Final Project Report
Biology 110 Success and Reading Skills: Is there a Connection?

1. Your Name: Karen Koenig and Fernando Agudelo Silva

2. If your project concerned curricular development, title of the course on which you focused: Biology 110 and reading skills

3. What specific student or institutional outcome was your project designed to develop or improve?

   We were trying to determine what role reading skills play in student success in Biology 110.

4. What did you research and develop to try to bring about the improved outcomes?

   We researched the correlation between a student's reading skills at the beginning of a semester of taking Biology 110 and that student's final grade in that Biology 110 course at the end of that semester. In doing this, at the beginning of each semester, we administered the Nelson Denny Reading Test to 5 sections of Biology 110, 4 taught by Dr. Fernando Agudelo Silva and 1 taught by Dr. Tina Christensen, to determine the percentile standings and grade equivalent scores for each student.

   In some sections we also administered an instructor-authored reading assessment (including vocabulary assessment, visual/figure comprehension, and Bloom's taxonomy comprehension assessment) based on readings from the textbook used in sections taught by Dr. Fernando Agudelo Silva. In addition, in some sections we administered an instructor-authored survey designed to determine where each student stood in the English sequence. We also found the readability rating of the Biology textbook used in Dr. Agudelo Silva's Biology 110 sections to approximately Grade Equivalent 13, appropriate for college freshmen.

   Here is what we discovered:

Bio 110 and Reading Skills Fall 2015 CRN 81389

Analysis of 21 students who completed the course and had taken the NDRT at the beginning of the semester:

Nelson Denny Reading Test

Looking only at NDRT scores, of the 4 students who received A at the end of the semester, the average GE (grade equivalent) at the beginning of the semester was 17.3, and their average percentile was 87th percentile.

Of the 4 students who received a grade of B, the average GE at the beginning of the semester of was 17.1 and the average percentile was 89th percentile.

Of the 6 students who received a final grade of C, the average GE was 14.5, and the average percentile rank was 67th percentile.

Of the 4 students who received a grade of D, the average GE had been 12.5, and the average percentile rank was 53rd percentile.

Of the 3 students who received a grade of F, the average GE had been 11.7, and the average percentile rank had been 45th percentile.

The pattern of higher reading skills at the beginning of the semester correlating **on average** to higher letter grades at the end of the semester is quite clear.

Mapping Final Grades and Percentile Reading Scores on NDRT at Outset

Percentile Range	Number of A's	B's	C's	D's	F's
90-99th Percentile	A	B	C	D	
	A	B	C		
	A				
80-89th Percentile		B			
70-79th Percentile		B	C	D	F
60-69th Percentile			C		
50-59th Percentile	A				
40-49th Percentile			C		
30-39th Percentile				D	F
20-29th Percentile			C		F
10-19th Percentile				D	

English Placement and Language Survey

In a survey administered at the beginning of the semester, students self-reported as follows:

--3 out of the 4 who received a letter grade of A in the course had already graduated from 4-year universities;

--1 of the 4 who received a letter grade of B in the course had already graduated from a 4-year university

--1 of the 6 who received a letter grade of C in the course had already graduated from a 4-year university

Asked if they had taken the placement tests, 15 of the students responded Yes, 4 responded No, and 3 said they had taken the math test only.

In response to what their placement had been in English as a result of the placement test, 4 said English 98, 1 said English 120AC (which is the same placement as English 98), 3 said English 120, 3 said English 150, and 12 said No or n/a or Not Sure or "I have an MBA" or did not respond.
When asked what English course they were taking the same semester, 1 student said English 98, 3 said English 120, 1 said English 150, 1 said English 151, and 18 said "None" or n/a or did not respond.
In response to the question "What is the highest level of English you have completed at College of Marin?" 1 student said English 98, 1 said English 120 at Napa CC, 6 said English 150, 1 said English 151, 10 said None or n/a, 1 said he had a B.A., one said UCSF graduate degree, and 1 responded "Another college."
The survey also asked students to state whether they were bilingual or spoke English only. Fourteen said they spoke only English. Seven said they were bilingual.
Finally, we asked students whether they thought it would be helpful to take a reading, note-taking, and study skills college reading course in conjunction with their biology course. Thirteen said Yes, 3 expressed Maybe Yes, 3 said they weren't sure, and 8 said No.

