The Art of Changing the Brain
Today’s Agenda

The Art of Changing the Brain

• The basics of how the brain learns
• A case study of poor teaching
• Being a Brain-Changer in the classroom
Teaching is the art of changing the brain.

-James E. Zull
My experience with having my brain changed

Thank you, Paul Schmelzenbach!
Brain Activity

Four-Step Process of Learning

• Abstract Hypotheses/ Manipulate/ Create (Ideas/Plans)
• Active Testing/ Action/ Do Something
• Concrete Experience/ Sensing
• Reflective Observation/ Meaning (Facts/Interpretations)
Using your group response cards, please vote

A.  Abstract Hypotheses, Concrete Experience, Reflective Observation, Active Testing

B.  Concrete Experience, Reflective Observation, Abstract Hypotheses, Active Testing

C.  Reflective Observation, Abstract Hypotheses, Concrete Experience, Active Testing

D.  Concrete Experience, Abstract Hypotheses, Active Testing, Reflective Observation
Hold up your answers, please!

B. Concrete Experience, Reflective Observation, Abstract Hypotheses, Active Testing
Now stick them to your Zull Brain

1. Sensory – Concrete Experience
2. Temporal Integrative Cortex – Reflection
3. Frontal Integrative Cortex – Abstract Hypotheses
4. Motor and Pre-Motor – Active Testing
Phase 1: Concrete experience
Sensing

The **Sensory Cortex** receives and begins to process information from the eyes, ears, skin, mouth, and nose.
Phase 2: **Reflective Observation Meaning (Facts/Interpretations)**

The **Temporal Integrative Cortex** connects sensory images to prior experience in one's memory banks, neural networks, or schemas.
Phase 3: Abstract Hypotheses
Manipulate/Create (Ideas/Plans)

The **Frontal Integrative Cortex**
develops abstractions, and creates
plans of action.
Phase 4: Active Testing
Action/Do Something

The **Motor Cortex**, where thought becomes real, so to speak, becoming written, spoken, and enacted. We make a choice. Make a decision. Do something.
And it goes on and on...

Active **Testing** gives us new sensory information that starts the cycle all over again.
“Learning is not a spectator sport. Students do not learn much just by sitting in classes listening to teachers, memorizing pre-packaged assignments, and spitting out answers.

They must talk about what they are learning, write about it, relate it to past experiences and apply it to their daily lives. They must make what they learn part of themselves.”

*Seven Principles for Good Practice in Undergraduate Education*

Chickering & Gamson (1987, p. 3)
• Let’s look more closely at Integration
Integration = Transformation

1. Transformation from past to the present and into the future.

2. Transformation of the source of knowledge from outside ourselves to inside ourselves. I make it my own!

3. Integration and Motor - Transformation of power. We become producers instead of merely receivers.
How often do we challenge our learners to become **producers of knowledge**?

**How do teachers facilitate that?**

Predict the outcome
Estimate
What would happen if....?
Write a script - Create a video
Develop your own instructions for...
Write an original research question
Make a diagnosis
Create your own way to analyze
Integration

An Inescapable Fact: No one can understand anything if it isn’t connected in some way to something they already know. Zull
We can help students integrate!

What does this remind you of?
Remember last week when we discussed........? How does this relate to what you've learned before?

Show pictures, use sounds, movies, concrete examples
Let students talk to each other
Use stories, emotional connection
Brain activity 2

In your folder, take out the sheet of labels.

As a group, decide where each of these 20 activities happens on the learning cycle. Place the sticker on your Zull brain at the main level it achieves.

You have 5 minutes
5:00
Let’s look at a few of these....

8. Answer a question by raising my hand
9. Listen as a student answers a question in class
10. Vote with a clicker and get the answer wrong

3. Read Ppt slides/ scholarly article
What is the underlying assumption when I ask a question in class, and call on one student to answer, and then go on to the next topic?
Why are clickers so great?

Work with your table to come up with a list of clicker outcomes.
1. Anonymity
2. ..... 
3. ..... 
4. ..... 
5. ..... 

Find the lavender paper and list student experiences and outcomes when using clickers. Write the number of outcomes you list on your paddles!

You have 2 minutes!
2:00
Clicker Outcomes

1. Anonymity
2. The cool factor
3. Everyone answers
4. Everyone’s opinion is of equal importance
5. Everyone gets feedback – student and teacher
6. Keep students’ attention – adds drama to class
7. Motivates students to do their homework
8. Reduces fear of failure
Reduces fear of failure?
The two fundamental things the brain wants:

To be Safe and to be Happy
or
Fear and Pleasure
or
“I want this” and “I don’t want that”
Am I in danger?

