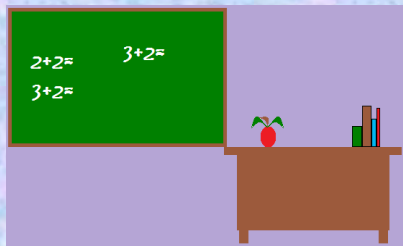
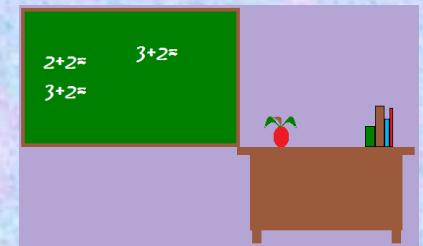


# Assessing General Education and Science Students in the 21st Century Classroom: Impact on Student Performance



**Eighth Annual  
Northern Nevada Assessment Conference  
January 29, 2010  
Joe Crowley Student Union  
University of Nevada, Reno**



**Franklin S. Carman III, A.A., B.A., Ph.D.,**  
Professor of Biophysical Sciences  
Western Nevada College

# Abstract



## **Assessing General Education and Science Students in the 21st Century Classroom: Impact on Student Performance**

Franklin S. Carman III, A.A., B.A., Ph.D., Professor of Biophysical Sciences  
Western Nevada College

- Assessment is becoming more and more significant in higher education: what to assess and how to assess “it” are challenging. Reading and Math are across-the-board general education requirements, as well as course pre-requisites, for all two-year and four-year degrees. The Cloze method to assess Reading and a Math model for assessing freshman and sophomore science students’ performances in transfer courses are presented and discussed. Practically speaking, if students are strong in reading and math, or develop those skills rapidly throughout the semester, they are more likely to be successful in their science courses.

# Introduction



- 2001 – heard “assessment”
- 2002 – heard “general education”
- 2003 – heard “assessing general education”

# Introduction



- What is “assessment”?
  - No idea!
  - Weren’t periodic exams “assessment”?
  - Weren’t ACS Final Exams “assessment”?
- What to “assess”?
  - College criteria?
  - Department criteria?
  - Own criteria?
  - Background info?
- How to “assess” “it”?
  - What tools available?
  - Who was “go to” person?
- What to do with the “data”?
  - If assessment is to help students be successful how is it to be applied?
    - Individual courses only?
    - All courses?
    - Across the system?
    - Constructively?
    - Punitively?

# Introduction



- What IS “general education”?
  - Gazillions of definitions
  - No two definitions alike ... much less akin
  - How does it interface with “general electives”
  - Does “one size fit all”?
  - Is there such a thing as “too much”?

# Introduction



- HOW does one assess “general education” when one is teaching students about:
  - Historically “major’s courses”?
    - Gen Chem I
    - Gen Chem II
  - Historically “service courses”?
    - Math for Nurses/Allied Health
    - Human Anatomy and Physiology I
    - Human Anatomy and Physiology II
    - General Microbiology
    - Principles of Nutrition
  - Historically challenging course content?
    - Human Genetics
    - Intro Organic Chem

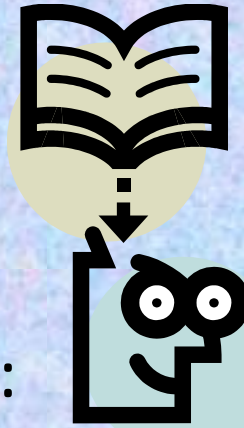
# Introduction



- Actively “assessing students” non-systematically
  - ACS exams -- 1999
  - Reading “baselines” -- 2005
  - Math “baselines” -- 2005
- 2006-2007 – systematized assessments
  - Stopped ACS exams
  - MATH assessment begun
  - READING assessment begun



# Introduction to Methods



- Why assess READING?

- Seems self-explanatory – may not be, though:

- Reading in University [transfer] courses is different than what most students are used to
- Reading in K-12 seems to be slipping [anecdotal]

- “[Superintendent Pendery Clark] ... said all students need to be able to demonstrate **9th grade** levels in reading, writing, basic algebra, geometry, government and show they understand how to draw and test a hypothesis. Clark said all students, no matter what they plan on doing after high school, should demonstrate those abilities.

