

Hot Science Cool Talks

UT Environmental Science Institute

60

How We Learn and How We Don't

Dr. Bob Duke

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How We Learn... and How We Don't

by Professor Bob Duke
Marlene and Morton Meyerson
Centennial Professor in Music and
Human Learning



- Do we need to know this?
- Will this be on the test?
- What do I need to do to make an A?
- How long does this paper have to be?
- I wasn't here on Wednesday.
- Did I miss anything?

A Vision of Students as Accomplished Learners

- Attentive
- Diligent
- Inquisitive
- Skillful
- Persistent
- Patient
- Thoughtful
- Meticulous
- Discriminating

Fundamental Skills of Effective Teaching

- Knowledge of Subject Matter
- Learning Environment
- Instructional Goals
- Sequence of Instruction
- Assessment
- Feedback

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Knowledge of Subject Matter

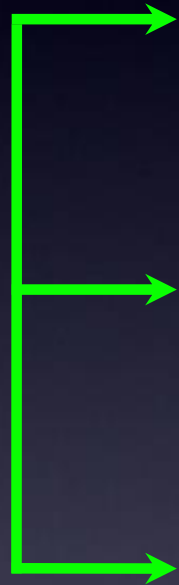
- From outside your expertise
- Fundamental structure of the subject
 - Broad underlying principles that are
 - ... intellectually interesting and
 - ... functionally valuable

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Fundamental Skills of Effective Teaching

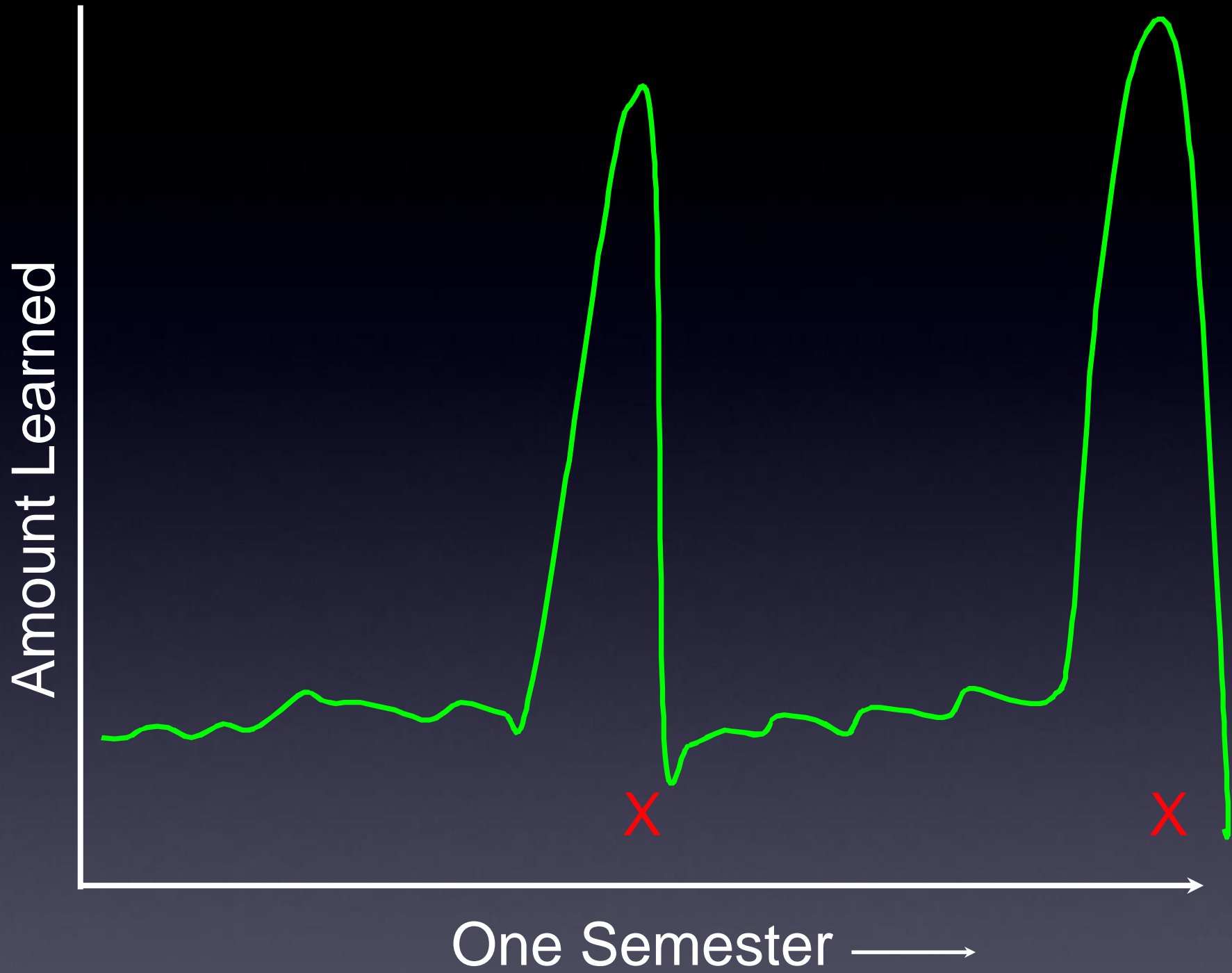
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- Feedback



Two Central Ideas

Learners construct knowledge

Tests teach



Data from new york
times, 8th grade
students?