How can we “trick” a student’s Amygdala into “relaxing”? 
Reducing Fear

Provide relevance = Emotional connection
Telling Students Why = Relevance

“gives students control over their own learning.
If we want students to learn, we must help them feel in control.
If people believe something is important to their lives, they will learn it.
If we want student to learn, we must help them see how their learning matters.
We must tell them why.”

Zull

See the goldenrod handout on Dan Adsmond
“Telling students Why”
Reducing Fear

Action reduces fear (estimate, predict, make a low-stakes or no-stakes decision)
Plunge students into problems immediately at the start of class—this helps “disarm” their defense system. (Am I in danger? No:)
Frequent active tasks will “hard-wire” in students’ brains the idea that being in class is a “fun” and “safe” place.
Fear reduction:

“In all these examples, students encounter safe yet challenging conditions in which they can try, fail, receive feedback, and try again without facing a summary evaluation.”

*What the Best College Teachers Do*, Ken Bain
So, if we know it reduces fear when students take action – to do something

–and it’s good for their learning as well...
How do we get everyone involved in learning?
Getting everyone involved!

Think of questions as facilitating discussion
Homework feeds into class discussion & group work
Use Response Cards, Paddles
Be willing to wait in silence
Give time for reflection
Write before sharing
Think-Pair-Share
Gallery walks in teams
Team work
Reducing Fear

Let’s look at some examples of syllabi
What’s the difference between:

1. Late papers will be penalized a letter grade for each day they are late.

2. For this paper, students may choose their submission date. Papers that are turned in on April 3 are eligible for 100 points. Papers turned in on April 5 are eligible for 80 points. Papers that arrive after April 5 are accepted and will receive feedback, but are eligible for 0 points.
How about......


- I realize that this is a thick and expensive textbook. However, this textbook is a great resource for Biology in general. I can tell you from experience that it will be a wonderful reference as you prepare for Graduate or Medical school, and while you are studying, or employed in, anything related to biology. Plus, after evaluating many texts, I realized that it doesn’t cost much more that other text options.  
  
  Mike Dorrell
COURSE FORMAT... The overall format for this class is likely to be different from most other courses that you have taken...

Extensive data has effectively demonstrated that students learn better by taking part in the learning process, a process called ‘active learning’...

To this end, this course will incorporate several active learning techniques, a few of which are referred to as ‘Jigsaw’ and ‘peer teaching’.

Mike Dorrell
How do we make students care about their own learning?

• Reduce Fear.
• Make EVERYTHING Relevant - No busy work!
• Tell students *Why*: Giving a feeling of Autonomy
• Make learning visible. Teach them the Zull model!
• Continual Feedback (Assessment)
Speaking of Fear

What stops us from addressing problems?
FUD

- Fear
- Uncertainty
- Doubt

Inadequate assessment of the costs of not doing something.
A brief (true) case on design of a learning process

Dr. Conners arrives in class at 9:00 AM. 30 of her 45 enrolled students are present. As a warm-up, he asks the students a few questions based on the reading assignment for this day.

“What was the main point of the reading?”

There is silence.

“What was a key concept you got from the reading?”

Silence still.

“Can anybody remember one important word from the reading?”

One student answers “externality?” which pertained to one example in the chapter, but was not a central concept.

In frustration, Dr. Conners asks, “Show of hands, how many of you read the assignment?” A scattering, less than 20% raise their hands. “Ok, he says, let’s go over what the reading says....” Dr. Conners proceeds to review through lecture the content of the reading assignment.
Conduct a Cost Analysis: Consider Dr. Conners’ teaching strategy and efforts on this very normal day. What are the “costs” (both visible and hidden; short term and long term) to him, to YOU and ALL OTHER PARTIES OR ENTITIES who might have a stake in what is happening?

Work with your partners to make a list of these costs you see being incurred by all interested parties or entities.

Place a dollar amount on the cost. Estimate if you cannot calculate.

Transfer your cost analysis to poster paper and put the final $$$ total at the bottom and also on your paddle.
As soon as you are done, hold up your paddle.
You have 10 minutes.
10:00
Share out of your analysis
As individuals and as an institution we tend to ignore...

...the cost of psychic wear on individuals whose work leads to frustration rather than satisfaction

...the cost (to all of us) in manpower, resources, reputation and morale when one of our colleagues lacks the tools and awareness required to be effective in the classroom

...the huge cost of inaction.
Break Time!

