Syllabus

Basic Information

LOCATION: Room 220 Parkvale Bldg

TIMES: W 3:00-5:00 PM

CREDITS: 1

Grading: Letter Grades

Class Participation, including examples brought to class: 60%

Analysis of Instructional Case in final paper: 40%

Texts:

Willingham, D. (2009). Why Don't Students Like School? San Francisco: Jossey-Bass. [This may seem like a strange book for a graduate course in medicine, but it turns out to be a very efficient way to get into the key concepts that will drive discussion throughout the course. It also has pointers to a lot more basic sources, and we will supplement it with some other readings.]

Links to the four papers cited below are found immediately below these references.


Core Readings

[Grasser Report] (84.405 Kb)
[Embrey paper] (213.359 Kb)
[Pashler paper] (924.931 Kb)
[Zhang paper] (223.632 Kb)

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Notes
I am dean of the School of Education and also have appointments in Psychology, Intelligent Systems, and the Learning Research and Development Center.

Final Assignment

Due November 15

Take a current instructional problem you face as a medical educator and discuss which principles of learning covered in the course might apply to that problem and how those principles might lead to improved approaches to training.
Basic Approach

Of the nine class meetings, seven will be devoted to discussion of key principles of learning and how they relate to medical education. The key drivers for this discussion will be two recently proposed list of such principles and the daily experience of fellows in teaching newer colleagues their medical specialties. The remaining two sessions will be devoted to a discussion of medical errors, their cognitive origins, and known approaches to controlling errors rooted in limits of cognitive processing.

Instruction and Training


This book may seem inappropriate, but in fact it contains an extremely readable presentation and defense of key principles of learning and teaching that have an extensive body of research behind them. Both more and less technical references are provided for each principle. The key principles introduced are:

- People are naturally curious, but they are not naturally good thinkers.
- Factual knowledge precedes skill.
- Memory is the residue of thought.
- We understand new things in the context of things we already know.
- Proficiency requires practice.
- Cognition is fundamentally different early and late in training.
- Learners are more alike than they are different in terms of the progression of learning.
- Intelligence can be changed through sustained hard work.
- Teaching, like any complex cognitive skill, must be practiced to be improved.


This recent report also presents a set of basic principles of instruction, this time only seven, because of extremely specific standards of evidence imposed by the agency that commissioned the report. The principles are:

- Space learning over time.
- Interleave worked example solutions with problem solving exercises.
- Combine graphics with verbal descriptions.
- Connect and integrate abstract and concrete representations of concepts.
- Use quizzing to promote learning.
- Help students allocate study time effectively.
- Ask deep explanatory questions.


The 25 principles put forward by this task force of the American Psychological Association are especially helpful, as they bridge more clearly to the psychological literature while still having definite implications for effective teaching and training. We will take the first two classes to go through these principles in a bit of detail and to explain them and tie them to medical education. Then, in the next five classes, we will consider examples from students' specialty areas that illustrate or could benefit from application of these principles.
1. **Contiguity Effects.** Ideas that need to be associated should be presented contiguously in space and time.

2. **Perceptual-motor Grounding.** Concepts benefit from being grounded in perceptual motor experiences, particularly at early stages of learning.

3. **Dual Code and Multimedia Effects.** Materials presented in verbal, visual, and multimedia form richer representations than a single medium.

4. **Testing Effect.** Testing enhances learning, particularly when the tests are aligned with important content.

5. **Spacing Effect.** Spaced schedules of studying and testing produce better long-term retention than a single study session or test.

6. **Exam Expectations.** Students benefit more from repeated testing when they expect a final exam.

7. **Generation Effect.** Learning is enhanced when learners produce answers compared to having them recognize answers.

8. **Organization Effects.** Outlining, integrating, and synthesizing information produces better learning than rereading materials or other more passive strategies.

9. **Coherence Effect.** Materials and multimedia should explicitly link related ideas and minimize distracting irrelevant material.

10. **Stories and Example Cases.** Stories and example cases tend to be remembered better than didactic facts and abstract principles.

11. **Multiple Examples.** An understanding of an abstract concept improves with multiple and varied examples.

