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Evolution and Adaptation Lesson Plan: A Comparison of Lecture and Activity Based Learning

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Honors Project Spring 2017

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I. Research Questions:

Are there innovative ways to help students remember the concepts instead of memorizing them for a test? Would creating an activity based lesson plan improve student understanding more than a lecture-based lesson plan?

II. Literature Review:

In today's society when it is really hard to keep students' attention, it is necessary to incorporate a variety of learning styles to inspire different kinds of learners. If students are failing classes because they were struggling to pay attention is it 100% their fault? Everyone is different and has different learning styles that need attention. It would be better for students to actively participate in lessons rather than just absorb information.

In one study that compared different styles of learning 225 exam scores were analyzed that compared lecturing and active learning. Scott Freeman and his coworkers found that on average exams improved by .47 standard deviations with active learning (n=158 studies). The chances of failing were 1.95 standard deviations under traditional lecturing (n=67). Exam scores for students in active learning improved by 6% and the students who were in the lectures were 1.5 times more likely to fail. Active learning seemed effective for any class size but particularly when n $\leq$ 50. The results of Freeman's study raised questions on whether lecturing should continue to be the preferred method in a classroom. (Freeman et al 2013).

Figure 1 (Freeman et al 2013)

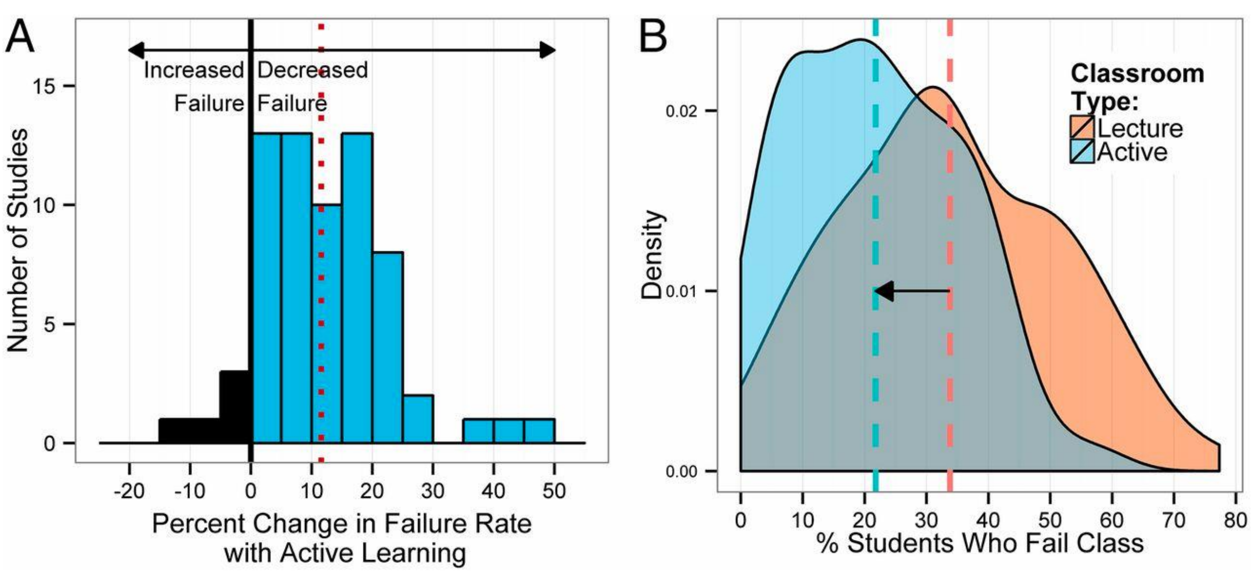

Figure 1 comes from Freeman's study on the use of lectures vs. active learning. The importance of this figure would be to notice the difference between the percentages of students who failed. With active learning, there was a significant difference in the percentage.

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In addition to strategies and standards, possible benefits of more activity based learning were researched. The following came from a study done on undergraduate medical education conducted by Nandi et al. Students learned more by actively participating in a lesson than by absorbing information from a lecture. Conventional students were compared with those taught using a problem based learning curriculum students (PBLC). Nandi and co-researchers found that PBLC students were more able to use the meanings of the terms instead of only memorizing them. Students were better at applying what they had learned, using interpersonal skills, and had more confidence. Although students were not as skilled at a basic science exam, they performed better in clinical exams. This study seemed to suggest the importance of using a mix of lecture and problem based learning. Even for future doctors, undergraduates within medical education, teachers need to continuously update their methods in order to keep the students' attention. Medical advancements have improved, but how they are taught has not. Even adult students require new methods of education so they can fully utilize what they learn. (Nandi et al 2000). This pertains to BIOL 2050, the class in which this study was tested, mainly because it is a class used for undergraduates who may go into the medical field.