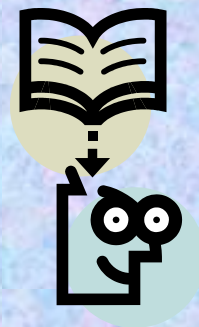
<http://www.recordcourier.com/article/20001014/NEWS/110141480&parentprofile=search>

- If students can not read, they will NOT be successful in college
- Reading requires constant practice



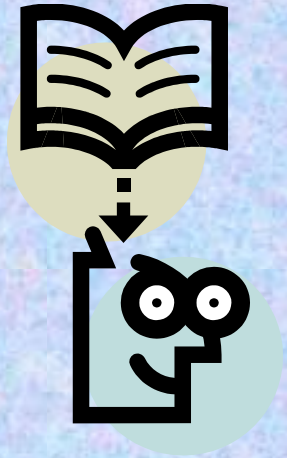


# Introduction to Methods



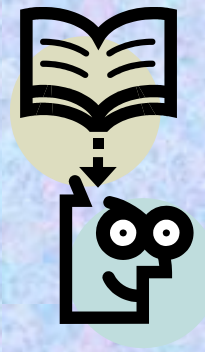
- Why assess MATH?
  - MATH important for student success in CHEM, PHYS, BIOL, NURS, MATH
  - Pre-req for CHEM 121, CHEM 122, NUTR 121
    - At WNC, CHEM 121 pre-req for BIOL 190, 191, 223, for CHEM 220 which is pre-req for NUTR 223
    - At WNC, MATH 120 and CHEM 121 pre-req for NURS
    - At UNR, MATH 120 and CHEM 121, CHEM 220 pre-req for NURS
    - At UNLV, MATH pre-req for NURS
  - MATH important for student success in BIOL
    - Pre-req for BIOL 190 at TMCC, GBC

# Methods



- How to Assess READING
  - Standardized Reading Test?
    - Difficult to get info
  - Something else?
    - Richard Riendeau, M.Ed., WNC Professor of English
      - ❖ CLOZE Procedure
    - My twist, eventually
      - ❖ OPEN Procedure
- How to “GRADE” the reading assessment
  - Microsoft WORD
- How to “STAT” the reading assessment
  - Student’s 2-tailed t test

# Methods



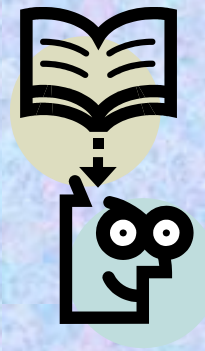
- CLOZE (and OPEN) Procedure

1. <http://faculty.weber.edu/fbutler/Cloze%20Passages.htm>
2. [http://www.aua.am/academics/dep/hf\\_publications/3%20Varieties%20of%20Cloze%20procedure.pdf](http://www.aua.am/academics/dep/hf_publications/3%20Varieties%20of%20Cloze%20procedure.pdf)

Education has two purposes. First, education provides tools so that \_\_\_\_ can earn a living. Some of \_\_\_\_ tools are basic tools, such as \_\_\_\_ and writing. Others are technical skills, \_\_\_\_ as typing, accounting, and data processing. \_\_\_\_ others are highly professional skills peculiar, \_\_\_\_ example, to medicine, to law and \_\_\_\_ teaching. Secondly, education provides experience so \_\_\_\_ we can learn how to live. \_\_\_\_ provides a background of ideas for \_\_\_\_ the past. It provides a sense of values for meeting the future.

- OPEN: the first Cloze at the beginning of the semester
- CLOZE: the last Cloze at the end of the semester
- In both: Exact Word Method is used
- Excerpt from source 2, above.

# Methods



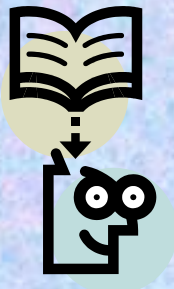
- CLOZE (and OPEN) Procedure
- Grading OPEN and CLOZE
  - Serendipity: MS Word has a grading function after Spellcheck:

The screenshot shows the 'Readability Statistics' dialog box with the following data:

Counts	
Words	1780
Characters	8663
Paragraphs	72
Sentences	84
Averages	
Sentences per Paragraph	2.8
Words per Sentence	19.0
Characters per Word	4.6
Readability	
Passive Sentences	22%
Flesch Reading Ease	55.5
Flesch-Kincaid Grade Level	9.9

An 'OK' button is located at the bottom right of the dialog box. A red arrow points to the 'Flesch-Kincaid Grade Level' value of 9.9.

