Affordable Learning Georgia Textbook Transformation Grants

Final Report

Date: May 29, 2015

Grant Number: 43

Institution Name(s): Columbus State University

Team Members

Amy Sandy, Lecturer – Biology Department Columbus State University

Sandy_amy@columbusstate.edu

Elizabeth Klar, Lecturer – Biology Department Columbus State University

Klar_elizabeth@columbusstate.edu

Project Lead: Amy Sandy

Course Name(s) and Course Numbers: Principles of Biology (BIOL 1215K)

Semester Project Began: Fall 2014

Semester of Implementation: Spring 2015

Average Number of Students Per Course Section: 24

Number of Course Sections Affected by Implementation: 8

Total Number of Students Affected by Implementation: 188

1. List of Resources Used in the Textbook Transformation

1. Concepts of Biology by OpenStax College. This work is licensed by Rice University under a Creative Commons Attribution License (3.0). http://openstaxcollege.org/textbooks/concepts-of-biology/get
2. Biology 1215 Principles of Biology Lab Manual developed by the Biology Department at Columbus State University.

2. Narrative

The overall goal of this project was to promote student success in Principles of Biology (BIOL 1215K). The success of this goal was assessed through the following objectives:

1. Increase the number of students who purchase the required course materials for BIOL 1215K
2. Increase student usage of the required textbook for BIOL 1215K
3. Improve student grades in BIOL 1215K and improve the drop/fail/withdrawal rates for BIOL 1215K.

Adopting an open-access textbook was relatively easy. OpenStax College has a readily available text that covers the same material in the textbook previously used in the Principles of Biology course at Columbus State University. The Biology Department had already developed a departmentally developed laboratory manual that cost the students $5.00 to purchase from the campus printing services department.

The major demands on the team were to review the laboratory manual for any copyright issues and to develop lecture power point presentations to follow the new textbook. The major obstacle encountered was the amount of time that it took to thoroughly review the resources and prepare the presentation files.

There were no observable transformative impacts on the instruction of this course. However, because this report only encompasses one semester of usage it is difficult to assess any long-term impacts that may evolve.

Overall, quantitative data suggest a negative impact on student performance when comparing one semester pre-transformation with one semester post-transformation. However, more data should be collected before determining a positive or negative correlation. Another possible explanation for the negative outcomes observed post-transformation was the absence of the lead instructor in any of the laboratory sections. In the Fall semester 2014 (pre-transformation), the lead lecture instructor also taught four laboratory sections (approximately ninety-eight students). In the Spring semester 2015 (post-transformation), the lead lab instructor did not teach any laboratory sections.

If taught in the future, the lead instructor should be present in some of the laboratory sections so that outcomes and grades can be compared between sections where the lead instructor is also present in lab versus the absence of the lead instructor in lab.

3. Quotes

1. Speaking of the departmentally developed lab manual "It was concise, clear, and easy to understand. I found it helpful and useful."
2. "It was free, good savings"
3. "I love having a book [bound textbook] but when it comes to cost, especially free, I will take digital all day long"

4. “I did not like reading the book online”

4. Quantitative and Qualitative Measures

The drop, fail, withdraw (DFW) rates were higher in Spring semester 2015 (post-transformation) compared to Fall semester 2014 (pre-transformation). The DFW in Fall was 6.59% (*n* = 349) and 14.89% (*n* = 188) in the Spring (Figure 1).

The Biology Department at Columbus State University has identified specific learning outcomes for BIOL 1215K. The Biology faculty developed a set of ten questions that can be associated with specific learning outcomes for the course.

Biology Program Learning Outcomes:

1. Knowledge and understanding of key principles, theories, facts and current hypotheses in several areas of Biology, including but not limited to:

- The Cell Theory of Life (including diversity of cell types and shared characteristics of all cells)
- The Genetic Theory of Inheritance
- The Theory of Evolution

2. Knowledge and understanding of scientific reasoning and how new knowledge is acquired in Biology, including the selection and use of appropriate methods, tools and technology for answering questions and solving problems.

3. Ability to relate scientific principles and methods in Biology to problems that are important to individuals and societies.

4. Assess the accuracy and validity of findings and conclusions in Biology taking into account ambiguity and uncertainty.