This study designed a module to be used in a high school level Biology class or an introductory college level Biology class. The standards of a high school are slightly different than the standards for a general education university course, (e.g.; BIOL 2050 Concepts in Biology) at BGSU. Biology 2050 counts as meeting the natural science standard that is a general education requirement at BGSU.

a. **State and National Standards:**

For the state of Ohio the science standards are focused on the following: Students need to have a background in scientific explanations of the natural world, scientific evidence and being able to evaluate it, and knowing the difference between science and pseudoscience (Ohio Department of Education 2011). This represents the expectation for a high school student by the end of their high school science career.

The national science standards go over a broader array. They are more focused on the big picture. These standards indicate that students should have an understanding of eight categories including unifying concepts and processes, inquiry, Physical Science, Life Science, Earth and Space Science, technology, personal and social perspective of science, and the history and nature of science. (The National Academies of Sciences Engineering Medicine 2017). This shows the broad topics that the federal government expects high schoolers to have covered by the time they graduate. In order to accommodate everyone, the federal government utilizes broad terms. Since this project was focused more on Biodiversity and Evolution, both categories fell into the Life Science standard. Therefore, both could potentially be used as a lesson for high school students.

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An updated standard for teaching science, specifically a lesson on Evolution, comes from Next Generation Science Standard (NGSS). NGSS require that students should see evidence of evolution by going over common ancestry and empirical evidence. Students should be able to evaluate evidence and create theories about it (NGSS Lead States 2013).

The unit under design focused on Evolution. All students should have learned a basic understanding of a definition of evolution. In a documentary presented by PBS, "How Does Darwin's Theory Illustrate the Process of Science," Biological Evolution is explained as the results of: interactions of species' populations increasing, genetic variability resulting from mutation and recombination of genes, limited resources that are necessary for life, and environmental influence on offspring survival. (WGBH Educational Foundation and Clear Blue Sky Productions 2001) This shows what the expected results of students' understanding should be after a lesson. In order to have a lesson more appropriate for the college students, there had to be more ways for the students to not only show they understood this definition but could apply it to activities.

b. Standards of a General Education University Course BIOL 2050 at BGSU:

According to Dr. Underwood's syllabus for BIOL 2050, the natural science BGP are as following:

BIOL 2050 fulfills a BG Perspective requirement for the Natural Sciences. The learning outcomes are:

> NS1: Describe how natural sciences can be used to explain and/or predict natural phenomena. NS2: Identify misconceptions associated with the specific scientific discipline.
> NS3: Explain simple quantitative data and its limits relative to the study of science.
> NS4: Demonstrate the application of simple quantitative and qualitative data in the scientific process.
> NS5: Solve problems using one or more of the logical approaches of science
> NS6: Reflect on the relevance of science to one's everyday life

(Underwood 2017). These standards require more focus on students being able to interpret scientific data rather than only being able to have a basic understanding of concepts. The main challenge this presented compared to the Ohio and National standards was to have students be even more engaged with the material. Students needed to be able to apply the concepts to an explanation of something that happens in the world around them.

c. The 5 E's:

The lesson plan developed for this unit was based on 5E and 6E models. The 5E's consist of Engage, Explore, Explain, Elaborate, and Evaluate (Corporation of Public Broadcasting 2002). The original reference of the 5E lesson plan that most other sources on the 5E's referenced came from Bybee (1997) in *Achieving Scientific Literacy: From Purposes to*

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Practices. According to Chessin and Moore, the 6th E in their learning model is for E-Search. They modified the 5E's by stating them as "Enhanced" Engage, Exploring with Technology, Explanations and Reflections, Extensions through E-search, and Evaluation with an E-Search. Their method serves as a reminder to include technology in the lesson plan. (Chessin and Moore 2004). In another version of the 6E Learning model, the 6th E stands for express (Duran et al 2011). This step provides an opportunity for all students to show that they are steadily progressing. In this version, the order of the steps is Engage, Explore, Explain, Express, Elaborate, Evaluate. The Express phase allows students the opportunity to show the teacher where they are in the learning cycle so that he or she can decide what to elaborate on in the next stage. Giving students the opportunity to present what they know also gives them more confidence in future assessments. It either shows them that they already know the material and will be ready for the test or it gives them an opportunity in the elaborate step to modify their misconceptions. (Duran et al 2011). Following a combination of these learning models, student learning should improve from an activity based lesson plan. These methods help answer one of the research questions, would creating an activity based lesson plan improve student learning more than a lecture based lesson? The 5E and 6E formats allow a combination of both types of lessons mixed in order to maintain student engagement by using multiple styles of teaching with in one lesson.

