

Teaching is More than Lecturing and Learning is More than Memorizing

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What problems do our students experience in chemistry?



**What are our expectations or
our students?**

Students

- Many insecurities such as:
 - Will I be able to pass?
 - Will I be able to get the grade I want?
 - Will I be able to do the work?



In the beginning, students plan to ...

- Work hard
- Come to class every day
- Memorize all their notes
- Do all the homework
- Get a tutor
- Come to office hours



What are students afraid of?

- Math
- Ability to memorize everything
- Periodic Table
- Equations
- Ability to Understand
- Adequacy of Secondary school background

What do we expect?

- Understanding rather than memorization
- Continued commitment on part of student throughout course
- Students will ask for help when they don't understand something
- Teacher's responsibility is with only the chemistry part of the course



What is our reaction when

- Students tell us they cannot understand?

“Pay attention to lecture and you will learn”

- Lectures
 - Organize the material
 - Cover the difficult points
 - Provide insights into the information in book/problems
 - Provide explanations
 - Introduce applications

Why do students have trouble learning in lecture?

Research on student attention

- Sample
 - Three general chemistry courses
 - Chem 1: Engineering students
 - Chem 2: Nursing students
 - Chem 3: Nonscience majors

Research Methodology

- Students wore clickers on lanyards around neck
 - Pressed button whenever they were aware that their minds had wandered
- Data collected every day in each course for 4 weeks

Data analysis

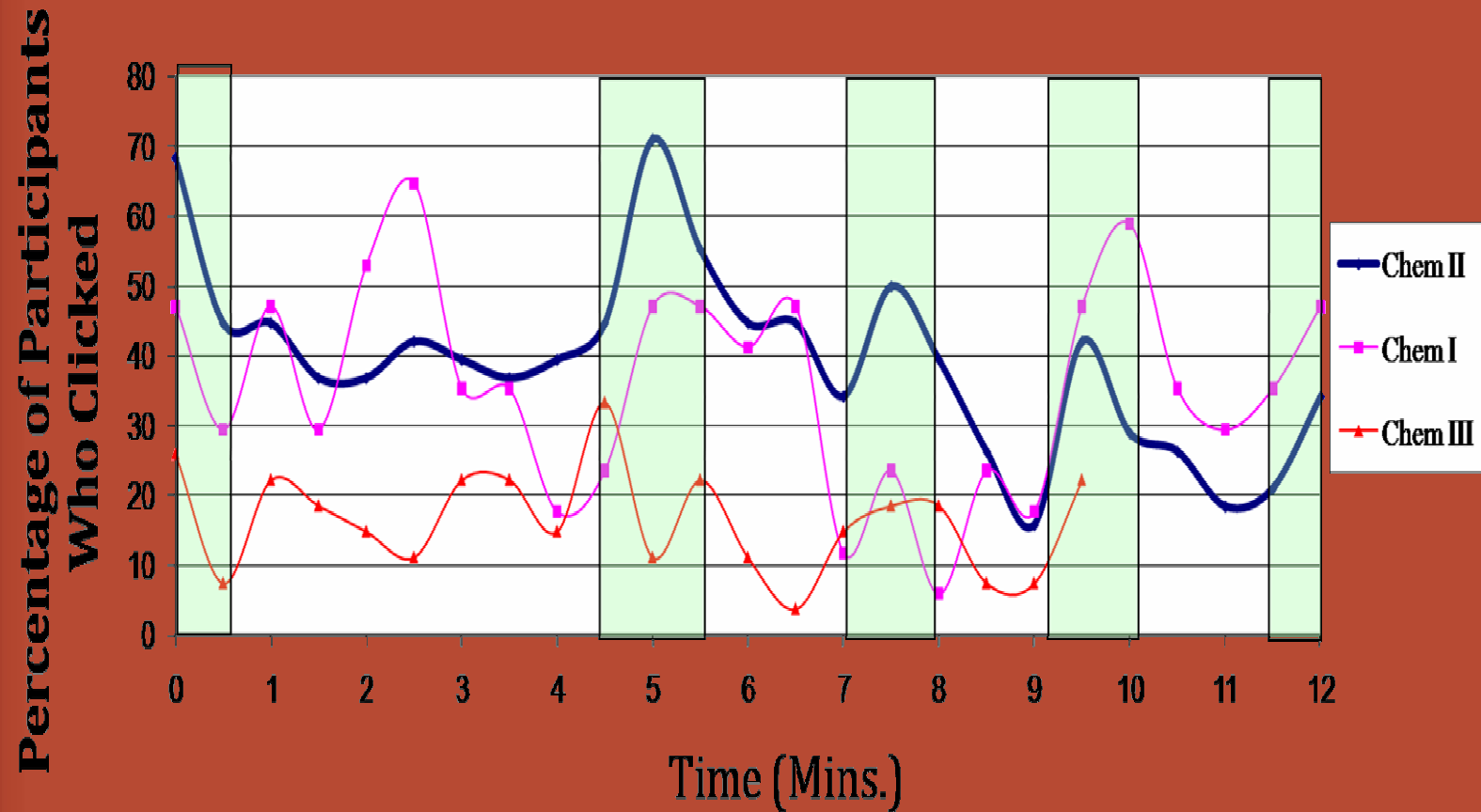
Analyzed only those students who participated