The students were given the ten questions in an assessment (Appendix 1) on the same day as the final exam in the Fall semester. Average student score for the ten questions was 64% (*n* = 311) in the fall. In the Spring semester, the students were given the same assessment on the last day of class (prior to the final exam, which was given one week after the last day of class). Average student score for the ten questions was 58% (*n* = 147) in the spring. Correct response rates were determined for each question and compared for the pre- and post-transformation groups (Figure 2).

Grade distributions were compared pre- and post-transformation. The number of each awarded grade was determined and grade distributions were evaluated using a chi-square test of homogeneity. There was an observable difference in grade distributions pre- and post-transformation ($\chi^2 = 14.49$; df = 4; P = 0.05).

Individual student grades were assigned a point value (A = 4.0, B = 3.0, C = 2.0, D = 1.0, and F = 0.0). The average of these grade points were compared pre- and post-transformation using a two-sample t test. The average GPA for Fall semester 2014 (pre-transformation) was significantly higher than for Spring semester 2015 (post-transformation); 2.80 and 2.34, respectively (t-value = 3.74; p-value = 2.17^{-4}).

Student course evaluations for Spring semester 2015 (post-transformation) are not available at this time and cannot be compared to pre-transformation course evaluations. However, students were given a short survey (Appendix B) asking them about their textbook purchasing preferences. The most notable statistic from the surveys is that in both pre-transformation and post-transformation semesters, the majority of students preferred a publisher bound and printed textbook (69%, *n* = 167; 68%, *n* = 111, respectively) (Figure 3). However, even when students were presented with a much cheaper (less than $40.00 in the campus book store) bound and printed book in the post-transformation semester, the majority of students (76%, *n* = 80) opted to use the free version of the OpenStax textbook (Figure 4).

5. Sustainability Plan

The departmental laboratory manual was initially created by team member Elizabeth Klar over three years ago. Mrs. Klar reviews the laboratory manual every summer term to make updates, as needed.

At the time of grant implementation, team member Amy Sandy was responsible for teaching the majority of BIOL 1215K sections at Columbus State University. Mrs. Sandy developed the presentation materials and classroom activities structured around the OpenStax textbook. It was her intention to build those materials based on experiences and student feedback. However, Mrs. Sandy will not be teaching the Principles of Biology course in the near future. At this time, the OpenStax textbook will not be used in the Principles of Biology Course and the other instructors have elected to resume the use of the textbook that has traditionally been used in the course.

6. Future Plans

I (Amy Sandy) was able to thoroughly review the OpenStax textbook for Principles of Biology. Through that, I learned that the material covered in the OpenStax book was equally comparable to traditional, publisher-printed textbooks. As a result of my experience I would like to explore the use of other OpenStax textbooks in other courses that I teach, specifically Human Anatomy & Physiology.

Although data suggest that the use of open educational resources may have had a negative impact on student grades and learning outcomes, I do not think that one semester worth of data is enough to make that determination. If I teach Principles of Biology in the future, I plan to use the OpenStax textbook again.

7. Description of Photograph

(left-right) Mrs. Amy Sandy, team lead and Lecturer, Biology Department, Columbus State University; Mrs. Elizabeth Klar, Lecturer and Laboratory Coordinator, Biology Department, Columbus State University.

Figure 1. Drop, fail, withdraw rates for BIOL 1215K pre- and post-transformation.