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III. Results:

A. Lesson plan development

The first part of the study was to develop a lesson plan that incorporated active learning activities. The following is the lesson plan developed based on the 5E model for use without traditional lecture. Parts of which were used in the comparison study.

Figure 2: 5E Table

E's	Activity	Guiding Questions Key Terms	Questions Students May Ask	Materials needed
Engagement	Comic Book Strip	-What is antibiotic resistance? -How do bacteria evolve?	-Can viruses have resistance to antibiotics? -What are the differences between viruses and bacteria?	
Explore/ E-search	Create a Creature	-What is natural selection? -What adaptations would help your creature have better survival strategies? -What is the fitness of your creature like?	-What is the difference between natural selection and fitness? -Isn't fitness just better health?	Computers
Explain	Look at animals/ Zoom in	What adaptations are you zooming in on?	How do we know what is considered an adaptation of our animal?	Phones with cameras, Bring in herps
Extend	Jenga	What are the different types of selection and would they help your species? -directional selection -disruptive selection -artificial selection -genetic drift		-Jenga Blocks with pictures of animals -Laminated Adaptations
Evaluate	Key Terms Quiz			Computers

Figure 2 shows a table used to plan this lesson using the 5e's.

Lesson Plan:

Students took a pre-assessment, followed by a lecture (class 1001) or an activity (class 1101). Then the mid-assessment was administered, followed by the opposite strategy for each class and a post assessment. Each lesson serves as a control for the other in a comparison of two teaching strategies. For the lecture based lesson, a traditional PowerPoint was utilized. There was very little group discussion. For the activity based lesson, the 5e/6e model was utilized.

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a. Engagement: Activity 1: Comic Book Strip:

For this activity, students were given a blank sheet of paper and asked to draw a comic strip of how bacteria become resistant to antibiotics. This allows them the opportunity to get creative while learning about the concepts of antibiotic resistance and bacterial evolution.

b. Explore: Activity 2: Create a Creature (Not conducted):

Students will be given a blank sheet of paper where they can draw a creature with what they think are the best adaptations it needs to survive. For inspiration, they can check out the following website: http://switchzoo.com/zoo-original.htm. Students can choose any environment they want for their creature. Their goal will be to show examples of why their creature has a better chance of survival or fitness level than other creatures. Students should also be able to show what adaptations their creature's species naturally selected for because of the environment they chose. This allows them another opportunity to get creative while learning about the concepts of natural selection, fitness, and adaptations.

c. Explain: Activity 3: Zoom In:

In this activity, each group, with the help of a learning assistant, had an animal from the BGSU Herpetarium to observe. Students were allowed to have their phones out to take pictures of the animals. As they took pictures of the animals they were asked to zoom in on what they thought were important adaptations for them. Learning assistants guided students to look at the important adaptations by the end of the activity.

d. Extend: Activity 4: Adapted Jenga:

Each group was given the following to play Adapted Jenga:

- Two to three blocks that already have pictures of animals on one side
- Possible Adaptations they wanted to focus on with Velcro on the back to be put on the blocks.
- Clip art representing dry or moist climates of environments with Velcro

The goal for each group was to determine which adaptation(s) the animal on their blocks had and which environment the animal was more suited for based on adaptations. Once students had determined this for each block their group had, one student from each group came to the front of the class and put their block in one of two possible towers each representing dry or wet environments. Once the towers had all of the groups' blocks, the class went through and determined if each environment had the right adaptations to help a creature living there survive. Each group was given the chance to explain why he or she put their block on a particular tower. The student talked about how the adaptation they chose was better for the environment.