Class	N	% participation
Engineering Chem	74	23%
Nursing Chem	68	56%
Nonscience Chem	44	27%

Data Analysis

- Compared lecture segments of comparable length across all three courses
- Demonstrations and/or use of clicker question segments of comparable length to lecture segments
- Lecture segments of comparable length following demonstration or clicker question

Common Declines of Attention in Lecture Reported Over Time For Three Courses



Analysis of

- Pedagogies, other than lecture
 - clicker questions
 - demonstrations
- Results
 - significantly lower student attention decline than lecture
 - Effect persisted during lecture segments immediately following these pedagogies.

Added benefit of clicker questions

Knowledge isn't passed directly from the teacher to the student.

- Student must integrate incoming information with that already stored
- Clicker pedagogy allows student to
 - Integrate knowledge
 - Demonstrate integration
 - Receive immediate feedback
 - and explanation ,if necessary

What are the implications of this for teaching?

- Teachers should be aware that students don't pay constant attention for entire lecture.
- Teachers can provide opportunities for students to
 - Engage in the process of learning
 - To learn, Students must
 - Be awake
 - Access what they already know
 - Have time to integrate new knowledge with previous knowledg

How does integration of new and previous knowledge take place?

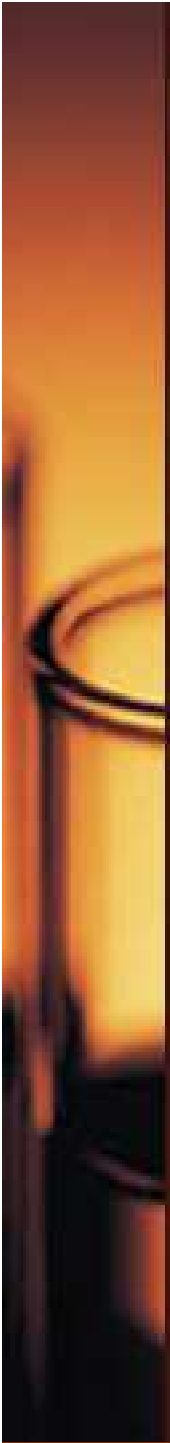
- Break the flow of Lecture
- Provide opportunities for students to reflect or try things out
- Encourage learning in class
 - With expert (teacher) present
- Make lectures interactive by providing opportunities for students to engage

How do we get students to become invested in their own learning?

