Assessment original plan, results, and future plans for BIOL 2420 and BIOL2320.

A preterm and a post term survey were constructed to address the following assessment concerns. The information highlighted in yellow indicate areas for future assessment.

1. Does the length of time between required and/or suggested prerequisites and this class affect student performance?

- The first several questions ask about previous classes that have been taken and how long it has been since those classes were taken.

- The next 15 questions are the same questions that are given in the BIOL1610 post quiz. The performance on these questions at the end of BIOL1610 and at the beginning of these classes can be compared. This will measure retention of materials learned in BIOL1610. By following student ID numbers, we could also assess whether the grade obtained in BIOL1610 predicts success in either BIOL2320 and/or BIOL2420

- The data from the first several questions aligned with the next 15 questions can assess how retention and also success in BIOL2320 and/or is affected by length of time since taking a class. They can also be used to compare retention from a prerequisite class and performance in the current class. Once again, by following student ID numbers, we could look at actual grade received in the class rather than just these survey questions.

2. Does a student's college major or interest affect retention and/or performance?

- The last question on the preterm survey asks about college major. Performance measurements on the various parameters were compared to the answer of this question.

3. Did the student performance improve on specific objectives from the preterm survey to the post-term survey?

- 13 questions are designed to specifically measure physiology objectives. The same questions are used on the preterm survey as the postterm survey. So far, we have only looked at average scores and pass rates. We could look at the individual questions to see if there are specific areas of concern.
- 12 questions are designed to specifically measure anatomy objectives. The same questions are used on the preterm survey as the postterm survey. So far, we have only looked at average scores and pass rates. We could look at the individual questions to see if there are specific areas of concern.
-

Analysis of Data

- Surveys were scored using the Parscoring system. Individual responses to each question were recorded. These responses could be analyzed by student ID number; however, only group data have been analyzed so far. The data from the Parscore system were sorted by various parameters to answer the above questions. The data can also be exported to excel where further analysis with variables such as grades, specific section numbers, etc. can be done.
- Using student ID numbers, individual performance from one class to the next can be analyzed (BIOL1610 to BIOL2320 to BIOL2420). This has not yet been done.

Preliminary Results

The preterm survey results from 72 BIOL2420 students were been analyzed before the large scale data collection began.

- The most striking results were the average performances on the 1610 objectives compared to the length of time that had passed since the student took 1610. The average number of questions correct (of 15) for students that had taken 1610 within the past year was 9.56 (63.8%) while the average number of questions correct for students that had taken 1610 more than a year ago was 5.62 (37.5%).
- A second important observation was a comparison of performance on 1610 objectives with enrollment in CHEM 1110 or 1210. Students who had already taken CHEM 1110 or 1210 (even if more than one year prior to this survey) accurately answered 9 of the 15 questions while student who had not yet taken a general chemistry class successfully answered 6 of the 15 questions. After this preliminary data had been gathered, we were able to add CHEM 1110 or 1210 as a prerequisite for BIOL 2420. The enforcement of this prerequisite began in *****. We need to analyze our data before and after enforcement of this prerequisite to demonstrate if indeed we have increased performance in BIOL2420. Our anecdotal evidence says that we have, but we would like to obtain some more objective data as well.

RESULTS, INTERPRETATIONS, AND FUTURE PLANS

Demographics

1200 to 1500 Human Physiology (BIOL2420) students were analyzed. The number varies based upon the question being asked. Students from 4 consecutive semesters were analyzed (Fall 2011, Spring 2012, Fall 2012, Spring 2013)

1300 to 3300 Human Anatomy (BIOL2320) students were analyzed. The number varies slightly based upon the question being asked. Students from 6 consecutive semesters were analyzed (Fall 2010, Spring 2011, Fall 2011, Spring 2012, Fall 2012, Spring 2013)

The data shown in Figures 1a. and 1b. were almost completely expected. 76-84% of our physiology and anatomy students are self-declared health science students. Because of this very large percentage of students

seeking this type of education, the biology department is developing an AS degree in Pre-Health Science. One surprising finding was the change in self declared majors from the beginning to the end of a term in anatomy. The percent of students that were following the health science route had dropped from 84% to 60%. This may indicate a need for better advising and/or an investigation into the rigor of our BIOL1610 course. Unfortunately, we did not collect these data for the physiology students. We predict that the drop would be less in the physiology students because most of them were already successful in anatomy before proceeding to physiology.