If a student was able to explain how their adaptations effected their animal, the student tried to take a block out of their tower. If an adaptation was in the wrong environment or students were not able to explain why that adaptation would help the creature's fitness level, they won't get a chance to remove their block. Other groups could be asked, if a group needed help. Whichever tower was left standing won the game, like in normal Jenga.

e. Evaluate: Activity 5: Key Terms Quiz

Throughout this project, students took the same 10-term quiz three times, once before the start of the unit, once after the lecture, and once after the activities. Their progress was graded based on the following rubric:

Figure 3: Rubric for Key Terms Quiz

Key Term	No understanding/ left blank (0 points)	Limited understanding (.1)	Basic (.2)	Complete Understanding/has complete definition (.4)	Exceeds expectations/able to provide examples of the concepts (.5)
Antibiotic					
Natural Selection					
Adaptation					
Fitness					
Evolution					
Directional Selection					
Resistance (to antibiotics)					
Disruptive Selection					
Artificial Selection					
Genetic Drift					

The main difference to look for from the students was to see if they were able to provide examples of what they learned from applying the concepts within the activities. It may be useful to memorize terms from a lecture, however if students were able to apply concepts, share them with fellow group members, and provide examples of them, this shows a deeper understanding of the material.

The first time they took the quiz, served as a baseline. The point of this study was to see whether students showed more improvement after the lecture or after the activities. It was expected that greater improvement occurred after the activities than after the lecture.

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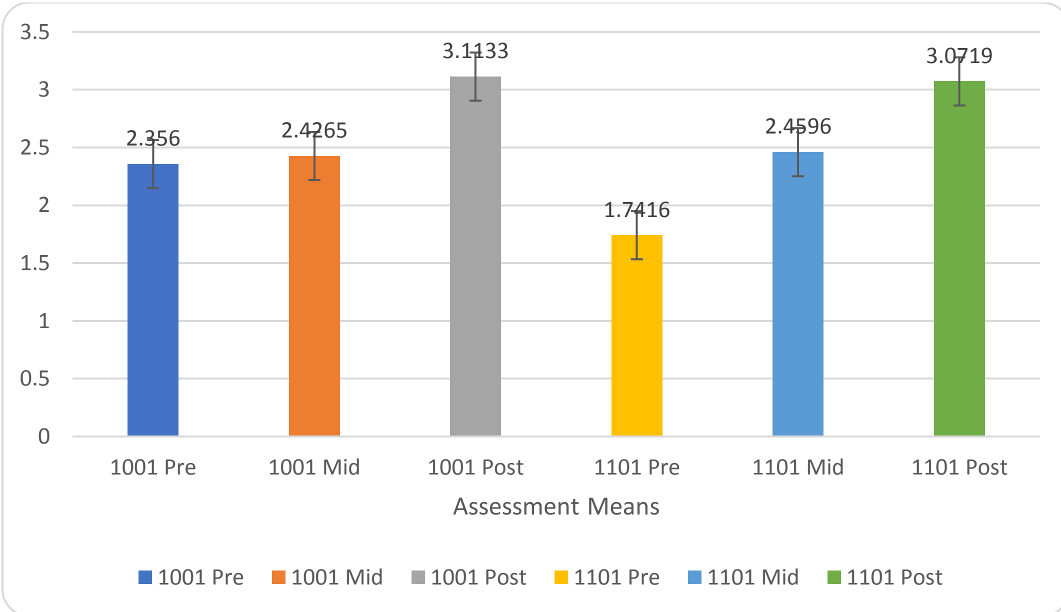
B. Comparison of activity versus lecture:

The purpose of this study was to determine if it made a difference in student learning in a large introductory college lecture, whether lessons used activities or a traditional lecture. Figure 3 shows a comparison of the means from each assessment. Each class improved from the pre-assessment to the post-assessment. The main issue to point out on this graph would be the difference in pre-assessment means between the classes. Class 1101 had much more room for improvement. More testing would be needed to see if one teaching style was more affective and if the order of teaching styles made a difference.

Figure 4 Graph of Means: Class 1001 Lecture first. Class 1101 Activities First:



In the following tables, * indicates statistical significance at the P=0.05 level.

In table 1, the pre-quizzes of class 1001 and 1101 were compared. Since there was a significant difference in them (t =3.818*, df =147) it made the comparison of other quiz results more difficult. Since the two classes started off the lesson with differences in their prior knowledge, any other comparisons were more complicated to interpret.

Table 1 Pre vs. Pre Quiz

	1001 Pre Quiz	1101 Pre Quiz
Mean	2.356	1.7416
Variance	1.4616	0.7379
Standard Deviation	1.209	0.859
N	83	89
t= 3.8188 * Degrees of Freedom= 147 Critical Value= 1.98		

Table 1: The pre-quizzes of both classes were compared to see if there was a significant difference between the starting points of each class. The calculated t value is less than the critical value in this case, (3.8188> 1.98). This shows a significant difference in the means of the pre-quizzes. This presents the assumption that the two classes were significantly different at the beginning of the lesson.