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Bio 110 and Reading Skills Fall 2015 CRN 81731

Analysis of 16 students who completed the course:

Nelson Denny Reading Test

Looking only at NDRT scores, of the 3 students who received a grade of A at the end of the semester, the average GE (grade equivalent) at the beginning of the semester was 14.6, and the average percentile was 71st percentile.

Of the 4 students who received a grade of B, the average GE at the beginning of the semester was 15.4, and the average percentile was 77th percentile.

Of the 3 students who received a grade of C, the average GE was 12.5, and the average percentile rank was 52nd percentile.

Of the 2 students who received a grade of D, only one took the reading test. Her GE had been 4.1, and her percentile rank was 2nd percentile.

Of the 4 students who received a grade of F, only one took the reading test. His GE had been 8.7, and his percentile rank had been 16th percentile.

Even though this section provided a very small sample, with reading test results on only 12 of the 16 students who completed the course the pattern of higher reading skills at the beginning of the semester correlating **on average** to higher letter grades at the end of the semester is quite clear.

Mapping Final Grades and Percentile Reading Scores on NDRT at Outset:

Percentile Range	Number of A's	B's	C's	D's	F's
90-99th Percentile	A	B			
	A				
80-89th Percentile					
70-79th Percentile		B	C		
		B			
60-69th Percentile		B			
50-59th Percentile					
40-49th Percentile			C		
			C		
30-39th Percentile	A				
20-29th Percentile					
10-19th Percentile					F
1-9th Percentile				D	

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Bio 110 and Reading Skills Spring 2016 CRN 10480

Analysis of 42 students who completed the course:

Nelson Denny Reading Test

Looking only at NDRT scores, for the 5 students who received a grade of A at the end of the semester, the average GE (grade equivalent) at the beginning of the semester was 15.6, and the average percentile was 78th percentile.

Of the 7 students who received a grade of B, the average GE at the beginning of the semester was 15.9, and the average percentile was 82nd percentile.

Of the 12 students who received a grade of C, the average GE was 13.8, and the average percentile rank was 60th percentile.

Of the 8 students who received a grade of D, the average GE had been 11.5, and the average percentile rank was 45th percentile.

Of the 10 students who received a grade of F, the average GE had been 8.7, and the average percentile rank had been 23rd percentile.

Even though students receiving a grade of A at the end of the course had slightly lower reading scores on average than the students who received a grade of B, the pattern of higher reading skills at the beginning of the semester correlating **on average** to higher letter grades at the end of the semester is quite clear.

Mapping Final Grades and Percentile NDRT Reading Scores at Outset

Percentile Range	Number of A's	B's	C's	D's	F's
90-99th Percentile	A	B	C		
	A	B	C		
	A	B			
80-89th Percentile	A	B	C		
		B			
70-79th Percentile			C		
60-69th Percentile		B	C	D	
			C	D	
			C	D	
50-59th Percentile		B	C	D	F
40-49th Percentile			C	D	
			C	D	
30-39th Percentile			C		F
					F
					F
20-29th Percentile	A				F
					F
10-19th Percentile			C		F
1-9th Percentile				D	F
				D	F
					F

Mapping Final Grades and Grade Equivalent NDRT Reading Scores at Outset

Grade Level Equivalent	Number of A's	B's	C's	D's	F's
18th GE	A				
17th GE	A	B	C		
			C		
16th GE	A	B	C		
		B	C		
		B			
		B			
		B			
15th GE	A				
14th GE		B	C	D	
			C	D	
13th GE		B	C	D	F
				D	
12th GE			C	D	
			C		
11th GE			C	D	F
10th GE			C		F
					F
9th GE	A				F
					F
8th GE					

7th GE								C	F
6th GE									D
									D
5th GE									F
4th GE									F
									F

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Bio 110 and Reading Skills Spring 2016 CRN 10479

Analysis of 13 students who completed the course:

Nelson Denny Reading Test

Looking only at NDRT scores, of the 2 students who received A at the end of the semester, only one had attended the NDRT. Her GE (grade equivalent) at the beginning of the semester was 18.4, and her percentile was 85th percentile. It should be noted that this student had already received a college degree before starting this course.