- Traditionally
 - Grades
 - Personal encouragement
 - But this only reaches a few students

Supporting student “investment”

- Provide students with more control over their own learning.
 - 24 hr access
 - Detailed syllabus and calendar
 - Grades and current standing in course
 - Handouts and notes
 - So they can help themselves
 - Quiz/HW
 - Communication with teacher

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- Create a community of learners
 - Provide opportunity for students to
 - Make suggestions on what would help them learn better
 - Comment on what is getting in their way without fear of repercussions

Different people learn in different ways

- Provide a variety of learning presentations
 - Listening
 - Reading
 - Visual
 - Animations
 - Particulate explanations
 - Demonstrations
 - Practice with models
 - Working alone
 - Working in groups

Communication

- Two-way
 - Office hours
 - Using technology
 - Virtual office hours
 - Email
 - Online Discussion boards
 - Class Advisory Boards

“Nice ideas, but I have a lot of content to get through”

- Teaching is *more* than lecturing
 - Use technology to help
 - Teacher creates “environment of learning”.
 - Students have access to what they need when they need it.
 - “Buffet” of opportunities

Problems and a possible solution...

- Problems
 - Limited time students can pay constant attention in lecture
 - Students need time to practice their integration of knowledge
 - Provide opportunities for learning to take place in class rather than outside class

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- One solution
 - Electronic Student Response Systems (SRS) aka “Clickers”
 - Using clickers in lecture....

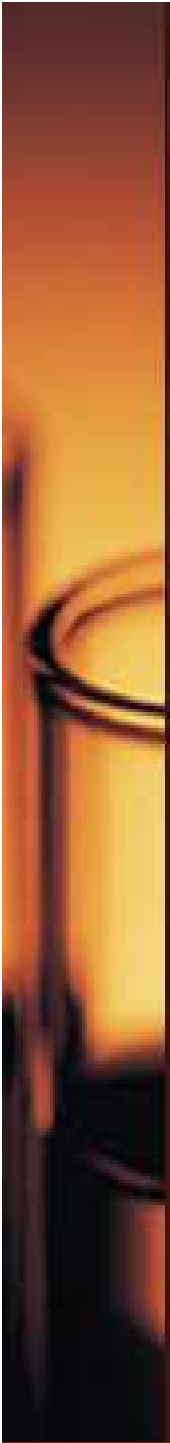


Advantages of Clickers

- Break the 50-minute lecture into smaller parts
 - Student attention continues to be increased following clicker intervention.
 - Students have opportunity to try out their integration of knowledge.
 - Teacher learns if students understand a topic before going on to a new topic.
 - Learning takes place in class.

Giving students control over their own learning

- Problem
 - Students work best between the hours of 11PM and 3 AM
 - We don't!
- Some solutions
 - Online course support (Web component)
 - Provide continual access to important documents and course calendar.

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- Blackboard
 - Post documents
 - Syllabus
 - Calendar
 - Class pictures
 - Class notes
 - Handouts
 - Online quizzes with automatic grading and posting of grades
 - Provide continual access to grades
 - Easy email access to all or some students in class



Welcome to *Blackboard Learning System™* (Release 6).
Please enter your username and password to access the system.

Click the **Preview** button below to access as a guest.

Preview

Click the **Create** button below to create an account.

Create

Have an Account? Login Here.

Enter login information here and click the **Login** button below.