As can be seen in table 2, with lecture there was no significant difference between the pre- and mid assessment average (class 1001, *t* = .4071, *df* = 164); but following activities (class 1101, *t* = 5.0736*, *df* = 176) the mean was significantly better than the pre- assessment.

Table 2 Pre vs Mid Assessments:

Class 1001 (Lecture First)			Class 1101 (Activities First)	
	Pre Quiz	Mid Quiz (After Lecture)	Pre Quiz	Mid Quiz (After Activities)
Mean	2.356	2.4265	1.7416	2.4596
Variance	1.4616	1.0264	0.7379	1.0445
Standard Deviation	1.209	1.0131	0.859	1.022
n	83	83	89	89
	t=-0.4071 Degrees of freedom= 164 Critical value= 1.976		t=-5.0736 * Degrees of Freedom= 176 Critical Value= 1.976	

Table 2: Class 1001: The absolute value of the calculated *t* when comparing the pre and mid quizzes of Class 1001 (Lecture First) is less than the critical value, 0.4071< 1.976. This shows they are not significantly different. This assumes that the lecture may not have been effective.

Class 1101: For the 1101 class that did the activities first, the absolute value of the calculated t when comparing the pre and mid quizzes was more than the critical value, 5.0736> 1.976. This shows they are significantly different. This assumes that activities could be more effective.

In table 3, the pre-assessment and post assessments for both classes were compared. A significant difference was seen for both classes (1001, *t* = 4.3547*, *df* = 164: 1101, t = 8.3595*, *df* = 176) demonstrating that both classes improved in understanding of basic terms used in evolution. By the post assessment, both classes had seen both the activities and the lecture.

Table 3 Pre vs Post Assessments:

Class 1001 (Lecture first, Activities Second)			Class 1101 (Activities First, Lecture Second)	
	Pre Quiz	Post Quiz (After Activities	Pre Quiz	Post Quiz (After Lecture)
Mean	2.356	3.1133	1.7416	3.0719
Variance	1.4616	1.048	0.7379	1.5159
Standard Deviation	1.209	1.0237	0.859	1.2312
n	83	83	89	89
	t=-4.3547 * Degrees of Freedom= 164 Critical Value= 1.976		t=-8.3595 * Degrees of Freedom= 176 Critical Value= 1.976	

Table 3: Class 1001: For the Pre vs Post Quiz of Class 1001 (Lecture first, Activities second), the absolute value of the calculated *t* is greater than the critical value, 4.3547> 1.976. This shows an assumption that the activities could have been more affective for the early class. However, at this point this class had seen both teaching styles.

Class 1101: For class 1101, the absolute value of *t* exceeds the critical value (8.3595>1.976), so the means are significantly different at the p=.05 level. This assumes that the lecture may have been effective for the 1101 Class, however this class also had activities first. Since both classes had seen both teaching styles at this point, more testing would be needed.

In table 4, the mid assessment scores for both classes were compared. It was assumed there was no significant difference between the two (*t* = -0.2128, *df* =170). This comparison was used as a potential way to see if lecture or activities alone were more affective. This suggests that there was no difference.

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Table 4 Mid vs Mid Assessments:

	1001 Mid Quiz (After Lecture)	1101 Mid Quiz (After Activities)
Mean	2.4265	2.4596
Variance	1.0264	1.0445
Standard Deviation	1.0131	1.022
n	83	89
t= -0.2128 Degrees of Freedom= 170 Critical Value= 1.654		

Table 4: For the comparison of the mid-assessments, the calculated absolute value of *t* was less than the critical value, (0.2128< 1.654). This shows that it is assumed there is no significant difference between the mid assessments.

In table 5, the post scores for both groups were compared. This comparison was used to see if there was any difference made for the students if they saw the lecture or activities first. It may be assumed that there is no significant difference between whether the activities or lecture were taught first (*t* =0.2385, *df* =170). However, there may have been a ceiling affect because Class 1101 had more room for improvement.

Table 5: Post vs Post Assessments:

	1001 Post Quiz	1101 Post Quiz
Mean	3.1133	3.0719
Variance	1.048	1.5159
Standard Deviation	1.0237	1.2312
n	83	89
t=0.2385 Degrees of Freedom=170 Critical Value= 1.654		

Table 5: For the comparison of the post assessments, the calculated *t* was less than the critical value, (0.2385<1.654), so it was assumed there was no significant difference in the order of lecture and activities.