The one student who received a grade of B, had had a GE at the beginning of the semester of 15.1 and a percentile of 79th percentile.

Of the 5 students who received a final grade of C, the average GE was 12.2, and the average percentile rank was 49th percentile.

Of the 3 students who received a grade of D, the average GE had been 9.5, and the average percentile rank was 27th percentile.

Of the 2 students who received a grade of F, the average GE had been 11.2, and the average percentile rank had been 37th percentile.

Even though this section provided a very small sample, the pattern of higher reading skills at the beginning of the semester correlating **on average** to higher letter grades at the end of the semester is quite clear.

Mapping Final Grades and Percentile NDRT Reading Scores at Outset

Percentile Range	Number of A's	B's	C's	D's	F's
90-99th Percentile=	A				
80-89th					
70=79th		B	C		
			C		
60-69th					
50-59th				D	F
40-49th			C		
30-39th			C		

20-29th	C		
10-19th		D	F
1-9th		D	

In the interest of using Multiple Measures:

Looking at a test designed by an English instructor using the Biology 110 textbook, is there a pattern?
The test assessed academic vocabulary in context, which yielded one score.
It also measured reading comprehension of visuals as well as
text comprehension as measured by a series of questions based on Bloom's Taxonomy, both of which went into the comprehension score.
Scores are criterion-referenced, not norm-referenced.
Unlike the NDRT, this instructor-authored test was not timed. Everyone finished with time to spare.

Of the 2 students who received a grade of A at the end of the semester, the average vocabulary score was 89.5% correct.
For the same students, the average comprehension score was 68.5%.

The student who received a grade of B at the end of the semester had scored 88% correct on the vocabulary test. On the comprehension, he scored 69%.

Of the 5 students who received a grade of C at the end of the semester, one missed taking the test. Of the 4 who were present at the beginning of the semester to take it, the average vocabulary score was 92%. Of those same 4 students, the average comprehension score was 62.5%.

Of the 3 students who received a grade of D at the end of the semester, the average vocabulary score was 86.3%. Of those same 3 students, the average comprehension score was 55%

Of the 2 students who received a grade of F at the end of the semester, the average vocabulary score was 87.5%. For the same 2 students, the average comprehension score was 74.5%.

Looking at this very small sample, there is a pattern of higher reading skills correlating with higher grades in Biology, except for the students who received F. Perhaps this is because a student with high reading skills stopped attending for reasons unrelated to academics.

English Placement and Language Survey

Students were asked the following questions, and this is an analysis of their responses:

1. Have you taken the English placement test at COM?

Yes=13 No=8

2. What level of English did you place into?

English 70SL=1 English 92=0 English 98=1 English 120=3
English 150=1 English 151=0
Most students had no idea what their placement had been.
Two said they already had a degree from a 4-year university, and 2 said they had completed English requirements at other colleges.

3. What English course are you currently taking? English 98=1

English 120=2 English 150=2 English 151=2
Not taking English this semester=12.
The remainder are the students who already have college degrees.

4. What is the highest level English course you have completed at COM?

English 92=1 English 98=1 English 120=2 English 150=3 English 151=2
English 155=1 No response/none=10

5. Do you speak only English?

Yes=16
No=5

6. Do you think it could be helpful to work on your reading, note-taking, and study skills in a college reading course while taking your Biology course?

Yes=10
Maybe=3
No=8

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Bio 110 and Reading Skills Summer 2016

Analysis of 42 students who completed the course:

Nelson Denny Reading Test

Looking only at NDRT scores, of the 9 students who received A at the end of the semester, the average Grade Equivalent (GE) at the beginning of the semester was 16.2, and their average percentile was 84th percentile.

Of the 12 students who received a grade of B, their average GE at the beginning of the semester was 15 and their average percentile was 73rd percentile. (Only 11 of the 12 students who finished with a grade of B took this test.)

Of the 5 students who received a final grade of C, the average Grade Equivalent was 13.5, and the average percentile rank was 59th percentile. (Only 4 of the 5 students took this test.)

Of the 7 students who received a grade of D, the average GE had been 12.3, and the average percentile rank was 48th percentile.

Of the 6 students who received a grade of F, the average GE had been 12.5, and the average percentile rank had been 55th percentile. (Note: the average percentile

would have been 46th percentile without the one person in the group who had scored 99th percentile.)