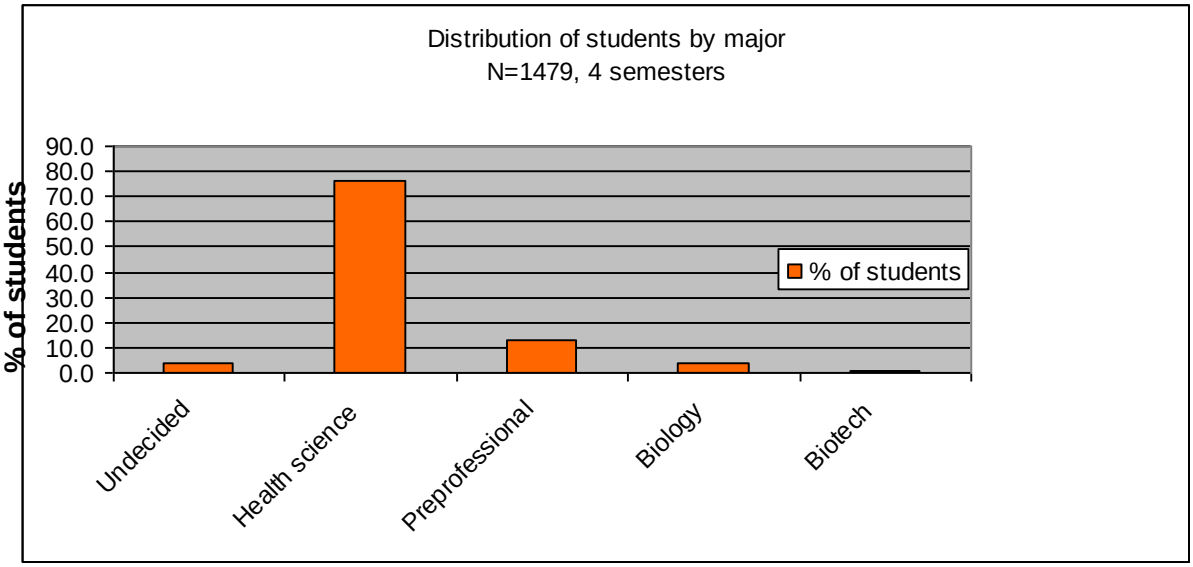

Figure 1a. Distribution of Human Physiology (BIOL2420) students by declared major at the end of the semester during which they took BIOL2420.

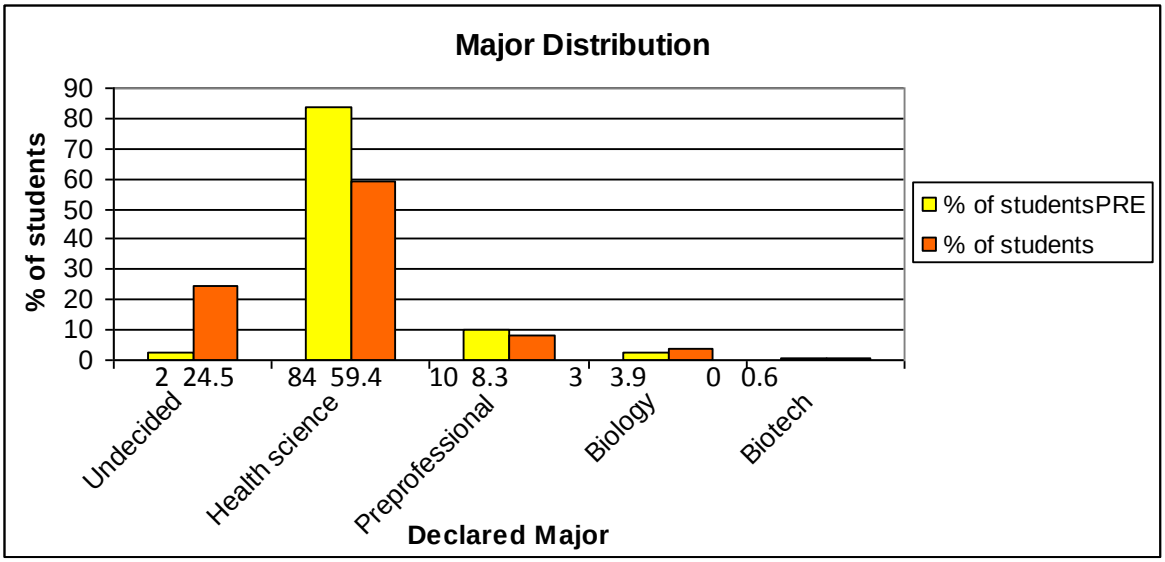

Figure 1b. Distribution of Human Anatomy (BIOL2320) students by declared major at the beginning (yellow, N= 3331) and at the end (orange, N= 1331) of the semester during which they took BIOL2320. 6 semesters.

The data presented in Figures 2a. and 2b. demonstrate that most of our students are proceeding through our suggested sequences of courses in a timely fashion. Approximately 90% of the BIOL2420 students took

BIOL1610 at SLCC. Only about 12% took it elsewhere. Similarly, about 75% of our BIOL 2320 students took BIOL 1610 at SLCC and about 12% took it elsewhere. Approximately 50% of the students have taken the prerequisite course within a year of the current course. These data (Figure 2a.) show that about 25% of the BIOL2420 students had not taken chemistry before registering for physiology. We need to analyze the data both before and after the chemistry prerequisite enforcement began. These data (Figure 2b) also show that most students take anatomy before taking physiology (60%). A significant percentage of students are taking anatomy and physiology concurrently (22% in Figure 2b.) We should perhaps address the idea of forming a learning community for those students that do wish to take these two courses concurrently. About 10% of the students took there prerequisites elsewhere more than a year before enrolling in the class being assessed. It seems that these students are perhaps individuals that have obtained a previous degree and are perhaps returning to school for a career change. The performance data for these students (later) is quite interesting.