12. **Feedback Effects.** Students benefit from feedback on their performance in a learning task, but the timing of the feedback depends on the task.

13. **Negative Suggestion Effects.** Learning wrong information can be reduced when feedback is immediate.

14. **Desirable difficulties.** Challenges make learning and retrieval effortful and thereby have positive effects on long-term retention.

15. **Manageable Cognitive Load.** The information presented to the learner should not overload working memory.

16. **Segmentation Principle.** A complex lesson should be broken down into manageable subparts.

17. **Explanation Effects.** Students benefit more from constructing deep coherent explanations (mental models) of the material than memorizing shallow isolated facts.

18. **Deep questions.** Students benefit more from asking and answering deep questions that elicit explanations (e.g., why, why not, how, what-if) than shallow questions (e.g., who, what, when, where).

19. **Cognitive Disequilibrium.** Deep reasoning and learning is stimulated by problems that create cognitive disequilibrium, such as obstacles to goals, contradictions, conflict, and anomalies.

20. **Cognitive Flexibility.** Cognitive flexibility improves with multiple viewpoints that link facts, skills, procedures, and deep conceptual principles.

21. **Goldilocks Principle.** Assignments should not be too hard or too easy, but at the right level of difficulty for the student’s level of skill or prior knowledge.

22. **Imperfect Metacognition.** Students rarely have an accurate knowledge of their cognition so their ability to calibrate their comprehension, learning, and memory should not be trusted.
23. **Discovery Learning.** Most students have trouble discovering important principles on their own, without careful guidance, scaffolding, or materials with well-crafted affordances.

24. **Self-regulated Learning.** Most students need training on how to self-regulate their learning and other cognitive processes.

25. **Anchored Learning.** Learning is deeper and students are more motivated when the materials and skills are anchored in real world problems that matter to the learner.

**Medical Errors**


We will consider the range of sources of medical error suggested by these two key review articles and then discuss examples brought by the students in the class of their own experiences with medical errors, trying to understand the source and possible remediation of each.

**Overview**

**Wednesday, September 2**

**Wednesday, September 9**

During the first two class meetings, we will review the various principles of learning that are covered in the Willingham book and in the report by Pashler and the compilation by Graesser. The goal will be to identify key principles that can be applied to the design of training approaches in medicine. Ideally, students will have read or at least skimmed the Willingham book prior to the first class meeting. The remaining readings should have been read prior to the second class meeting.

A key principle that we will focus on first is that memory is the residue of thought. This principle encapsulates the basics of how learning takes place. Each of the other principles will be reviewed in the context of this key principle. For example, that we understand new things in the context of what we already know follows from the basic mechanism of learning, which associates states of mind with cognitive and motor actions. A second key principle, that spans several of those listed in the three primary reference sources, is that cognitive capacity is limited. Most of the other principles, including the differences between thinking early and late in the course of training, come from that. Moreover, since there are only certain ways that a sequence of mental actions can be created (something for memory to be the residue of), it follows that learners will be as alike as their experience bases.

After we have done a bit of basic exploring of the core principles of learning, we’ll go through all of the principles on the three lists and tie each to a simple medical education situation or to some other learning situation that we are all likely to be familiar with.
Applying the Principles to Medical Education

September 16 - October 14

We'll take the next five classes to discuss specific medical education problems that students bring to class and to apply the principles of learning to them.

Practice

Wednesday, September 16, 2009

In past years' classes, a number of training issues involving practice have been brought to the class. For example, there are areas of history taking and other medical data gathering that are often missed by new physicians. What can a fellow do to help minimize this problem. There are cognitive skills of medicine that need to be practiced, including techniques for getting certain kinds of information from patients, techniques for educating patients about the importance of certain life changes and how to make them, office hour time management, etc.

Assignment

For this class, please come prepared to discuss in detail a specific problem that you have encountered as a teacher/mentor that involves the practice and refinement of basic medical skills.

Activity

We will take the examples brought to class and apply the principles of learning to them, focusing on how the principles might lead to better training.

Problem Solving

Wednesday, September 23, 2009

Much of the practice of medicine is problem solving, making diagnostic decisions and decisions about optimal treatments. In this session, students will bring examples from their experience of difficult-to-teach aspects of problem solving.