Table 6 compared the mid vs post quiz of class 1001 and the mid vs post quiz of 1101. There was significant difference in each class between their mid and post quizzes (1001: *t* = -4.3438*, *df* = 164, 1101 *t* = -3.6106*, *df* =170). This shows an assumption that there was a difference between each mid and post quiz. This comparison was made as another way to see if the order of lecture and activities made a difference. Since there was a significant difference in both classes more testing would be needed to know for sure.

Table 6: Mid vs Post Assessments:

	Class 1001 (Lecture first)		Class 1101 (Activities First)	
	Mid Quiz	Post Quiz	Mid Quiz	Post Quiz
Mean	2.4265	3.1133	2.4596	3.0719
Variance	1.0264	1.048	1.0445	1.5159
Standard Deviation	1.0131	1.0237	1.022	1.2312
n	83	83	89	89
	t= -4.3438* Degrees of Freedom=164 Critical Value= 1.976		*t*= -3.6106* Degrees of Freedom=170 Critical Value= 1.976	

Table 6: Class 1001: For the comparison of the mid and post quizzes of Class 1001, the absolute of the *t* value was more than the critical value, (4.3438> 1.976). This shows an assumption that there is difference between Class 1001's mid and post quizzes.

Class 1101: For the comparison of the mid and post quizzes of Class 1101, the absolute value of the *t* value was more than the critical value, (3.6106> 1.976). This shows an assumption that there is a difference between Class 1101's mid and post quizzes.

(Mathportal.org) http://www.mathportal.org/calculators/statistics-calculator/t-test-calculator.php

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IV. Discussion:

A lesson plan was developed and parts piloted in BIOL2050. Following the 5E model, and time permitting, students were able to do most of the activities when their class went over the active learning portion of this study. Students completed the engagement activity which had them draw a comic strip on what they thought antibiotic resistance was. This allowed misconceptions of viruses being involved for example to be corrected. It also allowed the students' current understanding to be seen. Some students took this opportunity to get really creative and draw antibiotics as super heroes. This allowed the students to connect to topics that they may find more enjoyable while being engaged in discussion about antibiotic resistance and evolution. The original explore activity, create a creature, was not piloted. Within the activity for explain, they may have started out exploring as well. In the activity Zoom In, groups of students were each given an animal from the BGSU Herpetarium. While observing the animals, students were able to look for adaptations that may be similar or different from other groups' creatures. This gave the students an opportunity to compare their ideas on adaptations not only with their own group but with other groups as well, which would have ended up being more of an Explore activity. (Bybee 1999) Some students even googled their creature to come up with more ideas, which offered connections to the E-search (Duran et al 2011). When the students reported out on their groups' creature later on that would have served more as an Explain opportunity. Students were able to come up front and talk about the adaptations of their creature. The Jenga game served as an opportunity to extend student knowledge and allowed them to elaborate on what they had already learned. By pairing a picture of a herpetology species, a wet/ dry environment picture, and adaptation words on a block, students were able to use what they had learned about adaptations to figure out the best environment and words to describe their species. It gave the students an opportunity to quickly talk about what else affected the adaptations their species had. The 10-term quiz served as an evaluation. This allowed students to write about what they understood on each concept and how they could connect it to an example. By following the 5E model, students were able to use their own natural inquiry to learn about the concepts in the Evolution/ Adaptations unit. (Bybee 1999).

The study attempted to compare the impact of activity versus lecture on student ability to thoroughly define terms related to evolution and natural selection. Only a few significant differences were observed, and the interpretation is complicated. Since there was a significant difference in the pre-quizzes of Class 1001 and Class 1101, there was a difference in prior knowledge which made any further comparisons difficult.

More testing would be needed to see the effects of the differences and how much of a difference there actually was. Looking at the mid-assessments, there was no significant difference between the two classes, suggested there was no difference between activity and lecture. This was a comparison of two different classes and would require more in depth testing to see differences on the individual student level. The comparison of post assessments also showed an assumption that there was no difference. This suggested that it also may not matter what order activities and lectures are taught in.

The main detail to point out from this study would come from Tables 2 and 3. Class 1101 had more room for improvement which suggested a significant difference between their pre-assessment and mid-assessment. Because of the significant difference in the pre-tests, comparison of the pre to mid, while suggestive of activities being better, more tests would be needed. When comparing the means, there seems to be a slight advantage in improvement for the class that did the activities first, Class 1101. Even though the data suggests that activities could have been more effective than lectures, more tests would need to be run.