- 10 minutes
Being a Brain-Changer
Implementing this in the classroom
What does it mean when a teacher says....

“My students don’t do their homework.”
Underlying message:

• It’s the students’ fault
• Students don’t care.
• I’m powerless to change them.
• The homework is not essential. (If it wasn’t, the students would all flunk.)
What are some techniques to change this?

Discuss with your table mates.

List 5 reasons students don’t do their homework

List 3 or more strategies to address these problems.

We will collect these and distribute by email.

Pinkish handout
Making things **relevant** in homework

1. Homework must matter – be meaningful and **useful**.
2. Determine how each assignment will meet your LO’s. No busywork!!!
3. Explain why the homework is important and how they will **use** the information.
4. As soon as possible, have students **use** the information in class – and keep using the information.
Now for that action piece...
How does this become a tree?

An acorn weighs almost nothing and yet grows into a huge oak tree that weighs many tons.

Q. Where does the mass of the oak tree come from? Be VERY specific. (April Maskiewicz)
“Prior knowledge is likely to be concrete; teachers should begin with the concrete.”

Zull
What would be missing?

If Columbus never discovered the Americas, what might be missing in this Italian meal?

The Columbian Exchange (Kelli McCoy)
Where will a tsunami hit?

(Walter Cho)
“Little true learning takes place from experience alone. There must be a conscious effort to build understanding from the experience, which requires reflection, abstraction, and testing of abstractions.”

Zull
What piece of Chamber Music are we performing?
“We need reflection to develop complexity. We may start with a direct and sometimes relatively simple concrete experience, but that experience grows richer as we allow our brain the freedom to search for those still unknown connections. And as we find those connections, our brain changes. We attach the networks of our present experience to those that represent our past experience.

The art of directing and supporting reflection is part of the art of changing a brain. It is the art of leading a student toward comprehension.” Zull
The Role of the Teacher

1: Teachers Do Learning Tasks Less

2: Teachers Do Less Telling: Students do More Discovering

3: Teachers Do More Design Work
Reflection on lesson design

Can you think of a lesson in your class that you could design so that students did the work of discovery?

Can you start with something concrete and use that to start the learning process?
**Flipped Classroom** Pre-class videotaped mini lectures or demonstrations, in-class application of concepts.

**Just-In-Time Teaching (JiTT):** Pre-class assignments sent electronically to Profs that then inform class content

**Peer Instruction:** Pre-class assignments emailed by students to their instructor, concept questions and peer teaching in class

**Team-Based Learning:** Pre-class reading, Readiness Assurance Process and in class application exercises
<table>
<thead>
<tr>
<th>Flipped Classroom</th>
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<tbody>
<tr>
<td>Instructor videotapes a short demo lesson or narrates a short PowerPoint lesson</td>
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<tr>
<td>Students watch the video and typically have a few application exercises to submit before class</td>
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<tr>
<td>In Class, students spend the majority of their time working on application exercises</td>
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<td>Instructor Uses Class Time to check understanding and Clarify Common Misunderstandings</td>
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<td>Process is Repeated with the Next Assignment</td>
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Just-in-Time Teaching

Students Complete a Pre-Class Reading Assignment and Application Exercises

Students Submit Answers and Any Questions Online

Instructor Reviews Students’ Responses Prior to Class

Instructor Uses Class Time To Clarify Common Misunderstandings

Process is Repeated with the Next Assignment
Peer Instruction

Typically, Students Complete and submit a Pre-Class Assignment

Class involves a series of multiple choice concept questions
Students must choose an answer and vote with a clicker

If a large percentage of students get the questions wrong, the instructor asks students to discuss with each other

Students work in small groups of 2 or 3
Explaining concepts and answers

After peer instruction, students revote
Instructor may step in to offer explanation
Team-Based Learning

Students Complete a Pre-Class Reading Assignment

At the beginning of unit, students take an Individual Readiness Assessment Test (iRAT). These are handed in.

Immediately, teams take the same test (tRAT). Team grades are made public to the class.

Timed application exercises in teams. Each team reaches consensus & publically votes on their answer.