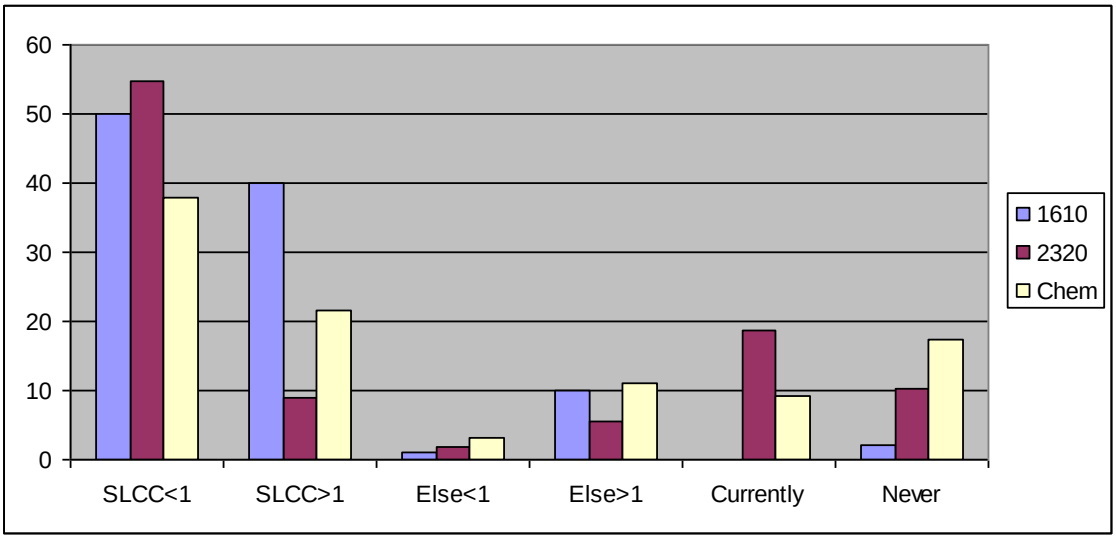

Figure 2a. Distribution of Human Physiology (BIOL2420) students by time/place of taking BIOL1610, BIOL2320, and Chemistry.

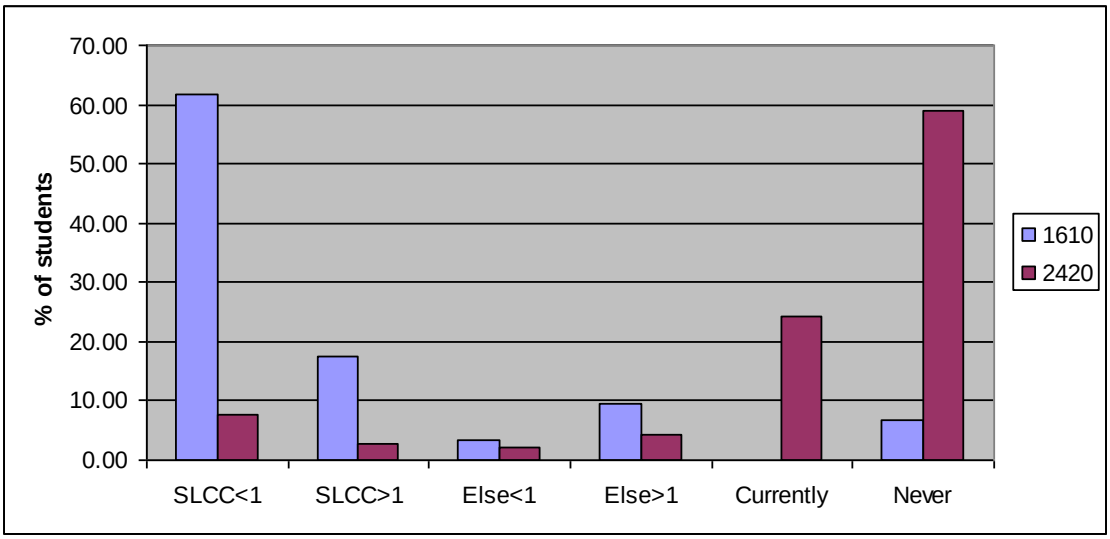

Figure 2b. Distribution of Human Anatomy (BIOL2320) students by time/place of taking BIOL1610 and BIOL2420.

The data presented in Table 1 indicate that many students have an inflated expectation of the grade they will receive in these classes. These data were gathered on the day of the lab practical in each class, so by that time, the student should have a pretty good idea of the grade they will be getting. Notice that for physiology, 48% of the students were expecting to receive an A grade while in reality, in a typical BIOL2420 section, only 24% of the students received an A. Oddly enough, it was the B grade that was overestimated in the BIOL2320 group. It might be informative to tie these expectations to actual performances by using the student ID numbers. Knowledge of which types of students overestimate their standing in a class might be helpful for advising during the class. It is important that students, instructors, perspective employees, graduate schools, etc. can assume that each grade level means a certain amount of proficiency was gained. The students that "predicted" they would receive an A did have the highest pass rate on the post-term survey questions. We would like to analyze this further.

			Percentage of students in each group			
Grade expectation	BIOL2420	"Pass rate" for 2420 post questions	Actual 2420 Grade	BIOL2320	"Pass rate" for 2320 post questions	Actual 2320 Grade
A	47.56	11.35	24	24.36	Not determined	31
B	34.70	6.67	19	43.55		25
C	13.62	7.56	9	22.92		21
D	2.83		10	8.31		16
E	0.77		6	0.86		7
Number of students	389		42	349		68

Table 1. The percentage of students with self-reported grade expectations of Human Physiology (BIOL2420) and Human Anatomy (BIOL2320) at the end of the term. The actual grades were taken from two sections taught in spring 2014.

Performance

.Performance was analyzed by major and by when/where four classes (BIOL1610, BIOL2320, BIOL2420, and Chemistry) were taken. The "pass rate" used in these graphs represents students who answered greater than 50% of the questions correctly.
Performance on 1610 questions was assessed at the beginning of each term. Performance on 2320/2420 questions was assessed at the beginning of each term and again at the end of each term.

Figures 3a. and 3b. do not really show any unexpected results. The students that are self-declared biology majors did perform better on both retention of BIOL1610 information and knowledge gained in both anatomy and physiology. This probably indicates that those students that find science classes reasonably easy to be successful in are the ones that will choose to follow this pathway. Understanding of these data might be helpful as we think about increasing the numbers of students in the STEM fields. These data might also help to inform the development of general education classes at appropriate levels for different student populations.