For the final quiz, both classes seemed to do significantly better than at the start which may have been due to having seen the assessment three times. For comparisons of the pre- vs post and the mid vs. post, there were significant differences in both classes. This mainly shows that the lesson made a difference.

After both types of classes were completed, some of the students talked about what they liked and didn't like. Most said they were bored in the lecture and enjoyed the activities. The main improvements suggested by students would be finding a way to have all members of the class fully participate in the activity, which would be easier with a high school sized class. Using the full 5E lesson plan instead of only pieces of it may show more accurate results. Finding more ways to engage students in what they are learning was the main issue of this study. If the students responded in more favor to the activities, it shows that the activities would benefit the students to at least be incorporated into lessons.

There were many factors contributing to the data that may have had made a significant change to it. One of the main issues to be aware of for this study would be utilizing only students who took all three assessments. Many students were absent for one or more of the days of this lesson. These students were not included in the study. Another factor that may have made a difference would have been having two different times for each class. The time each student has the class may have given them more or less time to study for example. Other than times of the classes, absent students, and over achievers there may have been other factors affecting each student on an individual level.

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V. Addendum:

I was originally going to do a lesson plan covering biodiversity for junior high or early high school students. Because of availability issues, I taught a college freshman Biology 2050 unit about Evolution and Adaptations. Being able to be flexible and change courses of action is important in education. I was still able to work towards finding evidence that support my main theory that activity based learning following 5E/6E models is more effective than lecture only based learning.

a. What Actually Happened:

Day One (Wednesday April 19, 2017):

10:30: I started this class with their pre-quiz over evolution in order to see where the students were at with prior knowledge. Then I proceeded to present a lecture that would have typically been done. After the lecture, they did one pre-activity of the antibiotic comic strip.

12:30: This class also started with their pre-quiz. However, instead of lecturing, this class went through the case study of sneaky salmon. In order to show that there were any differences between the teaching styles of the classes, I alternated which teaching styles I used first. This is to create a form of a control that shows the students did not necessarily just retain the information from the lecture and carry it into the activity day.

Day Two (Friday April 21, 2017):

10:30: First they took a mid-quiz. Then, alternating with the 12:30, they got to see the case study with the sneaky salmon.

12:30: First this class took a mid-quiz. Then, alternating with the 10:30, they got to see the standard lecture and do a pre-activity of the antibiotic comic strip.

Day Three (Monday April 24, 2017):

Both classes got to do two different activities on this day. Because of time constraints, the two longest activities were put on their own day. Within a high school classroom, it may have been easier to directly follow the 5e model. Within the intro college level Biology course and being able to fit my ideas into Dr. Underwood’s class structure, I had to use any time I could get to test out pieces of a lesson plan meant for high school students. Since this course was meant to be an introduction to Biology for Biology majors, it was perfect to test out some high school level activities because the majority of the class were people that had recently graduated from high school.

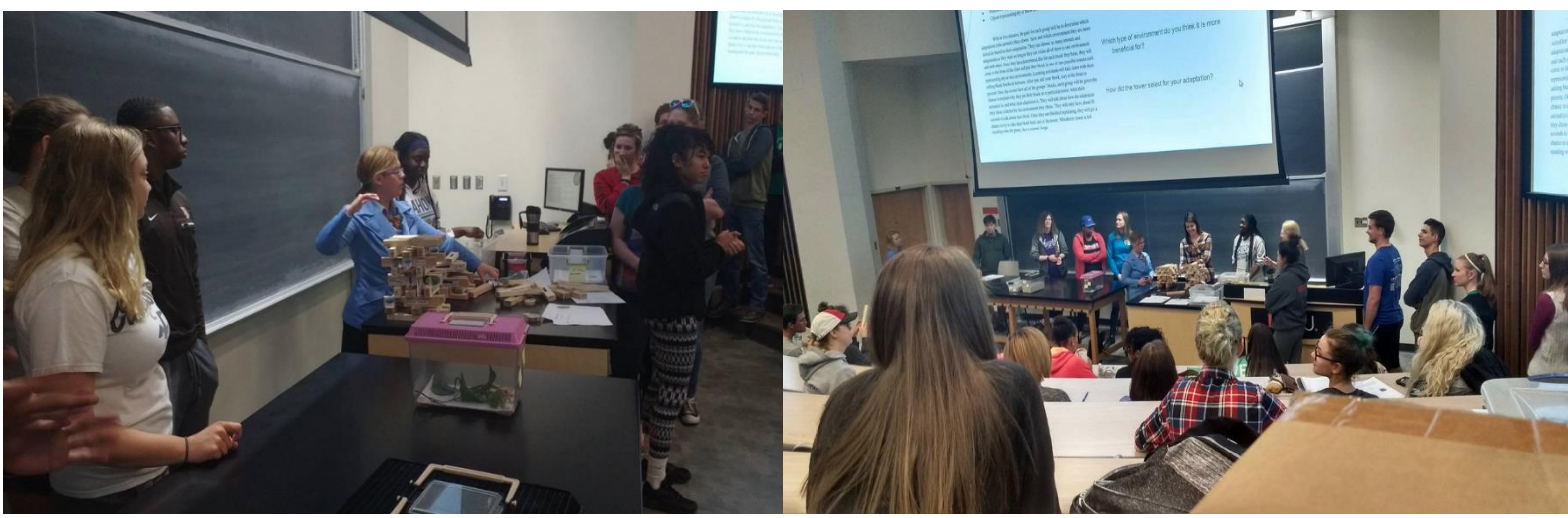
Within the time I had for this day, students were able to do the “Zoom In” and “Adapted Jenga” activity. It was rushed for both activities because normally either activity could easily have taken up a whole class period. The class started with Dr. Underwood explaining to the students they needed to be as efficient as possible with their time because of how much we had planned for them.