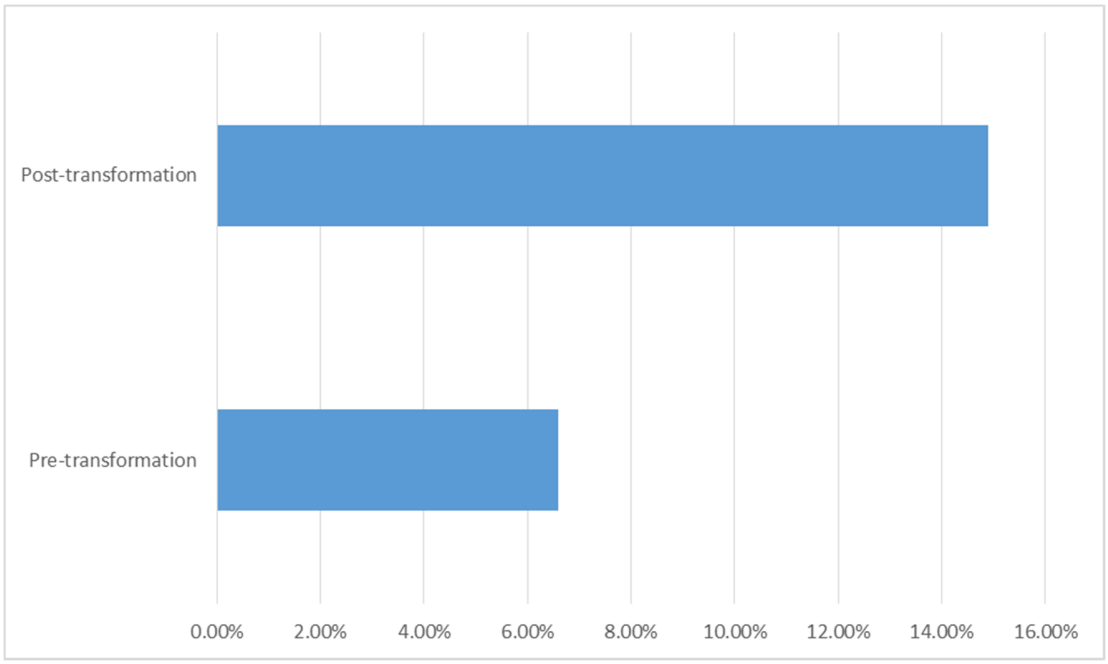


Figure 2. Correct response rates for departmental questions, pre- and post-transformation