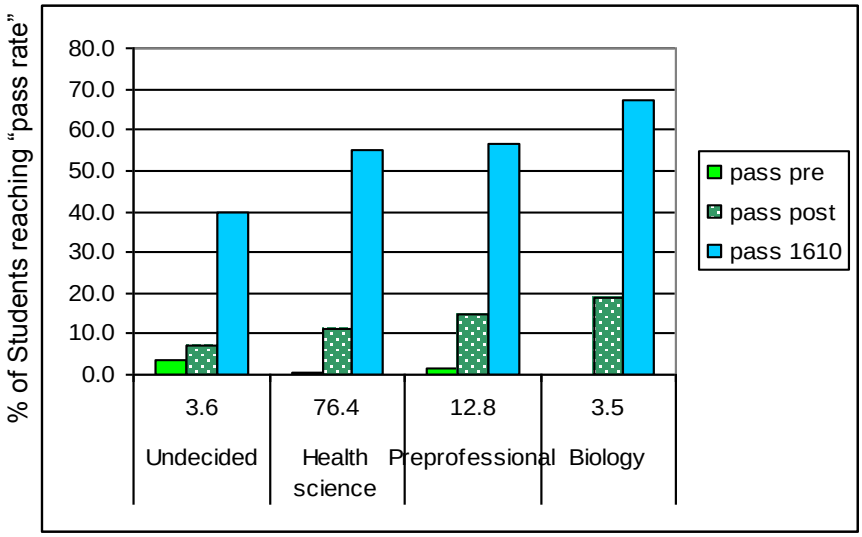

Figure 3a. Pass rate of students in Human Physiology (BIOL2420) versus major.
Pass pre represents the students who answered greater than 50% of the BIOL 2420 questions correctly at the beginning of their term in Human Physiology.
Pass post represents the students who answered greater than 50% of the BIOL 2420 questions correctly at the end of their term in Human Physiology. .
pass 1610 represents students who answered greater than 50% of the BIOL1610 questions correctly at the beginning of their term in Human Physiology.
Numbers on horizontal axis represent the percent of students in each group

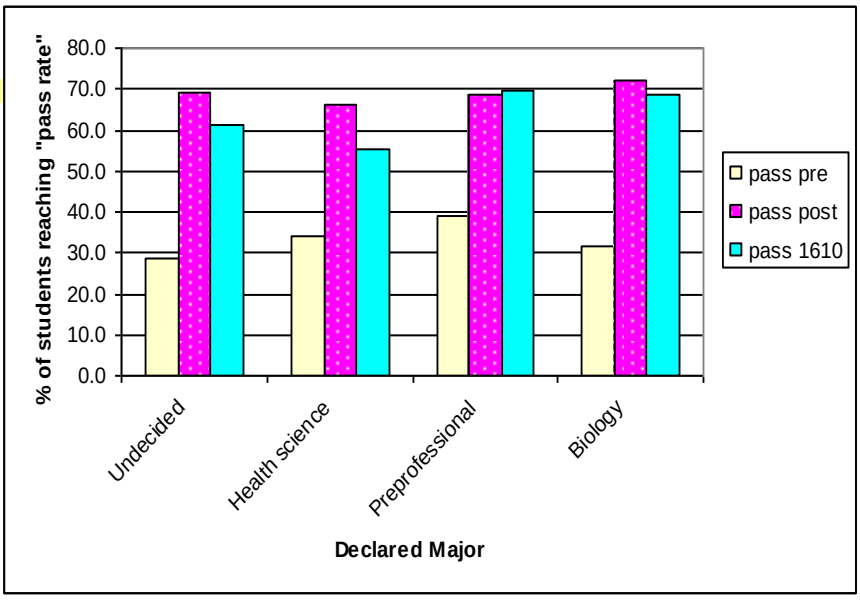

Figure 3b. Pass rate of students in Human Anatomy (BIOL2320) versus major.
Pass pre represents the students who answered greater than 50% of the BIOL 2320 questions correctly at the beginning of their term in Human Anatomy.
Pass post represents the students who answered greater than 50% of the BIOL 2320 questions correctly at the end of their term in Human Anatomy.
pass 1610 represents students who answered greater than 50% of the BIOL1610 questions correctly at the beginning of their term in Human Physiology.
Numbers on horizontal axis represent the percent of students in each group.

When one compares the retention of BIOL1610 knowledge in anatomy classes (Figure 3b) versus physiology classes (Figure 3a), he sees that 55-70 % of the anatomy students are able to "pass" the survey questions, while only 40-60% of the physiology students "pass" these retention questions. This is probably due to the fact that most students take anatomy immediately after BIOL1610 and then take BIOL2420 the following semester or later (demonstrated in Figures 4a. and 4b.). An unfortunate feature of this sequence is that the students need the BIOL1610 retention more for successful completion of physiology than they do for successful completion of anatomy. Encouraging students to take Anatomy and Physiology concurrently in a learning community could be a way to address this issue.

Another observation that needs to be pondered is the "knowledge gained" in the two classes, anatomy and physiology. The mean score on the BIOL2420 questions increased from 25% correct at the beginning of the term to 30% correct at the end of the term. The "pass rate" for these questions increased from less than 1% to 17%. This does not seem to be an adequate amount of "knowledge gained". One reason for this might be the actual questions used on the survey. As we continue with this type of analysis, we should more carefully select

our survey questions to represent major objectives. More questions would help with this; however, the amount of time devoted to these surveys must be kept within reason as well. Because we can tie these data to student ID numbers, we could also assess knowledge gained compared to the different presentational modalities, different time schedules, etc.