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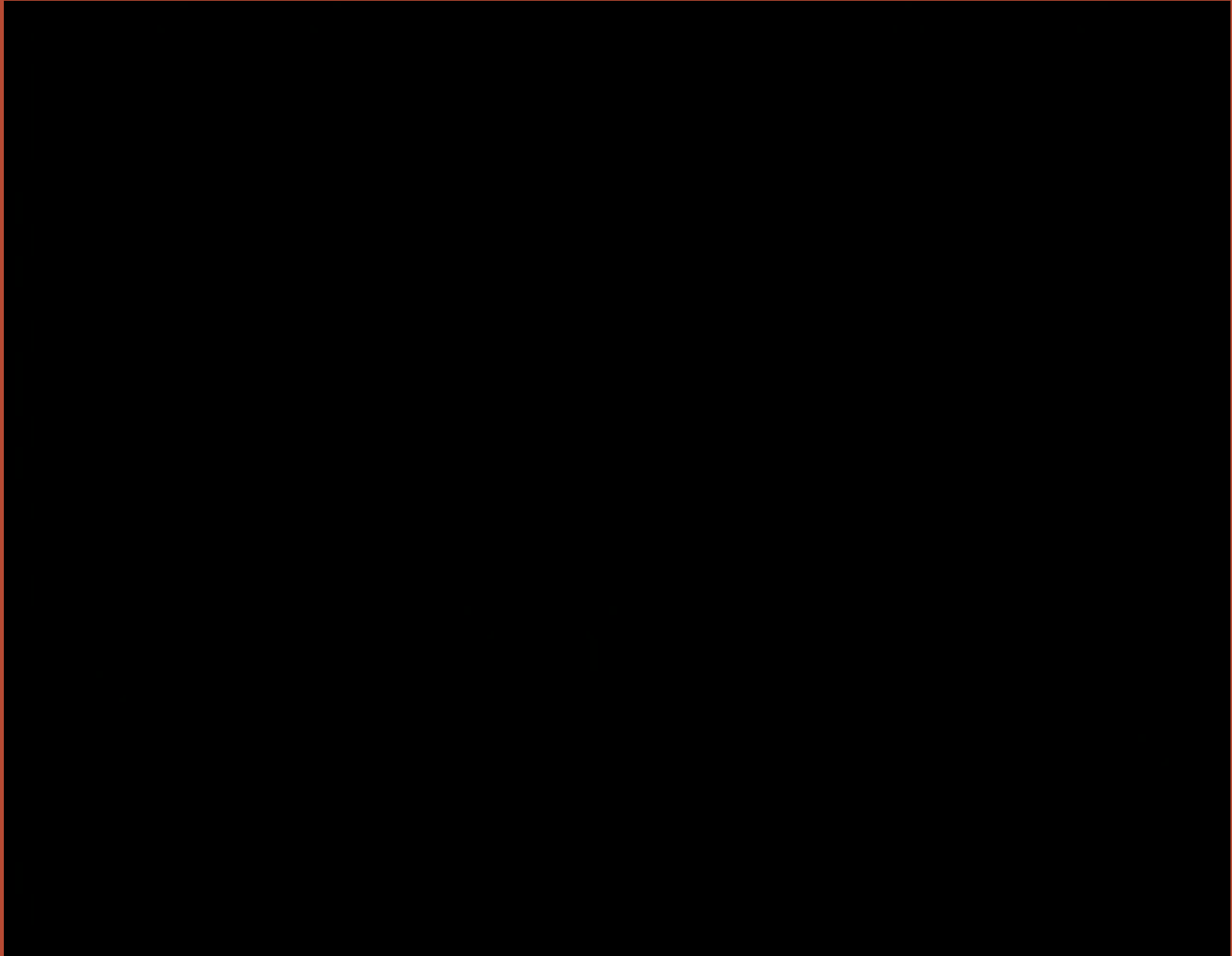
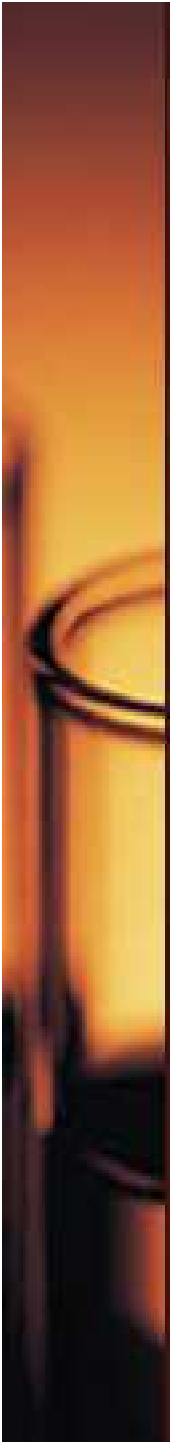


Communication

- Problem
 - Communication is often one-way
 - Teacher → Student
- Solution
 - Email
 - Class Advisory Boards
 - Web Discussion

