelo & Cross, 1993).

Using Selected Teaching Methods

Some teaching strategies such as discovery and problem-based learning incorporate uncertainty naturally as a source of intrinsic motivation and a stimulus to learning. They mimic the natural learning process and its refinement in the various methods of inquiry in academic disciplines. In discovery learning, rather than telling students a given principle, as is traditionally done,

instructors prepare the conditions of the learning experience so that students can discover the principle for themselves. Stimulated by "the irritation of doubt" before the problem posed, students, like amateur scientists, form provisional hypotheses and test them through repeated trials as they move towards discovery. The instructor intercedes only to remove insurmountable obstructions. Student involvement is normally intense with a final eureka experience at the moment of discovery, a natural reinforcer of the learning experience (Burner, 1971).

Problem-based learning (PBL) shares attributes of discovery learning but in its purest forms is more unstructured than the discovery learning approach. It uses "real world" problems as a context for students to learn critical thinking and problem solving skills and to acquire knowledge of the essential concepts of the course. In the typical PBL process, the instructor poses a problem for a small group of students to solve. Although students may have some prior knowledge related to the problem, it is not sufficient to solve the problem. After organizing what they do know, the students then identify "learning issues" that guide further research and investigation. Students share the information from individual investigations and bring it to bear on the problem at hand, working towards resolution (Norman & Schmidt, 1992).

Creating "Teachable Moments"

Instructors can also engender uncertainty by exposing students to concepts or ways of thinking that conflict with their current beliefs or ways of thinking. By creating "teachable moments" in which learners experience cognitive dissonance, instructors upset students' equilibrium, stimulate their curiosity, and make them more willing to reflect upon current understanding of the concept (Hansen, 1998). For example, on the first day of class, before

discussing the course syllabus, students in an introductory psychology class develop a collective concept map in which they organize the names, terms, and concepts they associate with psychology. After doing this, the instructor distributes the course syllabus and asks students to compare the class concept map with the class syllabus. Inevitably the class concept map is heavily skewed towards abnormal psychology, while the course syllabus addresses the foundations of normal psychology, including sensation, perception, learning, memory, intelligence, and personality with no discussion of abnormal psychology. A well-constructed true-false test that exposes students' misconceptions about a discipline can engender a similar receptive attitude to learning. In both cases instructors expose learner's implicit understanding of a concept as well as its inadequacy as a stimulus for learning.

Finally, instructors can create cognitive dissonance by developing and juxtaposing two equally compelling but conflicting assertions about a particular phenomenon or concept. The technique emulates the use of succinct paradoxical statements or questions known as "koans" as a meditation discipline for students of Zen Buddhism. The effort to "solve" a koan arouses an intense spirit of seeking and a compelling sense of doubt, intended to exhaust the analytic intellect and the egoistic will and force discovery through intuition (Watts, 1989). The early founders of quantum theory experienced similar states of doubt and tension as early atomic experiments suggested a reality quite different from Newtonian physics, grounded as it was in human sensory awareness. By exposing students to some of the contradictions raised by modern physics, for example, physics instructors can stimulate comparable states of doubt and tension that demand resolution. For example, the Newtonian model suggests that the speed of light changes and time is constant, while modern physics suggest the opposite (Capra, 1983.)

Summary

Uncertainty plays an important role in the natural learning process. By consciously incorporating it into classrooms as a stimulus to learning, instructors allow students to experience the thrill and challenge of intellectual discovery and genuine learning. At the same time, they can help students appreciate the dynamic nature of knowledge construction and their vital role in the process.

References

Angelo, T., & Cross, K.P. (1993). Classroom assessment techniques. San Francisco, Jossey-Bass.

Bruner, J. (1971). The act of discovery. Harvard Educational Review, 31. 21-32.

Capra, F. (1983). The Tao of physics: An exploration of the parallels between modern physics and eastern Mysticism. Boston: New Science Library

Germana, J., & Lancaster, R. (1995). Brain dynamics, psychophysiological uncertainty, and behavioral learning, Integrative Physiological & Behavioral Science, 30, 138-150.

Hansen, E. J. (1998). Creating teachable moments and making them last, Innovative Higher Education 22, 7-26.

Kember, D. (1997). A reconceptualization of the research into university academics' conceptions of Teaching, Learning, and Instruction, 7, 255-285.

Norman, G. R., & Schmidt, H.G. (1992). The psychological basis of problem-based learning: a review of the evidence. Academic Medicine, 67, 557-565.

Perry, W. (1970). Forms of intellectual and ethical development in the college years. New York: Holt, Rinehart, and Winston.

Pierce, C. (1878). How to make our ideas clear. Popular Science Monthly, January, 286-302.

Watts, A (1989). The way of Zen. New York. Vintage Books.