What we thought we taught...



From *Minds of Our Own*, Annenberg Media, Produced
by the
Harvard-Smithsonian Center for Astrophysics

So what's to know?

$$\frac{3}{4} \div \frac{1}{2} = x$$

$$\frac{3}{4} \times \frac{2}{1} = x$$

$$\frac{6}{4} = x$$

$$1\frac{1}{2} = x$$

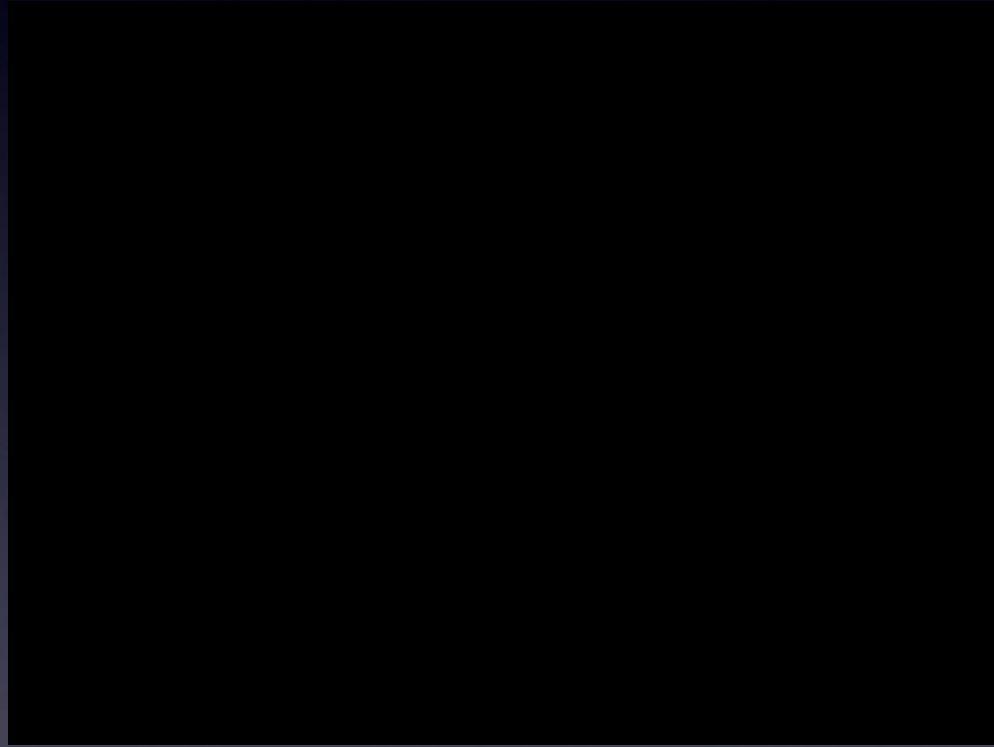
So what's to know?

$$\frac{3}{4} \div \frac{1}{2} = x$$

So what's to know?

$$s = \sqrt{\frac{\sum_{i=1}^N (X_i - \bar{X})^2}{N-1}}$$

Clear explanations,
hands-on activity, yet...



From *Minds of Our Own*, Annenberg Media, Produced
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Understanding how
and why things
change is the heart of
science.

Continua are interesting. Dichotomies rarely are.

Interesting or Not?

Interesting

- Exploration
- Experimentation
- Explanation
- How and Why...

• Not

- Labels
- Recipes
- Algorithms
- What...

The Rhythm of Education—A. N. Whitehead—

Generalization



Precision

Romance

The Rhythm of Education

— A. N. Whitehead —

Generalization




PRECISIO

n

Romance

How difficult can we make this?

