**Initial Teaching Method**

I initially taught the cell parts as a straight lecture. It was ok – student success on those questions in the Unit exam was not different to their success on other questions covering other content from the same unit. However, it was very boring for me as it is just a laundry list of features and what they do. I was getting tired of all the talking semester after semester. (2008 data)

**Switch to Jigsaw**

The first change I made was to teach the cell parts using a jigsaw method. This was my first attempt at a jigsaw so I did it pretty much “by the book”. Students were grouped into 5 groups of 4 students and each group was assigned a list of 4 or 5 related organelles/structures. The group was given a class period and a homework period to become experts on their assigned organelles. Guidance was given as to what to find out for each organelle/structure. Then the groups were re-ordered to have one member from each original group and were given a class period plus extra time in lab to teach their new groupmates their particular organelles. Whiteboards were provided to help with explanations. Resources included the Unit Outline and an instructor created PowerPoint that were posted on Bb, the text book and general internet resources. (2010 data)

(Instruction sheet given to students is attached)

**Initial modification to Jigsaw**

After the first run though I saw students dictating pages of notes to each other when it was their turn to explain their organelles. No active explanation or questioning was occurring within the groups and it was highly questionable as to whether they even understood the words they were using as they were copied from the text or online!

More detailed directions were given regarding how to “teach”. These include:

* Use the whiteboard to diagram things
* NO DICTATION
* No use of any word you cannot explain in your own words.
* Give information in a way that would be helpful for an exam – that is what do you think would be asked about this organelle/structure on an exam.
* Use your own words to describe things. It does not necessarily have to be scientific terminology.

**Second modifications**

Students were more active and engaged in teaching and learning the material following the first modification (extra teaching instructions) . However, there was still no noticeable improvement in student scores on exam questions covering this content. After talking with Shannon Manuelito I decided to devote even more class time to this topic, and required that each group make a set of PowerPoint slides for their assigned organelles so that we could assemble a communal ppt presentation in GoogleDocs. We then used the PPT for a PPT karaoke activity in lab where students were called on at random to discuss a slide that may or may not be one of their initial groups’ organelles. This added an extra layer of accountability for the information onto the students and also gave the instructor an opportunity to talk about each organelle to correct misconceptions and add information as each slide came up. (2012 data)

To determine whether these changes had any impact on student exam scores I compared scores on two mulitpart questions on the Unit 2 exam. The first question was on protein structure (11 points total) the second question was on cell parts (14 points). I wanted to see if:

1. Success on question 1 (protein) predicted success on Question 14 (cells)
2. Spending more time and focus on cell parts caused students to forget or not focus as much on proteins (that is Question 1 scores declined)
3. Changing the teaching method of the cell parts improved scores on question 14 (cells)

A Spreadsheet showing the data and analysis is attached. A correlation was used to determine if success in Q1 predicted success in Q15. That is, are good students just good students, regardless of teaching methods.

**RESULTS/DISUSSION**

**Overall, comparing lecture to modified jigsaw, scores on the cell exam question increased from 60.5% to 64%, while scores on the protein exam question increased from 67% to 68%.**

Using the lecture method (2008) and the modified jigsaw method (2012) the correlation between the scores on these two questions was high – indicating that good students are good students, regardless of teaching method. However in 2010 the correlation was significantly lower. This indicates that my initial use of jigsaw teaching potentially caused “good” student scores to decline or conversely allowed poor students scores to increase (I need statistical help to figure this out!)

However, looking at the p values when the sets of data are compared, the increased score on the cell exam question cannot necessarily be attributed to the change in teaching methods – it could just as likely be due to the different student populations in each semester.

**In summary:**

1. Does success on question 1 (protein) predict success on Question 15 (cells) YES
2. Does spending more time and focus on cell parts cause students to forget or not focus as much on proteins (that is do Question 1 scores decline)

NO

1. Does changing the teaching method of the cell parts improve scores on question 15 (cells)

NO, cannot be supported by this data

Unit Two of BIO181 comprises Protein structure/function, Enzymes, Membranes/Osmosis and basic Cell structure.   I have been using a jigsaw method for several semesters to teach the cell parts, with limited sucess.   It was no more  sucessful than straight lecturing thru the laundry list of parts, even though, in theory, it was a more student centered, active-learning kind of approach.  Last semester, I enhanced the jigsaw activitiy with extra components to see if that would increase student's understanding and retention of the (somewhat large amount of) information.  I also wanted to see if focusing more time on cell parts diminshed students' ability to learn and retain information on Proteins (the other main part of the module) that was covered prior to cell structure.

Knowledge of cell structure and protein structure was assessed in a Unit Exam.  One question at the beginning of the exam covered protein structure (11 points)  and one question (at the end of the exam) covered cell structure (14 points).  Together, these two multipart questions comprised a quarter of the points on the exam.   Data was analyzed us