The "knowledge gained" in anatomy appears to be better than that in physiology, with a pass rate improving from about 30% at the beginning of the term to about 68% at the end of the term. This could be due to the fact that anatomy knowledge is much easier to accurately assess with multiple choice questions than physiology knowledge. This may support the practice that most of us have of using essay questions and problems on exams in physiology but not in anatomy. Because we feel it necessary to assess physiology knowledge and application with these types of questions, we need adequate testing time for the students. As physiology instructors, we have expressed concern about teaching in the 50 minute time blocks of a MWF class because of the limitation that it places on testing and because of the decreased teaching time in that particular schedule block. Use of an online or inclass testing center would alleviate some of these time constraints.

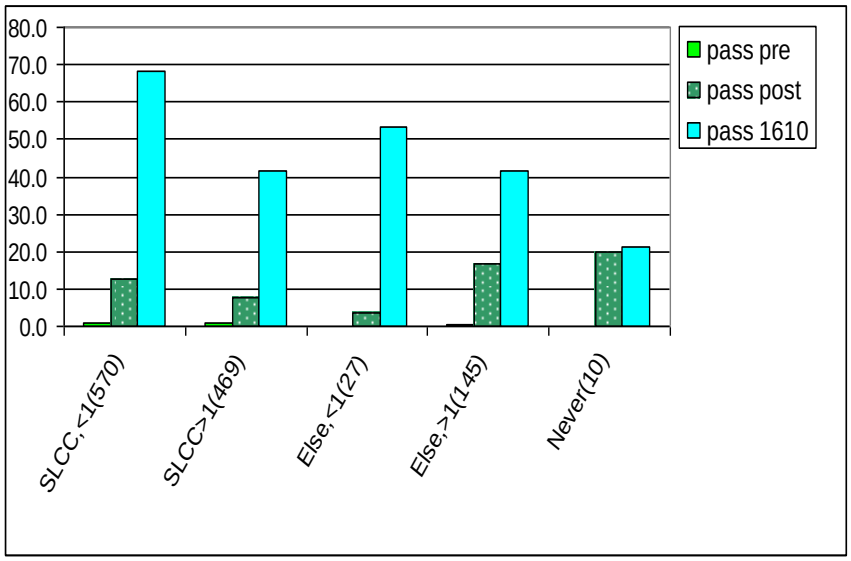

Figure 4a. Pass rate of students in Human Physiology (BIOL2420) versus time and place of taking BIOL1610.
pass pre, and pass post , and pass 1610 represent the same information as described in Figure 3a.
SLCC, <1= students that took BIOL1610 at SLCC within one year of enrolling in BIOL2420.
SLCC, >1= students that took BIOL1610 at SLCC more than one year before enrolling in BIOL2420.
Else, <1= students that took BIOL1610 at SLCC within one year of enrolling in BIOL2420.
Else, >1= students that took BIOL1610 at SLCC within one year of enrolling in BIOL2420.
Numbers on horizontal axis represent the number of students in each group.

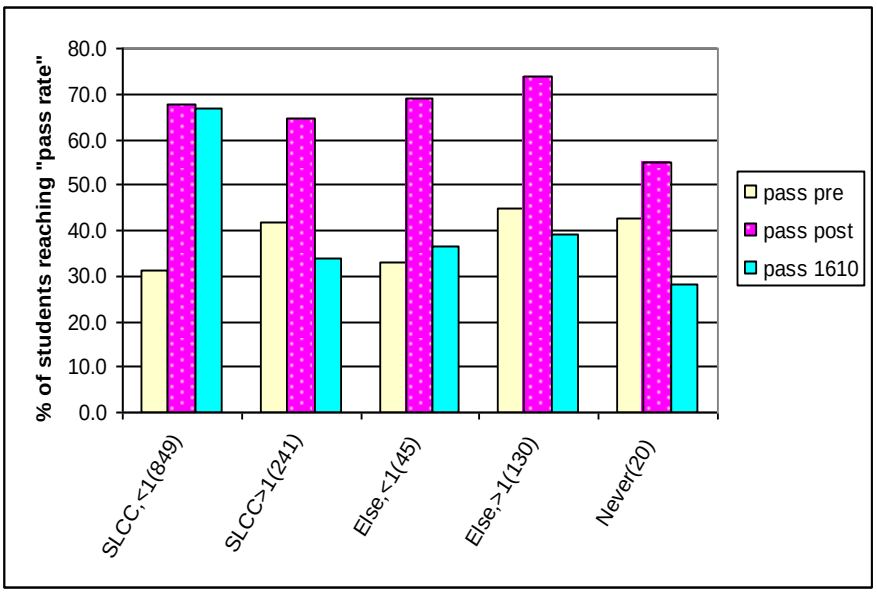

Figure 4b. Pass rate of students in Human Anatomy (BIOL2320) versus time and place of taking BIOL1610.
pass pre, and pass post , and pass 1610 represent the same information as described in Figure 3b.
SLCC, <1= students that took BIOL1610 at SLCC within one year of enrolling in BIOL2320.
SLCC, >1= students that took BIOL1610 at SLCC more than one year before enrolling in BIOL2320.
Else, <1= students that took BIOL1610 at SLCC within one year of enrolling in BIOL2320.
Else, >1= students that took BIOL1610 at SLCC within one year of enrolling in BIOL2320.
Numbers on horizontal axis represent the number of students in each group.