Assignment

Bring to class an example of a medical education situation in which you have found yourself that involves a difficult issue of diagnosis or treatment selection.

Activity

We will consider these examples in light of the principles of learning. A key principle to be considered in depth is that of limited cognitive capacity, as well as other principles that derive from that.
Complex Procedures

Wednesday, September 30, 2009

In some medical specialties, much of training consists of learning how to perform complex procedures. As imaging systems and distal effectors (such as robots and tools connected to imaging devices) have become more prevalent and more powerful, there is need for continual retraining of physicians and surgeons in the use of new tools. In this class session, we will consider key principles that apply to providing mentored practice in doing complex procedures.

Assignment

Bring to class an example of a procedure that is difficult to learn that you need to deal with in your role as a medical educator. It can be a surgical procedure, but it also can be a data-gathering procedure (e.g., for people early in training, auscultation).

Activity

We will apply principles of learning to identifying what makes training in these procedures difficult and also to the design of improved approaches.

Embedding Instruction in Clinical Work Situations

Wednesday, October 7, 2009

Much of medical education takes place in clinical contexts. Senior house staff and attendings work with new physicians and medical students in hospitals and clinics, using the course of medical care for patients to present teaching opportunities. In this session, we will consider the particular issues of training that are of special importance because of this approach. Learning by doing with reflection afterwards is a powerful approach to education; we will look at why that is and what maximizes the power of the approach.

Assignment

There is no advance assignment for this class. However, as topics are discussed, students will be asked to think of examples from their own work that support or challenge the points being made.

Key Steps in Designing Instruction

Wednesday, October 14, 2009

Assignment

Each student will be prepared to discuss in rough terms his/her plans for the final assignment.

Activity
We will, as a class, consider ways in which the ideas put forth by each student might be strengthened further. We also will do a quick scan of the range of final topics to see if there are particular areas of instructional principle that no one has addressed.

**Medical Errors and their Implications for Medical Education**

**Monday, October 29**

**Wednesday, October 31**

**Learning Objectives**

Be able to apply the several models of human error to the case of medical error.

**Assignment**

Bring to class one example of a consequential medical error with which you had some relatively direct experience.

**Activity**

We will review the literature on medical errors and consider, given what we have learned throughout the course, how different kinds of errors can best be prevented. In some cases, this will involve training, but in other cases, the best approach may be various safeguards that can be built into the care delivery system. We will consider the core research on medical errors in light of the examples brought to class and also will consider whether it is possible to improve training or make other systemic changes that might decrease the likelihood of such errors.

**Readings In Addition to Textbook**

**Interesting Readings**

These readings are not required for the course but may be useful in your future work.


Course Policies

Academic Integrity:

Students in this course will be expected to comply with the University of Pittsburgh’s Policy on Academic Integrity. Any student suspected of violating this obligation for any reason during the semester will be required to participate in the procedural process, initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity. This may include, but is not limited to, the confiscation of the examination of any individual suspected of violating University Policy. Furthermore, no student may bring any unauthorized materials to an exam, including dictionaries and programmable calculators.

Disabilities:

If you have a disability that requires special testing accommodations or other classroom modifications, you need to notify both the instructor and the Disability Resources and Services no later than the 2nd week of the term. You may be asked to provide documentation of your disability to determine the appropriateness of accommodations. To notify Disability Resources and Services, call 648-7890 (Voice or TTD) to schedule an appointment. The Office is located in 216 William Pitt Union.

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Course Requirements and Grading

There will be small assignments for each class - involving coming to class with specific examples from medical experience or medical education experience that meet criteria set by the instructor. These examples will allow us to better discuss the topic of the day and to tie it clearly to medical education and medical practice.

In addition, there will be a final assignment that will involve considering a specific component of medical education and discussing how it can be done better taking into account content covered during the course.
G-Grade Policy

If there are unusual circumstances that prevent completion of the final assignment by the due date, an extension can be given until the end of Fall Term. In extreme circumstances, if an arrangement is made by December 15th, a G grade can be given and the work completed no later than February 1st.

Accessibility
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