Overall, the pattern of higher reading skills at the beginning of the semester correlating **on average** to higher letter grades at the end of the semester is quite clear.

Mapping Final Grades and Percentile Reading Scores on NDRT at Outset

Percentile Range	Number of A's	B's	C's	D's	F's
90-99th Percentile	A	B	C		F
	A	B	C		
	A	B			
80-89th Percentile	A	B		D	
	A	B			
	A				
70-79th Percentile	A	B		D	F
	A	B			F
60-69th Percentile	A	B		D	F
50-59th Percentile		B			
40-49th Percentile		B		D	
30-39th Percentile		B	C	D	
20-29th Percentile					
10-19th Percentile			C	D	F
				D	
1-9th Percentile					F

Mapping Final Grades and Grade Equivalent Scores on NDRT at Outset

Grade Level Equivalent	Number of A's	B's	C's	D's	F's
18th GE	A	B	C		F
		B	C		
		B			
17th GE	A				
	A				
16th GE	A			D	
	A				
15th GE	A	B			F
		B			
		B			
14th GE	A	B		D	F
	A				
	A				
13th GE		B		D	F
		B			
12th GE				D	
11th GE		B			
		B			
10th GE			C	D	

9th GE		D	
		D	
8th GE			F
7th GE			
6th GE	C		
5th GE			
4th GE			F

In the interest of using Multiple Measures:

Looking at a different vocabulary/reading test designed by an English instructor using the Biology 110 textbook, is there a pattern?
The test assessed **academic vocabulary in context**, which yielded **one score**.
It also measured reading **comprehension of visuals as well as text comprehension** as measured by a series of questions based on Bloom's Taxonomy, both of which went into the **comprehension score**.
Scores are criterion-referenced, not norm-referenced.
Unlike the NDRT, this instructor-authored test was not timed. Everyone finished with time to spare.

Of the 9 students who received a grade of A at the end of the semester, the average vocabulary score at the beginning of the semester was 92.4% correct.
For the same students, the average comprehension score was 74%.

Of the 12 students who received a grade of B at the end of the semester, the average score was 94.6% correct on the vocabulary test. On the comprehension, the average score was 69.3%.

Of the 5 students who received a grade of C at the end of the semester, the average vocabulary score was 89%, and the average comprehension score was 54.7%. (Only 3 of the 5 students with a grade of C took this test.)

Of the 7 students who received a grade of D at the end of the semester, the average vocabulary score was 83%. Of those same students, the average comprehension score was 70%.

Of the 6 students who received a grade of F at the end of the semester, the average vocabulary score was 89.2%. For the same students, the average comprehension score was 64.6%. (Note: Only 5 students in this group took this test.)

Looking at this sample, there a descending pattern of reading skills correlating with grades in Biology for students who received A, B, or C grades at the end of the semester. The pattern is not as clear for those who received D or F.

It should be noted that because some of the students who received failing grades in the Biology 110 course did not do all assignments or take all quizzes throughout the semester, the slight elevation in pre-test scores for these students may be attributable to lack of participation or attendance and not to a correlation between entering skill levels and final letter grades.

5. In your opinion, did your project (or will it be in the future) bring about any change or improvement(s) in outcomes?

   In our opinion, this data clearly demonstrates a correlation between students' reading skills as they enter a new semester of Biology 110 and their final grades in the course at the end of the semester.

   We also believe that offering a 3-unit reading course linked in a learning community with Biology 110 could greatly increase student success in Biology 110, and at the same time improve students' reading/study skills applicable to all other content-area courses in college, giving our learning-community students an advantage throughout the rest of their college semesters. Further, we believe that given the fact that success in biology is a high-stakes goal for students hoping to major in nursing and other STEM fields, such a learning community will greatly increase student motivation to improve their reading skills.

6. If you think it will, what evidence can you provide to support your opinion?

Of course, this year of research has involved only assessing things as they are right now, that is, a situation in which students can register for Biology 110 regardless of their academic skills. Now, as can be seen from the above data, students with low reading skills, especially those below the 50th percentile and below 12th grade reading level, are at very strong risk of failing Biology 110, while as other students' scores ascend above those markers, their chances of passing or getting high grades ascend accordingly.