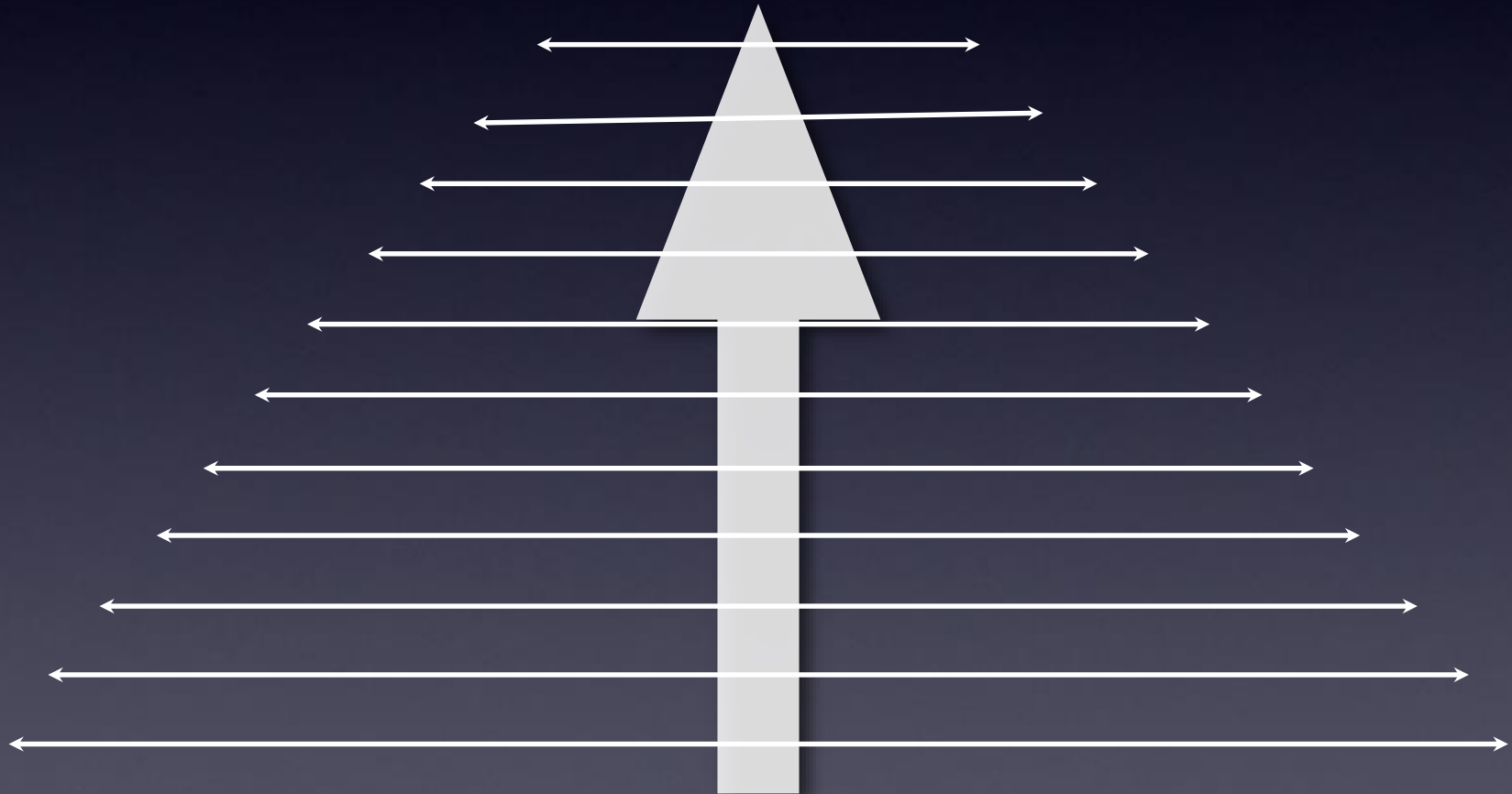
The Good Stuff



prerequisites
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prerequisites-prerequisites-prerequisites-prerequisites

How difficult can we make this?

The Good Stuff



The Rhythm of Education—A. N. Whitehead —

Generalization



Precision

Romance

Every Day, the Good Stuff

Generalization

Precision

Generalization

Precision

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Generalization


Precision

Romance

Teaching a Class that Changes Thinking

- Determine what's most important and far-reaching
- Teach what you like and care about
- Write the assessments first
- Provide opportunities for varied practice
- Each step, an approximation of the end goal
- Recognize a continuum of correctness
- Expect high standards of quality throughout

Teaching a Class that Changes Thinking

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Two Central Ideas

Learners construct knowledge

Tests teach

Valuable online resources From the Society for Neuroscience Neurosciences Education Resources Virtual Encycloportal

<http://www.ndgo.net/sfn/nerve/>

The screenshot shows the NERVE Virtual Encycloportal website. At the top left is the logo for "NEUROSCIENCE EDUCATION RESOURCES NERVE VIRTUAL ENCYCLOPORTAL" featuring a brain icon. To the right is the "SfN SOCIETY FOR NEUROSCIENCE" logo. Below the logos is a navigation bar with links for "Welcome", "About This Site", and "How To Search". There are also dropdown menus for "Audience" (set to "Any Audience") and "Format" (set to "Any Format").

