Commentary

Learning Theories Implicit in Medical School Lectures

FACULTY lectures are the primary method for teaching first- and second-year medical students. Lecture styles have an enduring quality of sameness that suggests that the lecturers possess unvarying theories about the value of lectures and the way medical students learn. Medical school faculty rarely have formal training as educators, and four out of five have never had a college-level course in teaching.[1] Their lecture styles must be derived from personal experience as students and later as faculty; their approaches to lectures may not have anything in common with those of educational theorists.[2,3]

Observation suggests that faculty subscribe to different theories of medical student learning. The theories include *passive diffusion*, *receptor*, *queuing*, and *vigilance*. A few lecturers use a style inconsistent with any underlying theory, apparently believing that learning does not occur during lectures. The underlying learning theories (or lack of theory) implicit in each style are discussed herein.

Passive Diffusion Theory

The majority of lecturers treat the lecture as a process akin to passive diffusion across a semipermeable membrane. There is a paucity of knowledge on the medical student's side, a surfeit on the lecturer's, and a membrane between them. The purpose of the lecture is to provide a high gradient of knowledge. Producing a gradient causes diffusion, increasing concentration on the student side. The rate of transfer and accumulation of "molecules" of information is a function of the height of the gradient, the permeability of the membrane, and the duration of exposure.

Lecturers subscribing to this theory place great emphasis on quantity of information, using the lecture period to make the gradient as high as possible in an effort to speed diffusion. Adherents seem to believe that the nature of the barrier membrane is fixed for each student.

According to this theory, absence of a lecture-side concentration will allow molecules (the course materials) to leak back across the membrane. The lecturer frequently hands out detailed charts and complicated tables to maintain the gradient after the lecture.

Because the theory is molecular in nature, small molecules (simple data) are expected to diffuse more rapidly than large ones (complex concepts). There is a limit to the membrane pore size, and certain concepts are too large to permit diffusion. These may pose an osmotic load and (paradoxically) cause backflow of small molecules from the student side; large concepts, therefore, are avoided.

The Receptor Theory

According to this theory, medical students have individual, highly selective knowledge receptors. The role of the lecturer is to package course materials so as to match the receptor affinity. The presence of the receptor-shaped package increases the probability that course materials will bind to and have an effect on the student.

The adherents to this theory place greater emphasis on the format of presentation than do the diffusionists and are more likely to spend time investigating just what causes an idea to "take hold" of a student. Their presentations are characteristically colorful and feature large-print (frequently single-word) slides.

The affinity and specificity of the receptors are debated hotly among the lecturers who subscribe to this theory. Some, believing that the receptors are specific, fine-tune their presentations, while others believe that activating receptors sets up nonspecific activity in the cell (student). This may explain the latter group's use of multiple jokes or humorous slides unrelated to course material. In either case, binding at receptor sites is competitive, and receptor theory lecturers, therefore, prefer early morning lectures, when most receptors are unoccupied and available for binding.

The Queuing Theory

These lecturers suppose that the student has a limited memory for a subject, consisting of a finite number of slots that contain simple data items. Slots are arranged in a queue and data may be put into and later retrieved from the queue according to a set of rules.

Most lecturers who use queuing theory believe in a last-in first-out (LIFO) queuing rule (the most recently learned data item is the first to be recalled). Overflow of the queue, according to the theory, causes loss of the oldest data. These lecturers compete for lecture hours immediately preceding examinations.

In contrast, a small group of lecturers believe in the first-in first-out (FIFO) method of queuing. They believe that over-

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flow of the queue causes new items to be lost and that permanence in memory is a function of early presentation. They schedule lectures early in the term.

Both groups lean toward simple presentations of data items. Learning the relationships between items requires a higher level of student cognition than is consistent with the theory. Lecturers who use a queuing theory usually can state the number of distinct items presented in their lectures. The number indicates their estimate of the average medical student's queue size.

The Vigilance Theory

According to the vigilance theory, students are inattentive, and increased vigilance is the prerequisite for learning.

Various techniques for gaining and sustaining attention are used. The most ubiquitous is the "pop quiz," which increases the air of uncertainty and tension surrounding a lecture series. Pop quizzes are disparaged uniformly by students. Vigilance theorists take this as evidence that attention is the underlying problem with medical education and that increasing vigilance is the solution. Another device for heightening vigilance is forward projection examples. Stories of missed diagnoses are frequent and, in recent years, malpractice litigation stories have gained popularity.

Students attend vigilance theorists' lectures faithfully, especially if they perceive the risk of an in-class pop quiz to be great. Vigilance theorists have a tendency to ask questions of students chosen at random during the lecture. Seating in a vigilance lecturer's classroom typically is weighted heavily toward the back of the room.

Nihilists

While nihilism is not a true theory, there are nihilists within the lecturing community. These individuals believe that lectures are unlikely to result in learning and have abandoned whatever learning theories they may have had. Almost invariably, they include in the lecture an assurance that the examination questions will be drawn entirely from the assigned text.

Many nihilists are diffusionists who, through misadventure or long experience, have concluded that lectures are necessary but unproductive. The absence of former vigilance and receptor theorists from the nihilist group is somewhat surprising. Vigilance and receptor theorists may not become disillusioned or, alternatively, may evolve into diffusionists who later become nihilists. Longitudinal studies of individual lecturers may provide more insight.

Conclusions

Lecture style reveals the faculty member's underlying theory of medical student learning. The styles described herein correspond to the diffusion, receptor, queuing, and vigilance theories and to the nihilist position. The four theories characterize learning as a primarily passive process. It remains for educational researchers to identify other styles and theories. If the majority of medical lecturers remain untrained in education in general and lecturing in particular, new (but not necessarily effective) styles will evolve.

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