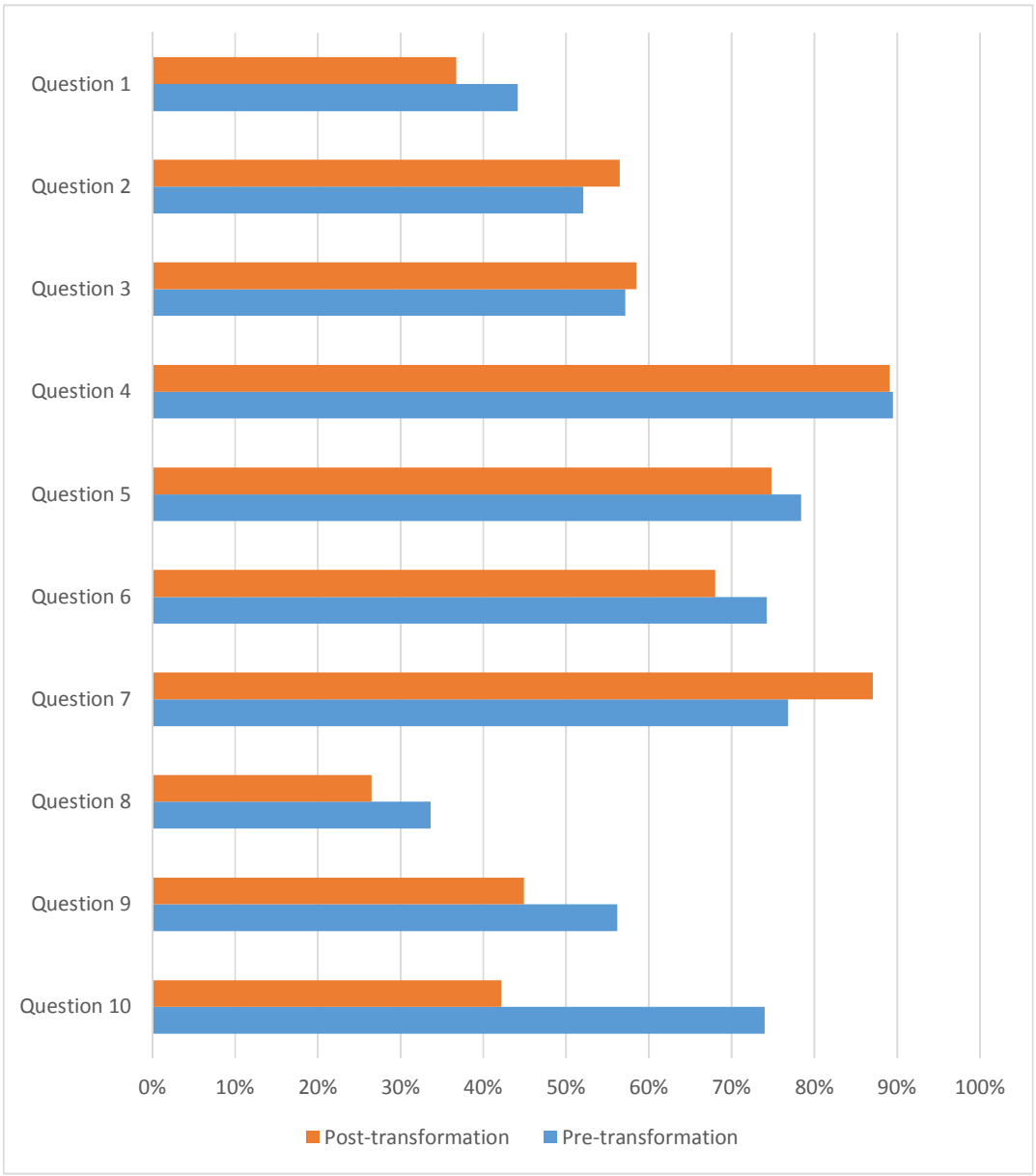


Figure 3. Survey Question 5: Assume that cost is NOT a factor. Which of the following is the most important textbook format to you?

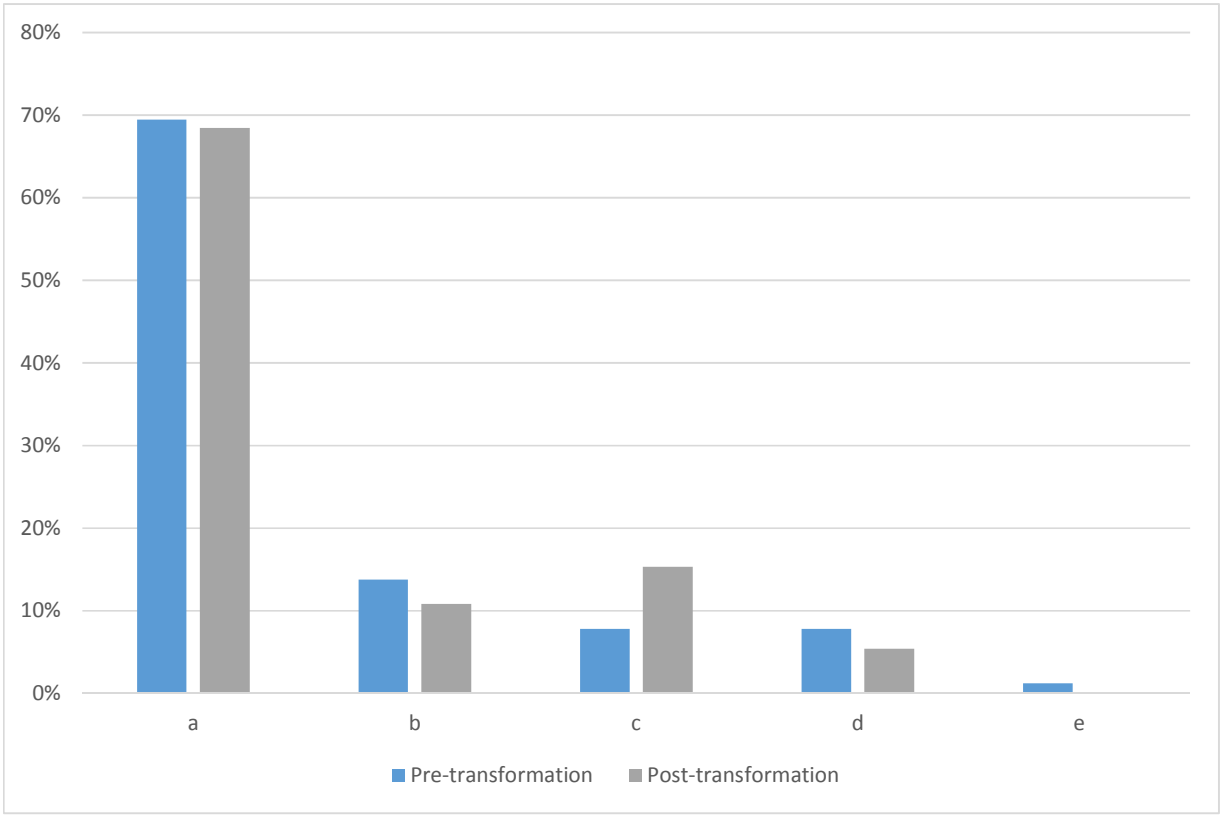
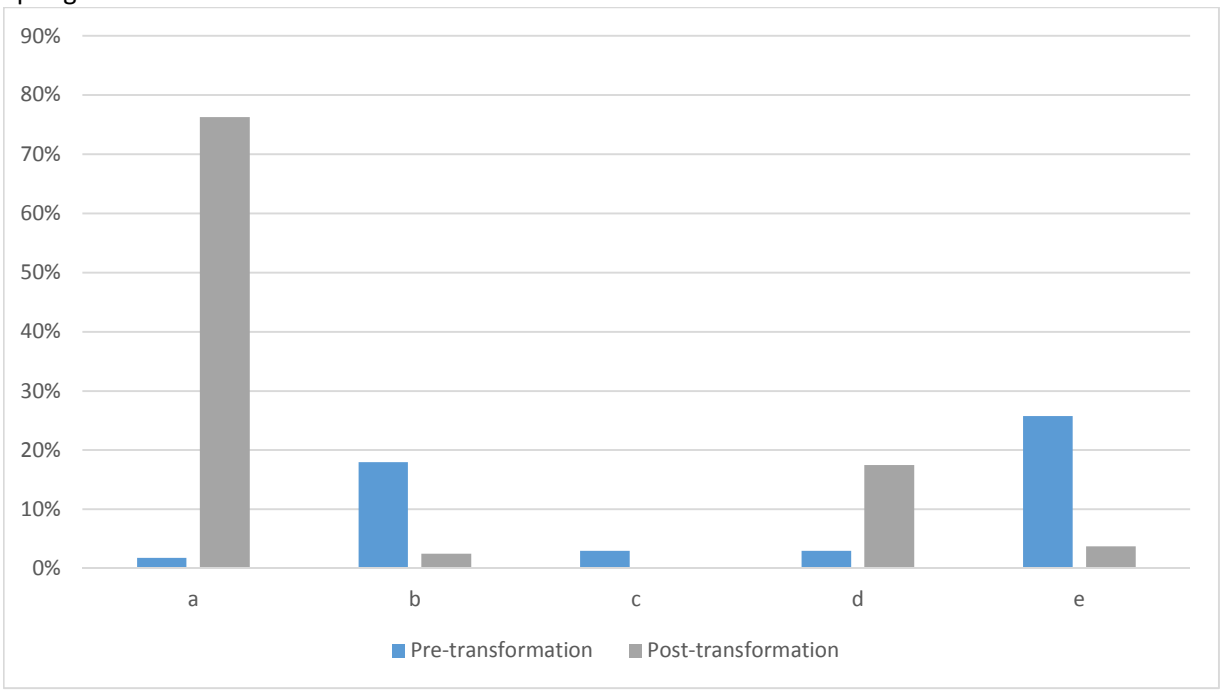