Most of the information from Figures 4, 5, and 6 is summarized in Figure 7. However, a few items need to be pointed out before going to Figure 7. The red circles in Figures 4a. and 4b. draw ones attention to the students that took BIOL1610 somewhere other than SLCC, more than a year ago or never took BIOL1610. The numbers of students that never took BIOL1610 are very small (10 for BIOL 2420 and 20 for BIOL2320) indicating that enforcement of our prerequisites is working quite well. Those students that had never taken BIOL1610 had a lower gain of knowledge than other students when the average score of the students was analyzed. Although the numbers are small, these data support the need of BIOL 1610 as a prerequisite.

The students that took BIOL1610 more than a year ago at some other location out-performed other students in terms of both anatomy and physiology "knowledge gained". As mentioned earlier in this report, we feel that these students may be returning to the educational environment for a career change. Some of these students probably already have a bachelor's degree in a different area. These students seem to be better able to take in the large amount of knowledge presented in these classes. This is important to note because these students often find it difficult to register for our classes due to the time required for transcript evaluation. Perhaps we could use this information to encourage the most rapid evaluation of transcripts possible so enrollment of these types of students is not hindered.

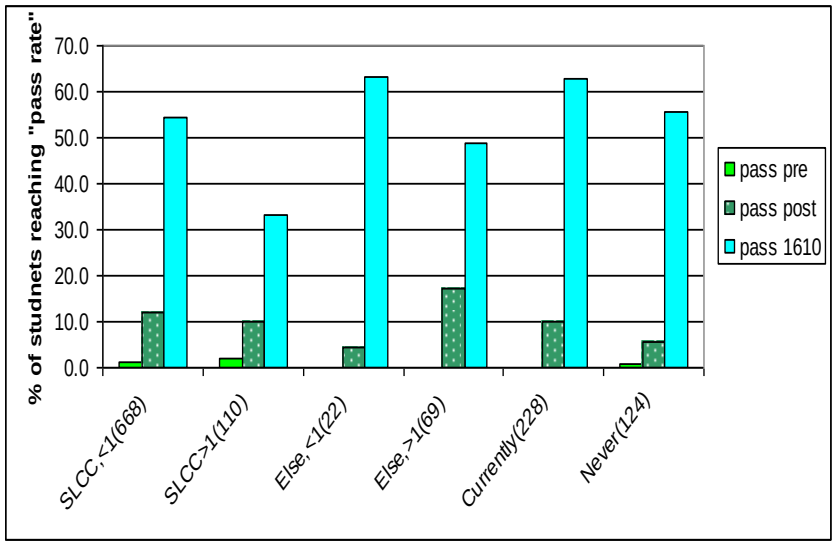

Figure 5a. Pass rate of students in Human Physiology (BIOL2420) versus time and place of taking BIOL2320.

Pass 1610, pass pre, and pass post represent the same information as described in Figure 3a.
SLCC, <1= students that took BIOL2320 at SLCC within one year of enrolling in BIOL2420.
SLCC, >1= students that took BIOL2320 at SLCC more than one year before enrolling in BIOL2420.
Else, <1= students that took BIOL2320 at SLCC within one year of enrolling in BIOL2420.
Else, >1= students that took BIOL2320 at SLCC within one year of enrolling in BIOL2420.
Currently=students who are taking BIOL2320 concurrently with BIOL 2420.
Never= students that have not taken BIOL2320.
Numbers on horizontal axis represent the number of students in each group.

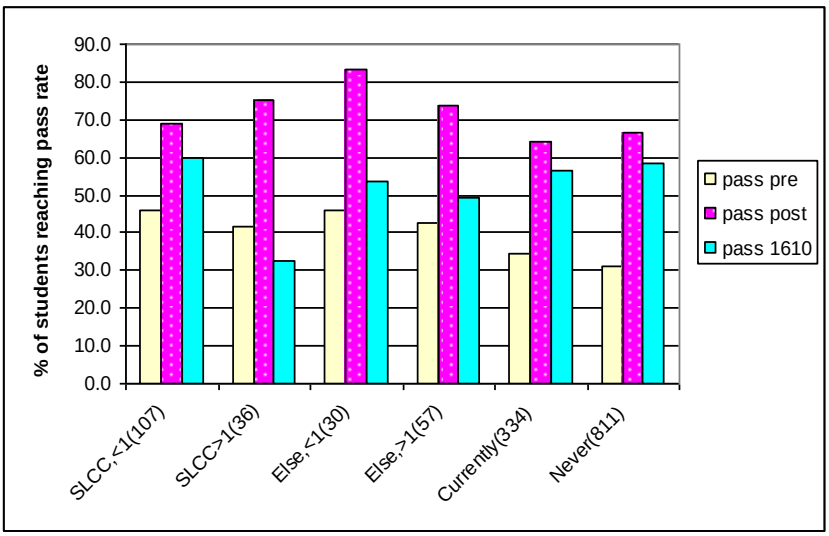

Figure 5b. Pass rate of students in Human Anatomy (BIOL2320) versus time and place of taking BIOL2420.

Pass 1610, pass pre, and pass post represent the same information as described in Figure 3b.
SLCC, <1= students that took BIOL2420 at SLCC within one year of enrolling in BIOL2320.
SLCC, >1= students that took BIOL2420 at SLCC more than one year before enrolling in BIOL2320.
Else, <1= students that took BIOL2420 at SLCC within one year of enrolling in BIOL2320.
Else, >1= students that took BIOL2420 at SLCC within one year of enrolling in BIOL2320.
Currently=students who are taking BIOL2420 concurrently with BIOL 2320.
Never= students that have not taken BIOL2320.

Numbers on horizontal axis represent the number of students in each group.