The first activity they got to go over was the “Zoom In” one. Most students reacted very positively to getting to interact with the animals. Dr. Underwood typically does a similar activity to this every semester. The part I added to it was having students use their phones to take pictures of the animals. For the students that paid attention to that detail, it took them away from the temptation of looking at non-class things on their phone and had them using their phones for class. This also gave students who were slightly apprehensive to being too close to herp species a chance to get involved with the activity.

The second activity they got to go over was the “Adapted Jenga”. This activity was definitely meant for a typical high school classroom of about thirty students instead of a college lecture. For the students who got to come to the front and actually participate, they were fully engaged and seemed to really enjoy applying the concepts they had learned to the game.

Figure 4, pictures of the Jenga Game, show how students were able to extend their knowledge. The students came down to talk about what their groups had put on their blocks. This gave each presenting student the opportunity to extend their knowledge because as they presented, the facts their groups used were corrected and guided to the right answers. For the students that presented, they were fully participating and got the most out of the activity. These pictures show how it would have been easier to use this activity for a typical high school sized class. If only the presenting students had been doing the activity, about twenty students, then the whole class would have been fully engaged. Some of these students were the ones who commented about enjoying the activities. These pictures show how important it is to find a way to have the whole class participate in the lesson.

Figure 4: Jenga Game (Photos: William Gyurgyik)



Day Four (Wednesday April 26, 2017):

Both classes finished up reporting out from observing the reptiles and took the final assessment.

VI. Reflection on Experience:

Within every teaching experience, one has to learn to be flexible. The main lesson I could say I took from this project would be flexibility. Out of all the activities I came up with based on the 5E model, I was only able to use three. The main issues that got in the way of being able to use all of them would include: teaching to a different level than the lesson was originally written for (Intro College level instead of high school), time constraints, fitting my project into what is taught in BIOL 2050, following BGP requirements versus National/Ohio teaching standards, student attendance, and being able to manage the activity for about 150 students per class versus a typical high school class that would have been 30 students.

One student did ask about this project after it had been conducted in a study session for the class. She talked about how the activities made the concepts easier for her to understand than only having them presented to her in a lecture format. Having a student specifically talk about this shows how important it could be to some students that may require a different learning style than a traditional lecture.

It was both exciting and nerve racking to be able to present the project in front of a lecture hall. I was really lucky to get the chance. I also learned how difficult it can be to do education based research and how many different aspects there are to be aware of while completing it. If I were to do this experiment again, it would be easier to conduct in high school classes that meet at the same time. I would need to make sure each student is present for every assignment or part of the lesson. In order to show any significance, I would need to continue to do more research.

From this project, I will mainly take the encouragement to continue inspiring or educating others about Biology concepts with different methods including lectures, activities, and the 5E model. I will also take the idea that if your class is entertained by you then they are more likely to pay attention. In the future, I hope to be able to encourage others to continue learning about topics such as biodiversity and evolution by keeping their attention through engaging methods.

Allison Rees
Honors Project Evolution Adaptation Lesson Plan

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Allison Rees
Honors Project Evolution Adaptation Lesson Plan

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