Professor facilitates discussion between teams, bringing everyone to the correct understanding.
Outcomes

• Individual Accountability
• Balance of individual and group learning
• Higher attendance rates
• Lots of reflection, hypothesizing, doing
• Higher critical thinking
• More teacher satisfaction
What Great Teachers Do
Ken Bain

“We found no great teachers who relied solely on lectures -- not even highly gifted ones”
Let’s revisit Dr. Conner’s class

• Let’s see how the learning has changed.
### IDEA Progress on Objectives

#### Fall 2012

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<th>A. Progress on Relevant Objectives</th>
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<tr>
<td></td>
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<tr>
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#### Spring 2013

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Dr. Conners arrives in class at 9:00 AM. 43 of 45 students are present. On the overhead projector he shows the cumulative results of the online quiz that students took on the day’s assigned reading. Students scored well on all but 2 of the 10 questions. He places these two questions on the overhead, and asks the students to group up and re-evaluate their responses. After a few minutes he calls on different students to provide an explanation of the thinking behind their answers. Bolstered by their groups, they speak without hesitation. Through discussion with these students, the more difficult concepts that the quiz tested become clear.

Dr. Conners now shows on the doc cam a new case with a new attack on the problem. He tells students they have a few minutes to read, reflect and write out their ideas. He then asks students to work in their groups to come up with their analysis based on the homework, and write them on large sheets of paper. After 10 minutes, he asks groups to stick their sheets to the wall, so everyone can see everyone else’s answers.

In seeing those answers, he is able to tell quickly how well students understand the principles covered in the unit, and to use the comparisons to show students which thinking is most sound. He calls on specific students to explain or justify some of the differences in their answers.

He then lectures for about 10 minutes to place further emphasis on those things he wants students to remember and be able to apply in the future. He ends class with a question and brief, informal discussion, intended to get students thinking about the next reading. He adds a comment about the specific tasks students will be doing with this information in the next class meeting.
What Changed?

Did Dr. Conners recover any costs?

How is Dr. Conners now a brain-changer?

You have **5 minutes** to write your answers on a poster paper. You will then trade papers with a table in your quadrant.

**Things to consider:**

Individual accountability, group learning, fear reduction, making things relevant, assessment, homework, time for reflection and integration and action....
Things Dr. Conners changed

1. Individual accountability
2. Reducing fear - Students are able to try and fail and try again
3. Making things relevant (focuses on the 2 questions missed on the quiz)
4. Assessment – knowing and caring if students “get it”
5. Makes homework relevant – application of concepts in class
6. Time for reflection and integration in class
7. Shows students he cares whether they “get” the concept
8. Makes students make choices - Active testing
9. Makes learning visible (tells them to reflect)
10. Using other student’s neuronal networks to help each other
11. Helping them integrate (mini-lecture at the end)
Was it worth the effort?

• How do you suppose Dr. Conners feels about his career now?

• How do you suppose Dr. Conners’ students feel about his class?
Traditional university teaching:

“Let me tell you what you need to know and what to do. At the end of the course, you can show me whether or not you got it.”

• Time obligation: prep lectures; grading; office hours
• Connection to student learning process: vague or not at all
• Impact on students: unknown; or measured too late to matter
• Implication to student role and responsibility: very little
• Risk of psychic wear on instructor: High (boredom of students; low course evaluation scores; student pushback and failure to comply due to feeling like children; poor performance; cheating and plagiarism)
Changing how we think about our jobs as teacher-leaders

Compare:

“Go do this thing (read X, write X, find X, summarize X, try X), and then let’s look at how you did. Based on how you do on that, you’ll then be asked to apply what you learned. Once you do that, we’ll move to the next level.”

• Time obligation: course planning; assignment design; feedback; grading
• Connection to student learning process: immediate, frequent
• Impact on students: known, monitored
• Implication to student role and responsibility: accountability; self-informed
• Risk of psychic wear on instructor: down (authentic in-class conversations with students-as-adults; higher attendance; improved course evaluation scores; visible student learning; reduced cheating and misconduct)
How to be a brain-changer

Embrace unapologetically the centrality of how students learn to guide your teaching methods.

Make your own teaching a model of research-based best practices.

Find kindred spirits

✓ Ask them to visit your class to give you feedback (demonstrate openness)

✓ Invite them to meet for lunch and discuss their teaching successes.

Over time, promote a formal conversation with colleagues on best practices.
The Big Rocks

• Teach in ways that include and encourage reflection, integration and actively doing something – applying knowledge.

• Search for ways to create relevance and emotional connection with students and content.

• Reduce fear – reduce the risk of failure.

• Build student’s neuronal networks by breaking down large tasks into smaller tasks that build skills and explain Why.

• Balance individual accountability with learning from others.

• Make learning visible, talk about learning.
Be a Brain-Changer

August 26, 2013
Faculty Development Day

Jo Clemmons
CTL Director
Point Loma Nazarene University
The End