The data in Figure 5a. demonstrate that students that have never had anatomy make the least progress in physiology "knowledge gained". This deficit is not present for students that take the anatomy concurrently with the physiology. The same type of deficit may exist for anatomy "knowledge gained" when a student has never had physiology or is taking the physiology and anatomy concurrently (Figure 5b). One interpretation of this would be that our current recommendation to take anatomy before physiology seems to work well for most people. A second interpretation could be that some of the students that struggle with physiology would not have enrolled in physiology if they had first taken anatomy. This interpretation is supported by the fact that we have many more anatomy students than physiology students. Unfortunately, some students are not successful in anatomy and thus change their career choice.

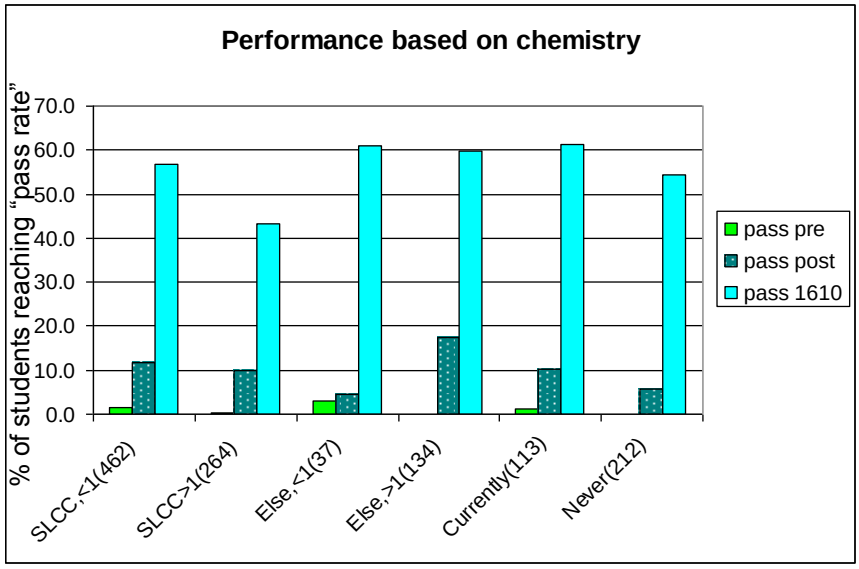

Figure 6. Pass rate of students in Human Physiology (BIOL2420) versus time and place of taking Chemistry.
Pass 1610, pass pre, and pass post represent the same information as described in Figure 3a.
SLCC, <1= students that took Chemistry at SLCC within one year of enrolling in BIOL2420.
SLCC, >1= students that took Chemistry at SLCC more than one year before enrolling in BIOL2420.
Else, <1= students that took Chemistry at SLCC within one year of enrolling in BIOL2420.
Else, >1= students that took Chemistry at SLCC within one year of enrolling in BIOL2420.
Currently=students who are taking Chemistry concurrently with BIOL 2420.
Never= students that have not taken Chemistry.
Numbers on horizontal axis represent the number of students in each group.

The data in Figure 6 show that students that have never taken chemistry gain less knowledge during their physiology classes than students that have taken a chemistry class. This information supports the need for chemistry as a prerequisite for BIOL 2420. Interestingly, students that take anatomy and chemistry concurrently have the same knowledge gain as those that have taken chemistry.

Figure 7a is perhaps the best visual presentation of this information for our human physiology class. The students that have the greatest gain in knowledge from their physiology class are those that have taken BIOL 1610, BIOL2320, and CHEM 1110 or 1210 within a year of enrolling in BIOL 2420. Those that have never taken BIOL2320 or chemistry achieve the least gain. This information points to the importance of keeping our students on track and returning each semester to make progress toward their ultimate goal. If we make students aware of this information, they may be more likely to stay focused and enrolled.

The most striking portion of Figure 7b. is the percent of students reaching the "pass rate" who have had BIOL2420 greater than one year before taking anatomy. Almost all of these students took this physiology somewhere other than SLCC so this leads us to feel that they perhaps already had a degree in some type of science and are thus well equipped to be successful in this type of class.

