Meaning-making in anatomy education: using “applications” to expand constructivist learning in the anatomy class and lab.

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History of anatomy at Duke: Built on concepts and teams.

- Duke NUS Medical School Established. TBL discussions begin.
- Normal Body created
- Anatomy faculty departures & retirements
- The textbook for the new course
- The “TBS” introduced with evolutionary framework.
- 1969 Anatomy is revamped
In this moment of crisis we “innovated” (slowly).

This year (2011) we:

1. Re-established lab teams with faculty team “facilitators”: pretty good results with a little complaining.

2. Set up an online dissector (you have heard about the results on that).

3. Replaced four lectures with some combination of IRAs, GRAs, and application: the IRAs were not very successful, but Jennifer has addressed solutions to that. The GRAs were not very successful. The applications were successful in ways that we did and did not expect.

4. Added in-lab GRA/applications for every session: A great idea (we think) that you will see needs some tweaking.

This presentation focuses on the in-class and in-lab applications.
The traditional didactic experience.
Individual and Social Constructivism:

That students actively make meaning: Develop “knowledge”
Knowledge is within both the instructor and the student.
Meaning-making relies on learner pre-conceptions

Meaning-making = learning.

Didactic and team-learning both have a place and both allow
(by their very action) meaning-making.

Constructivism is possible even in a didactic environment if
we choose our approaches and
Meaning-making occurs in a social context and cannot be separated from that context.

Gross Anatomy then, since 1969, at least has been inherently constructivist and inherently team-based and therefore an ideal space for testing innovations (slowly).
History: A 35 year old woman comes to the Emergency Department following a blow to the left side or her head. Her husband states that they were at their son’s little league game when a hard hit foul ball struck his wife while she was looking away, talking to the person next to her. The ball hit her head just behind the orbit. She did not lose consciousness, but did fall to the ground after the impact. She appears to be in pain and somewhat disoriented.

Physical Findings: On physical examination you find swelling and bruising in the temporal region just posterior to the lateral margin of the left orbit. The temporal pulse appears normal. There is tenderness over the area to touch, particularly the lateral margin of the orbit which seems to be significantly distorted. She has a headache but no nausea. She responds to questions, but seems to be distracted and responds slowly. The patient's left eye appears to protrude from the socket more than the right eye. The pupil on the left side is low to respond to light. She has trouble moving her left eye laterally and complains of pain behind the eye. As the examination proceeds her symptoms become more acute and new symptoms appear. She complains of weakness in her left arm. She also begins to have increased trouble moving her eye in any direction. The time it takes for her pupil to respond to light is becoming greater and she is becoming less lucid.
**Additional physical findings:** A radiological study results in the following images shown in figures 1 and 2. The radiologist’s notes regarding figure 1 describe the presence of lentiform area of high density extending from the lambdoid suture to coronal suture. The notes regarding figure 2 describe defects in the right orbit and maxillary bones which include an indentation or “funneling” of the right orbital floor (indicated by the yellow line in figure 2A), an oblique line of increased contrast extending from the floor of the orbit to a region lateral to the 2\textsuperscript{nd} incisor on the right (indicated by the black arrow in figure 2A), and a hypoplastic right maxillary antrum (indicated by the white arrow in figure 2B).
9. While the radiographical anomalies observed in the orbit and maxilla shown in figure 2 might be associated with the head trauma in this particular case, they also might very well be unrelated. Please describe what your group thinks is the most likely cause of these anomalies.

OCCULT FACIAL CLEFT; DIAGNOSED PREVIOUSLY AND REPAIRED BUT WITH SOME ANOMOLIES RETAINED. GIVEN THE HIGH FREQUENCY OF CLEFT PALATE IN THE POPULATION THIS IS NOT UNCOMMON. IT IS IMPORTANT TO DISTINGUISH BETWEEN NATURAL ANOMOLIES AND FRACTURES.

But we have a serious problem......
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First, hands all started shooting up and we realized our mistake. But we decided to play it out. We told them that this discrepancy was part of the problem (not, on its face, a great solution but it bought me some time!)

Faced with this unexpected conflict in the question the students were made uncomfortable and they had to struggle with what was inherently an easy question. But how they answered revealed more than I expected.

Student answers varied:

1. A few groups got it right. They dismissed the idea that the radiological finding on the right were the result of damage and then considered alternate options. This was the “right” strategy but in many ways the most constrained and least creative.

2. Another few groups also dismissed the findings as part of the current trauma and argued that its was an old fracture and considered issues of past trauma (I liked this answer a lot).

3. One group insisted that the radiographs were wrong or flipped and focused on clinician error.

4. Most of the groups came up with ideas that fell into two categories.
   “The blow was hard enough to damage the other side”
   “When she fell she was hit on the left and that knocked her down and she hit the right side of her head”
Survey results: In-class Application

Please answer the following questions regarding your Gross Anatomy TBL team and experience

<table>
<thead>
<tr>
<th></th>
<th>In-class TBL Application exercises (paper-based) were aligned with course content.</th>
<th>In-class TBL Application exercises (paper-based) helped me learn course content.</th>
<th>The Application Exercise helped me make connections between basic science content and clinical problems.</th>
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<tr>
<td></td>
<td>COUNT</td>
<td>%</td>
<td>COUNT</td>
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<tr>
<td>Almost always (5)</td>
<td>19</td>
<td>17.8%</td>
<td>18</td>
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<td>3.7%</td>
<td>12</td>
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<tr>
<td>Never (1)</td>
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<td>1.11</td>
<td>1.12</td>
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</table>
After a difficult birth, the parents of an infant notice that he seems to hold his head cocked to the right with his face slightly turned to the left. At his checkup, the parents bring the baby’s unusual head carriage to the attention of their doctor, who finds a fibrotic mass in one of the muscles of the neck. The doctor explains that the mass likely developed from a hematoma as a result of a torn muscle in the baby’s neck, and this might cause the muscle to be shortened. This is called “wry neck” or “muscular torticollis”.

2. What muscle is affected?

3. What is the origin and insertion of this muscle?

4. What nerve innervates this muscle?

5. On rare occasions this syndrome requires surgical intervention. A surgeon has to be careful not damage other structures. What major structures run across the superficial surface of the involved muscle? What major structures run immediately deep to the involved muscle?

Positives: (1) students engage each other as a team, (2) students stay in lab (3) students connect cadaver to a larger basic or clinical concept.

Challenges: (1) relevance, (2) timing, (3) teamwork, (4) online resources
Survey results: In-lab GRA

I loved these a lot, but........

Just didn't find these that helpful. Because we were always working hard to complete our dissection, we usually tried to race through these rather than taking the time to think them through. The questions were useful, but I'd rather do them in a TBL group application in the amphitheater, or for review at home.

These should be graded. If we know what material is being tested then we can prepare and will be more open to group and team discussion.

Often not coordinated with current material.

Pointless. Team applications in general are unnecessary.

It would be helpful to know what to prepare for.

Sometimes the lab GRA's did not really match up well with lab content. Maybe do the GRAs after we have done the dissections in lab - e.g. do the dissection and then the next session, do the GRA that is related.
Conclusions:

1. Anatomy at Duke has always used a concept-based and team-oriented approach.

2. Didactic and TBL approaches can and must incorporate a recognition of the mind of the learner.

3. Applications and in-lab GRAs are best when they capitalize on and challenge pre-conceived knowledge.

4. Some ideas don’t work at all institutions. We must be prepared to adjust or abandon.