Figure 4. Survey Question 2: If you did not purchase or rent a textbook for BIOL 1215K in Spring 2015 what was the reason?



Appendix A – Biology Departmental Questions to Assess Student Learning Outcomes in Principles of Biology

1. Which statement is *not* consistent with the theory of evolution by natural selection?
    a. Individuals in a population exhibit variations that can be inherited.
    b. Individual organisms experience genetic changes (mutations) during their life spans to allow them to become better fit for their environment.
    c. Individuals in a population compete with each other for limited resources.
    d. Those individuals that are better fit in their environment will leave more offspring than less fit individuals.
    e. Natural selection can lead to the appearance of new species.

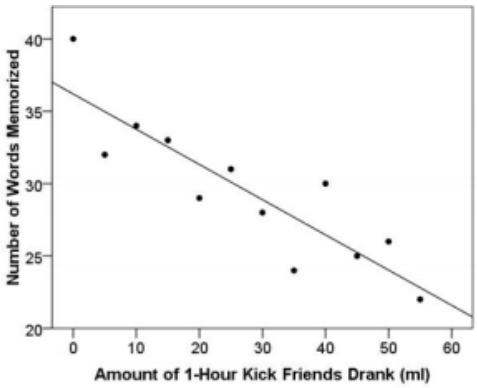
As you probably know, 5-hour Energy® shots are flavored liquids containing select vitamins, amino acids, and small doses (less than a cup of coffee) of caffeine that are supposed to help adults "stay bright and alert" for up to five hours. You decide that you want to develop a new drink that helps students stay alert just long enough to take an exam. You call it "1-Hour Kick" and decide you will run an experiment to evaluate your new product's effectiveness. You divide up your friends and give half of them a dose while the other half gets nothing. You then have them take a simple memorization test.