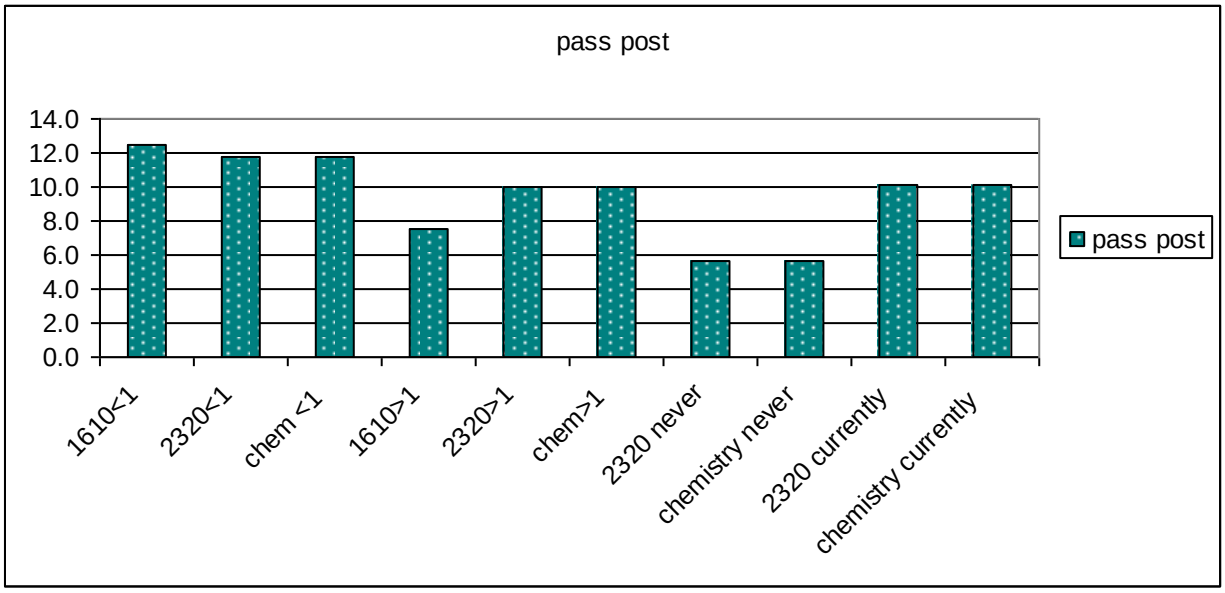

Figure 7a. Pass rate of students in Human Physiology (BIOL2420) for 2420 questions at the end of each term versus time and place of taking BIOL1610, BIO2320, and Chemistry.

pass post represents the same information as described in Figure 3a.

1610, <1, 2320<1, and chem.<1= students that took that class at SLCC within one year of enrolling in BIOL2420.

1610, >1, 2320>1, and chem.>1= students that took that class at SLCC more than one year before enrolling in BIOL2420.

2320 currently and chemistry currently=students who are taking either BIOL2320 and/or chemistry concurrently with BIOL 2420.

2320 never and chemistry never= students that have not taken BIOL2320 and/or Chemistry.

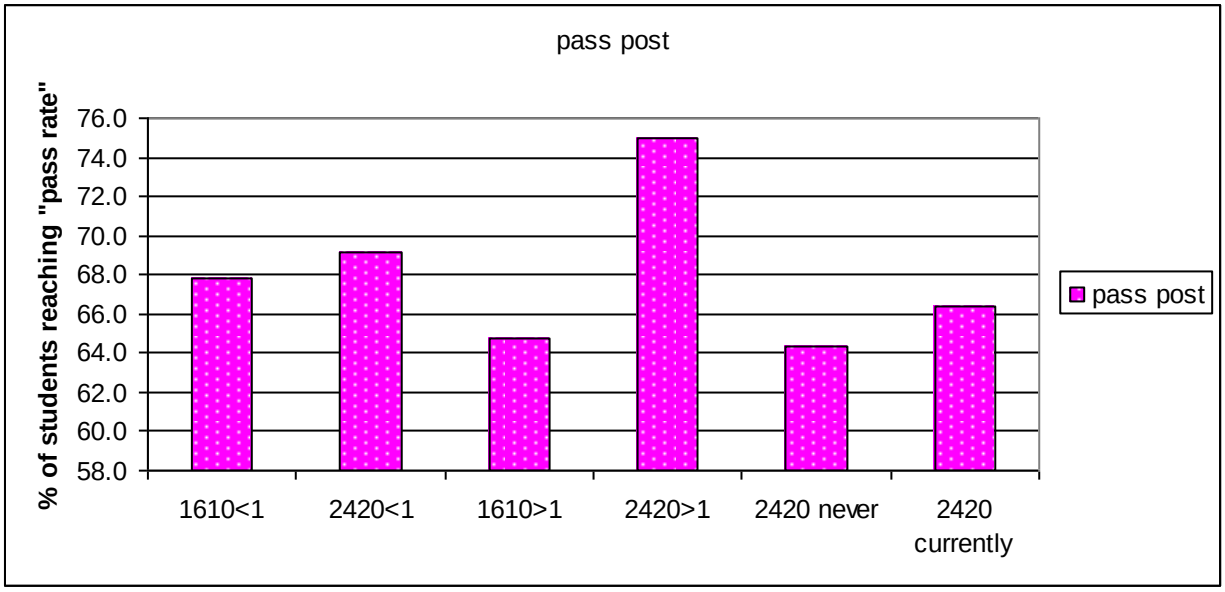

Figure 7b. Pass rate of students in Human Anatomy (BIOL2320) for 2320 questions at the end of each term versus time and place of taking BIOL1610 and BIO2420.

pass post represents the same information as described in Figure 3b.

1610, <1, 2420<1= students that took that class at SLCC within one year of enrolling in BIOL2320.

1610, >1, 2420>1= students that took that class at SLCC more than one year before enrolling in BIOL2320.

2420 currently =students who are taking BIOL2420 with BIOL 2320.

2420 never and chemistry never= students that have not taken BIOL2420.

Summary

In summary, we have obtained some answers to our original three questions and we have also generated some new questions to be analyzed.

1. Does the length of time between required and/or suggested prerequisites and this class affect student performance?

We did find that there was a significant effect on retention and knowledge gained when compared to the various prerequisites. The data support our current prerequisite requirements, especially for physiology. We also found that students who might be returning to the educational environment out-perform the other student groups (on average). This is important to consider when one is determining how long a prerequisite class should be accepted.

We have not yet correlated these data with actual grades given in these classes. We hope that there would be a very direct correlation between the knowledge gained by a student and the grade he/she earns in each of these classes.

2. Does a student's college major or interest affect retention and/or performance?

We did find that students that are self-declared Biology majors perform better than other students.

3. Did the student performance improve on specific objectives from the preterm survey to the post-term survey?

We did see improvement in the average score on these questions; however, we have not yet analyzed the objectives in a specific manner. More questions would be needed to directly and specifically analyze specific objectives. A different study design would be required to access this information.