Class Advisory Boards

- Class elects 2-3 students
 - Meet with Professor on a regular basis
 - Discuss
 - Issues brought up by members of the class
 - Minutes of Class Advisory Meeting posted electronically



Minutes of Class Advisory Board Meeting

- **Improvement**
Students type the minutes during the meeting
- **Student representatives have now decided to distribute surveys to students before the Advisory Board Meetings**

On the Class Website

- Annotated PowerPoints available same day
 - Includes clicker questions that were used in class
- Online quizzes after each lecture
- Reviews for each of the four tests given during the semester

Recitation (extra 1 hour session each week)

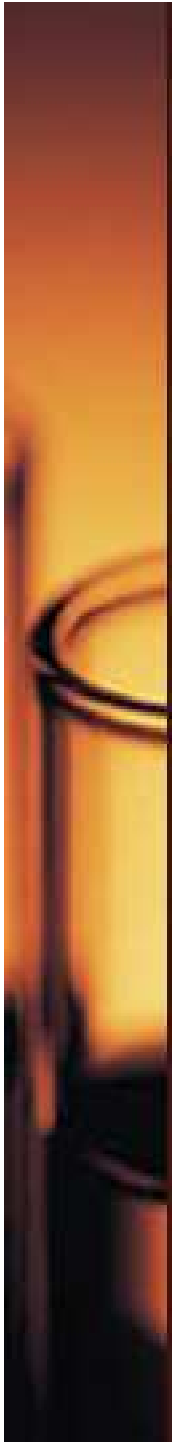
- Problem
 - Typically go over homework problems
 - Most students not engaged in discussion.
 - Attendance at recitation is low
- Solution
 - Work in small groups
 - Leader
 - Facilitator
 - Recorder
 - Reporter
 - Challenging problems assigned
 - Teacher and TA circulate to help groups

Use of Small Groups in Recitation

- Leader
 - Keeps group on task to complete work within the allowable time
- Facillator
 - Makes sure that everyone has a chance to contribute and that conversation is not dominated by 1 or 2 individuals
- Recorder
 - Records group's answers
- Reporter
 - Serves as group's spokesperson when reporting to other small groups or to the large group.

Small Groups

- Groups have access to
 - Answer keys at front of the room
 - Recorder checks group's work against key and reports back.
 - Group works to correct misunderstandings.
 - Teacher concludes session
 - What was the “Ah HA” experience (insight) that your group had about a particular problem?



Teaching is *more* than Lecturing. Teaching....