On the left side, there is a "Select a Theme" section with several buttons: "Show all Themes", "Addiction, Drugs, and the Brain", "Anatomy of the Brain and Nervous System", "Cells of the Nervous System", "Sensation, Perception, and Movement", "Mental Health, Brain Disorders, and Disease", "Nervous System Injuries", "Brain Basics" (which is highlighted), and "Neuroscientists at Work".

The main content area is titled "Brain Basics" and displays a list of search results. Each result includes a title, a brief description, a URL, and buttons for "Details", "E-mail Friend", and "Print Record".

- Access Excellence (The National Health Museum)**
Great site for health and bioscience teachers and learners. (Look at the Activities Exchange section for more lesson plans and ideas.)
<http://www.accessexcellence.org/>
- Action Potential Animation**
This Flash movie details the action potential—electrical activity that allows neurons to communicate with each other.
<http://www.brainu.org/movies>
- Adult Neurogenesis: Do new neurons develop in the brain?**
This is an article in the "Hot Topics in Biology" section of BioEd online. Accompanied by a slide set on Adult Neurogenesis.
<http://www.bioedonline.org/hot-topics/adult-neurogenesis.cfm>

At the bottom left, there is a "Google Custom Search" button and a "Suggest a Resource" button. Below these is the text "50 Results". At the very bottom, there is a footer with links for "About the Society for Neuroscience", "Join the Society for Neuroscience", "Disclaimer", "Comments & Feedback", and "Who is using this site?". The copyright notice "Copyright © 2008 Society for Neuroscience" is also present.

From the Canadian Institute for Neurosciences, Mental Health and Addiction
and the Canadian Institutes of Health Research

The Brain from Top to Bottom

http://thebrain.mcgill.ca/flash/index_a.html

THE BRAIN FROM TOP TO BOTTOM

Back to Main Topics

LEVEL OF EXPLANATION

Beginner
Intermediate
Advanced

LEVEL OF ORGANIZATION

△ Social
■ Psychological
□ Neurological
□ Cellular
▽ Molecular

MEMORY AND LEARNING

1 2 3

SUB-TOPICS

How Memory Works
Forgetting and Amnesia

Original Modules

"The purpose of memory is not to let us recall the past, but to let us anticipate the future. Memory is a tool for prediction."
- Alain Berthoz

If you show a chess grand master a chessboard on which a

Learning is a process that lets us retain acquired information, affective states, and impressions that can influence our behaviour. Learning is the main activity of the brain, in which this organ continuously modifies its own structure to better reflect the experiences that we have had.

Learning can also be equated with encoding, the first step in the process of memorization. Its result - memory - is the persistence both of autobiographical data and of general knowledge.

But memory is not entirely faithful. When you perceive an object, groups of neurons in different parts of your brain process the information about its shape, colour, smell, sound, and so on. Your brain then draws connections among these different groups of neurons, and these relationships constitute your perception of the object. Subsequently, whenever you want to remember the object, you must reconstruct these relationships. The parallel processing that your cortex does for this purpose, however, can alter your memory of the object.

Also, in your brain's memory systems, isolated pieces of information are memorized less effectively than those associated with existing knowledge. The more associations between the new information and things that you already know, the better you will learn it. For example, you will have an easier time remembering that the entorhinal cortex is connected to the hippocampus via the dentate gyrus if you already have some basic knowledge of brain anatomy.

Psychologists have identified a number of factors that can influence how effectively memory functions.

1) Degree of vigilance, alertness, attentiveness, and concentration

2) Interest, strength of motivation, and need or necessity

Attentiveness is often said to be the tool that engraves information into memory. Thus, attention deficits can radically reduce memory performance. You can improve your memory capacity by making a conscious effort to repeat and integrate information.

It is easier to learn when the subject fascinates you. Thus, **motivation** is a factor that enhances memory. Some young people who do not always do very well at the subjects they are forced to take in school often have a phenomenal memory for statistics about their favourite sports.

Dr. Bob Duke



A former studio musician and public school music teacher, Dr. Duke directs an active research program in motor skill learning and procedural memory at UT. He has also worked closely with children at-risk, both in the public schools and through the juvenile court system. He lectures frequently on the topics of human learning, systematic observation and evaluation, and behavior management, presenting workshops and teaching demonstrations throughout North America. Dr. Duke is the Marlene and Morton Meyerson Centennial Professor in Music and Human Learning, University Distinguished Teaching Professor, Elizabeth Shatto Massey Distinguished Fellow in Teacher Education, and Director of the Center for Music Learning at the University of Texas at Austin.