Real Life Can Promote Meaningful Learning!

Susan’s mother, her two sisters, her aunt, and her aunt’s daughters had contracted breast or ovarian cancer and three of them, all less than 45 years old, had succumbed to their diseases. For these reasons, Susan decided to have her breasts removed prophylactically. However, cancer researchers had just identified a molecular marker associated with the gene for breast cancer in Susan’s family known to them as “Family 15.” The researchers hadn’t thought about sharing their findings with the family until they heard about Susan’s plans for surgery.

Members of Susan’s family had come to believe that a breast cancer gene was being passed from mothers to daughters. Susan thus assumed she would follow in her sisters’ footsteps. However, the researchers informed Susan that she didn’t require surgery because she did not have the breast cancer gene. Without realizing the bomb they were dropping, they explained that 50% of all family members, males and females alike, would have this autosomally linked gene.

The many family members who had thought they were exempt from the cancer plague went into shock. Anna and Adrienne, two daughters of Susan’s Uncle Doug, had assumed their father did not have the gene and thus neither did they. However, they learned within a period of less than 3 intense weeks that a) they may have the breast cancer gene, b) in fact, they did have the breast cancer gene, and c) they not only had the gene, but mammograms revealed that they also had breast cancer! Their previously secure worlds turned topsy-turvy. At the same time, they realized that their newfound scientific knowledge probably saved their lives. (Waldholz, 1997)

This vignette illustrates a mother to daughter theory of inheritance invented by a family under duress. The theory adequately accounted for the cancer cases they observed in their own family during a relatively short period of time, but the data were limited and insufficient. Under dramatic circumstances, family members were informed that the scientific theory was quite different from their own. Compelling evidence (in the form of the unexpected presence of breast cancer in two young women who thought they were safe from the scourge) supported the scientific theory. All 39 family members not only had to discard their “naive conceptions” (described in Chapter 4) and assimilate the new scientific ideas, but they also had to generate new inferences about appropriate ways of managing their lives.

Real life has a way of imposing meaningful learning on us in a highly persuasive manner. Learning and retention are generally increased when adrenaline levels are
higher, as in these life and death situations. The classroom is a bit different, however. This chapter looks at the problems of achieving meaningful learning in biology classrooms.

WHAT IS LEARNING?

Learning can be a lot harder than simply absorbing new knowledge. Learners’ prior knowledge and background assumptions can present major obstacles. Carefully selected hands-on experiences can serve to challenge such background assumptions and bring new understandings. Such science activities are not an end in themselves, but rather a means to an end – to develop understanding of scientific ideas. In this chapter I aim to clarify and make explicit what we mean by “understanding of scientific ideas,” “meaningful learning,” and “mindful learning.”

Much has been discovered about how people learn in the past few decades, due in part to a convergence of theory and empirical research from many different fields. These findings seem strong because different researchers in different fields using different methodologies have come to similar conclusions. The reform movements currently sweeping educational communities at all levels; especially precollege (briefly described in Chapter 1), are attempting to bring some of this knowledge into the classroom. The goal is to generate the mirror image of how to learn – namely, how to teach.

MINDFUL LEARNING

The processes of mindful learning lead to meaningful understanding (Langer, 1989, 1997; Murray, 1997; Gagne, 1977). Mindful learning refers to the ways in which we function during the learning process.

The basic idea is that fluid, flexible thinking boosts our learning ability. Langer encourages us to experiment and to play with information, looking at it from different perspectives. making use of multiple examples, and exploring how the meanings of a given set of information change in different contexts. She identifies seven myths or false attitudes (Langer, 1997, p. 2) that are embedded in the educational system and that stunt students’ growth and interest in learning. They are reviewed below.

First, many in education believe that the basics should be so well learned that they become second nature. This is incorrect, says Langer. Drilling in the basics leads to overlearning or learning without thinking – the automaticity described above. Does it make sense, she asks, to freeze our understanding of a skill before we try it out in different contexts and adjust it to our own strengths and experiences? One of the studies performed by Langer and her colleagues found that pianists who learned by varying their playing style performed more competently and creatively than those who learned to play strictly through repetition.

Second, educators think that paying attention means staying focused on one thing. This myth, according to Langer, fails to recognize the value of novelty in holding our attention. Her studies show that varying the target of our attention, whether it is a visual object or an idea, improves our memory of it. In one study performed with