2. What is the dependent variable in this experiment?
    a. The drink treatment
    b. The gender of your friends
    c. The scores on the memorization test
    d. The time between taking the drink and doing the test.

3. What is the control group in this experiment?
    a. The scores on the memorization test
    b. The friends who took the dose of 1-Hour Kick
    c. The friends who did not take the dose of 1-Hour Kick
    d. The friends who did not participate in the experiment.

As a follow-up study, you decided to vary the amount of 1-Hour Kick you give to your friends and then test how many words (out of 50) they can memorize in 2 minutes. When finished, you graphed the results.

4. What does the graph tell you about your results?
    a. That the amount of 1-Hour Kick does not seem to affect the words memorized.
    b. That friends who drank more seemed to learn fewer words.
    c. That friends who drank more seemed to learn more words.
    d. That your study was poorly designed.



5. Which of the following statements regarding cells is *false*?
    a. All cells are enclosed in a membrane that maintains internal conditions different from the surroundings.
    b. All cells have a cell wall.
    c. All cells can interconvert forms of energy.
    d. All cells can interconvert chemical materials.
    e. All cells have DNA as their genetic material

6. How do cells capture the energy released by cellular respiration?
    a. They produce ATP.
    b. They produce glucose.
    c. They store it in molecules of carbon dioxide.
    d. The energy is coupled to oxygen.
    e. They store it as thermal energy.

7. What is the general function of enzymes within a cell?
    a. To promote the synthesis of monomers.
    b. To induce chemical reactions.
    c. To stop chemical reactions.
    d. To speed up chemical reactions.
    e. To reverse the direction of chemical reactions.

8. What is the main purpose of meiosis in a sexual life cycle?
    a. To generate genetic diversity in the gametes.
    b. To allow homologous chromosomes to come together.
    c. To reduce the chromosome number from diploid to haploid.
    d. To allow for crossing over between homologs.
    e. To produce somatic cells.
9. In Labrador retrievers, black coat color is dominant to brown. Suppose that a black Lab is mated with a brown one and the offspring are 4 black puppies and 1 brown. What can you conclude about the genotype of the black parent?

    a. The genotype must be *BB.*
    b. The genotype must be *bb*.
    c. The genotype must be *Bb*.
    d. The genotype could be either *BB* or *Bb*.
    e. The genotype cannot be determined from this data.

10. Which of the following options best depicts the flow of information when a gene directs the synthesis of a cellular component?
    a. RNA→DNA→RNA→protein.
    b. DNA→RNA→protein.
    c. protein→RNA→DNA.
    d. DNA→amino acid→RNA→protein.
    e. DNA→tRNA→mRNA→protein.

Appendix B – Student Survey

1. Did you purchase or rent the required textbook for BIOL 1215K for Spring semester 2015?
    a. Purchased or rented at campus bookstore
    b. Purchased or rented from an online vendor (Amazon.com, half.com, etc.)
    c. Purchased or borrowed from a friend
    d. Purchased or rented a different textbook (not the required textbook)
    e. Did not purchase or rent

    If you purchased your textbook, skip to question #3

2. If you did not purchase or rent a textbook for BIOL 1215K in Spring 2015 what was the reason?
    a. I used a free version of the OpenStax textbook (pdf, web view, epub)
    b. I did not think that I would need the textbook.
    c. The textbook was too expensive.
    d. Used other resources.
    e. Other

3. How much (in total) did you spend on textbooks for Spring semester 2015?
    a. $000-100
    b. $101-200
    c. $201-300
    d. $301-400
    e. Over $400

4. What percentage of your textbook costs are covered by financial aid?
    a. I do not receive financial aid.
    b. I receive financial aid, but none of my textbook costs were covered by financial aid.
    c. Less than 50% of my textbook costs were covered by financial aid.
    d. 51%-99% of my textbook costs were covered by financial aid.
    e. All of my textbook costs were covered by financial aid

5. Assume that cost is NOT a factor. Which of the following is the most important textbook format to you?
    a. Publisher bound and printed
    b. Download and read on personal computer
    c. Formatted for cell phone or for ebook reader (Kindle, iPad, other)
    d. Read online (internet access)
    e. Formatted for disabilities (large print, audio)

From the types of study aids listed below that were available to you this semester which did you find to be most useful to support your learning?

1. Interactive practice questions (like LearnSmart)
2. Powerpoint slide shows
3. YouTube video

a. Very important
b. Somewhat important
c. Not important
d. Did not use