Our carefully considered prediction is that if future students receive formal reading and study strategy instruction based in the textbook readings required in their concurrent Biology 110 course, those at risk of failing because of low reading skills will greatly increase their chances of success.

7. If there was not a measurable change, what other evidence can you provide to support your opinion?

As can be seen in the above data, we did survey some Biology 110 class sections and found that when we asked students whether they thought it would be helpful to take a reading, note-taking, and study skills college reading course concurrent with their biology course, they responded as follows:
Yes=13
Maybe Yes=3
Not sure=3
No=8.

In another section, student responses to the same question were:
Yes=10
Maybe=3
No=8.

In short, the majority of students in the 2 sections surveyed would be interested in getting reading instruction concurrently with their Biology 110 course.

8. What, if anything, did you learn about your teaching or your students' learning as a result of this IR&D project?

Since this project was an assessment of student needs, we really weren't sure if we were going to discover any connection between reading skills at the beginning of the semester and letter grades in the course at the end of the semester. When we started assembling the data and looking at it, we were amazed at how consistently most students' grades were correlating with their NDRT scores 4 months later. Even more striking was the fact that the final Biology 110 grades came from 2 different instructors who use 2 different textbooks and different tests to teach the course, yet the data emerging from both is so similar. (Note: the English instructor on the project did not share these scores with biology instructors until after they finished submitting end-of-semester grades.) Also, the English instructor was surprised to learn how difficult it is to create a reading assessment that consistently predicts student performance in content-area courses! This resulted in a new appreciation for standardized tests.

Another discovery was that not only did students' scores in some Biology 110 sections span across more than 12 grade levels at the beginning of each semester, but in some sections there were adults with 4-year college degrees, and in some cases, master's degrees. That alone made us glad we did this needs-assessment study before jumping into a learning community that would have required all Biology 110 students to register for a co-requisite reading course! Clearly, some of the students in each section did not need reading instruction, although others were in desperate need of it. This has taught us that we need to be thoughtful in setting up the future learning community linking reading instruction and biology.

9. In your opinion, was the project successful? Why or why not?

For the reasons stated above, we feel it was very successful, and for that reason, we are eager to share the data with the larger college community of faculty. We now see clearly that reading skills are a powerful factor in student success in Biology 110.

10. What could you have done, if anything, to make your project more successful?

The only thing we wish we had done more testing of English 98 students because the Biology Department has formalized completion of English 98 as a prerequisite for entering Biology 110. Since the English instructor on this project, Karen Koenig, teaches English 98, she ran one set of NDRT on one section of English 98 at the beginning of a semester, and the results were as follows:

Grade Level Equivalent	**Percentile Rank**
15.9	85th
14.2	67th
14.1	66th
13.5	59th
12.5	49th
11.3	39th
11.1	38th
11.1	38th
10.8	35th
10.4	33th
10.4	33th
10	29th
9.2	19th
8.9	17th
8.5	15th
8.1	13th
7.7	12th
6.6	7th
6.3	6th
4.1	1st

At the beginning of this research project we were not sure what was happening with the prerequisite of English 98 for Biology 110, whether it was going to be eligibility to start English 98 or completion of English 98 that would be set as the prerequisite. If we had known, we would have tested several sections of English 98 at the end of the semester also to see how those students would stand in relationship to the 5 sections of Biology 110 students we had already tested. Unfortunately, we do not have that data.

However, in light of the data we do have, we have noticed that a rough line of demarcation separating the majority of students who pass Biology 110 from those

who fail is about GE 12 and 50th percentile as measured by the NDRT. It is also a rule of thumb that adult learners, on average, advance about one grade level for every 45 hours of instruction in reading. Given that English 98 is described as a course in reading and composition skills, one could estimate that only ½ that time is devoted to direct reading instruction at most, resulting in about 24 hours of reading instruction, which could translate to .5 grade-level advancement on average. If that were true, on average, perhaps 6 students from this section of English 98 would have a good chance of passing Biology 110 after English 98. However, more than 6 students passed this section of English 98, so it could be expected that some English 98 "graduates" would still be at risk of failing Biology 110.

Now that this prerequisite is being fully enforced for the first time in Fall 2016 (as this report is being written, it would be very interesting to again test Biology 110 sections to see if this prerequisite is working.