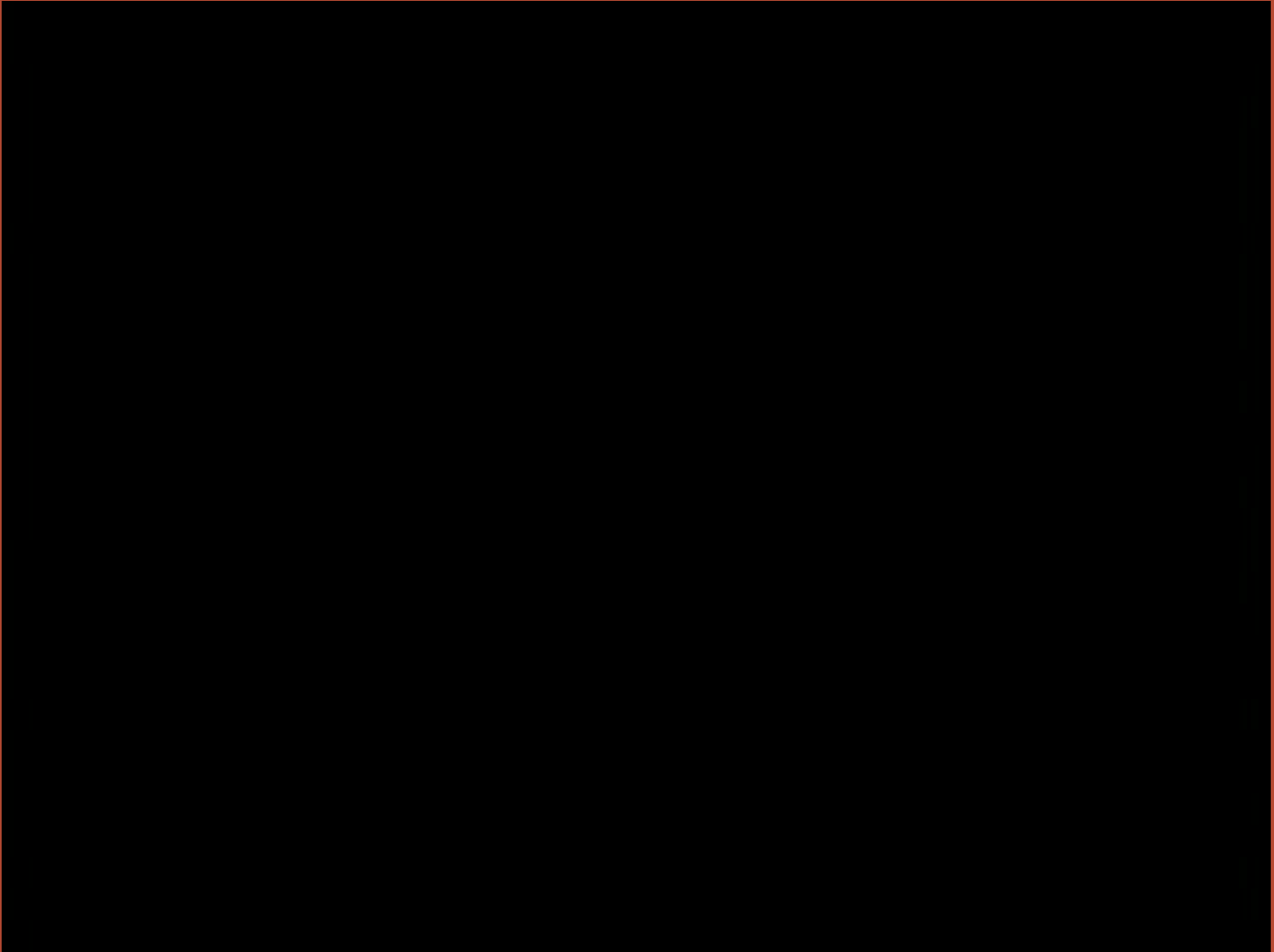
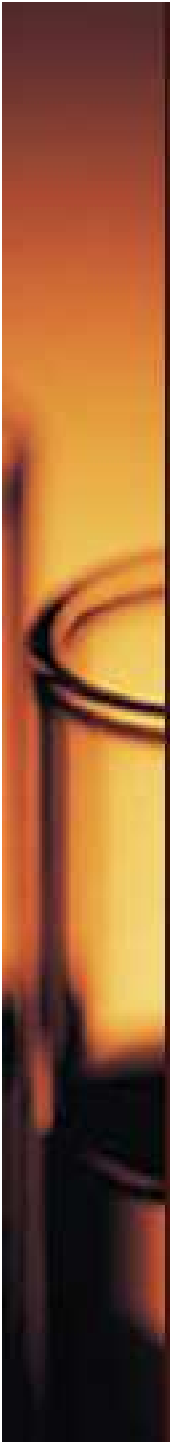
- Addresses the whole person
- Respects the student as an individual
- Provides “safe” environment for trying out newly formed knowledge
- Creates opportunities for each student to learn via different avenues.

Teacher's role is more than provider of content

- Teacher
 - Creates environment (both in class/recitation and online) where student can learn.
 - Removes false barriers to learning.
 - Shifts responsibility of successful learning to individual student.
 - Community of Learners
 - Provide what student needs so student can learn

Student's role changes

- Accept responsibility for learning
 - “Learning is something I do, not that someone does for me.”
- Help will be provided if I ask for it
 - But I must do my part.
- The course is jointly owned by teacher and student.
- Learning is more than memorizing or punching numbers into a calculator.
 - “Learning is understanding”





Learning chemistry is a human
activity.

Any person who really wants to learn
chemistry, should be able to.

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