# Methods



- Grading OPEN and CLOZE
  - Serendipity: MS Word has a grading function after Spell-check:
- Flesch Reading Ease Scale:
  - 60-70 = 8<sup>th</sup>/9<sup>th</sup> grade level
  - 50-60 = 10<sup>th</sup>/12<sup>th</sup> grade level
  - < 30 = College level
  - Like golf: lowest numbers best scores

Readability Statistics	
<b>Counts</b>	
Words	1780
Characters	8663
Paragraphs	72
Sentences	84
<b>Averages</b>	
Sentences per Paragraph	2.8
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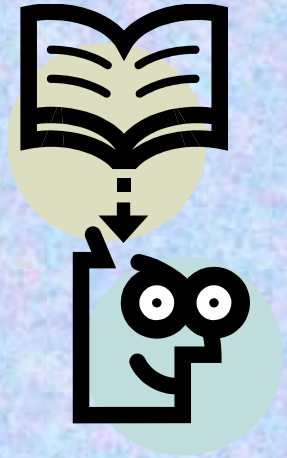
The screenshot shows a dialog box titled "Readability Statistics". It contains three sections: "Counts", "Averages", and "Readability". The "Readability" section shows "Passive Sentences" at 22%, "Flesch Reading Ease" at 55.5, and "Flesch-Kincaid Grade Level" at 9.9. A red arrow points from the "Flesch-Kincaid Grade Level" value to the left, and another red arrow points from the "Flesch Reading Ease" value to the right, meeting at a central point. An "OK" button is visible at the bottom right of the dialog box.

- “...most states require scores from 40 to 50 for insurance documents.”

[<http://www.bluecentauri.com/tools/writer/sample.php#flesch>]

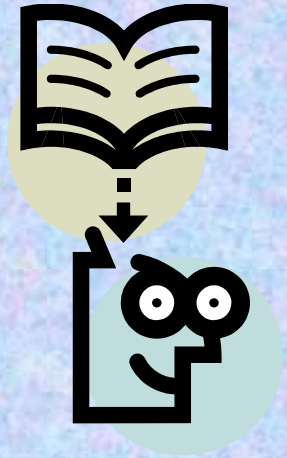
- Conflicts exist between the two levels – 2010-01 Syllabus Draft, above.

# Methods



- How to Assess MATH?
  - Some sort of test
- WHAT to assess in MATH?
  - Problematic given the potential MATH pre-req courses depending on student's program of study:
    - MATH 120 ← BIG one for NURS
    - MATH 126
    - MATH 127
    - MATH 128 ← BIG one for CHEM 122 and PHYS 151/2
    - MATH 181 or higher ← BIG one for PHYS 180/1/2

# Methods



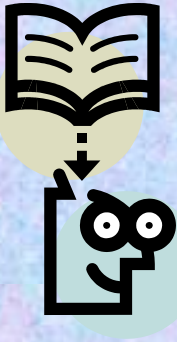
- Example MATH Question:

- \_\_\_\_ 5. Which of the following responses is the best solution to the following:

$$\ln x^{\frac{1}{8}} = ??$$

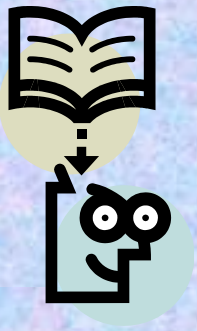
- A.  $0.125 \ln x^{-1}$
- B.  $8 \ln x$
- C.  $8 \ln x^{-1}$
- D.  $0.125 \ln x$
- E. None of the above are correct

# Methods



- Lowest common factor is MATH 120 and CHEM 121
  - Looked closely at what MATH skills were needed to be successful in CHEM 121
  - Developed two 20 question exams to test those concepts
    - » Pre-semester – first week
    - » Post-semester – immediately after “Primer”
    - » Post-semester -- last week of classes or final exam week
    - » Idea was to develop an exam that wasn’t much more difficult than Geometry and Algebra II in High school (after reviewing several MATH 120 and High School Geometry and Algebra textbooks)





# Introduction to Results



- 2007-2009 – what to do with data??????
  - Susan Priest, M.Div., WNC PARC Chair
  - Robert Morin, J.D., Ph.D., DC SSEH&PS, WNC
  - Penny Nicely, M.S., Adjunct Geology Faculty, WNC
  - Kevin Burns, M.A., Adjunct English Faculty, WNC
  - Sherry Neil-Urban, Ph.D., Professor of Nursing, WNC
  - Cat Boedenauer, M.Ed., Programmer/Analyst, WNC

# Results

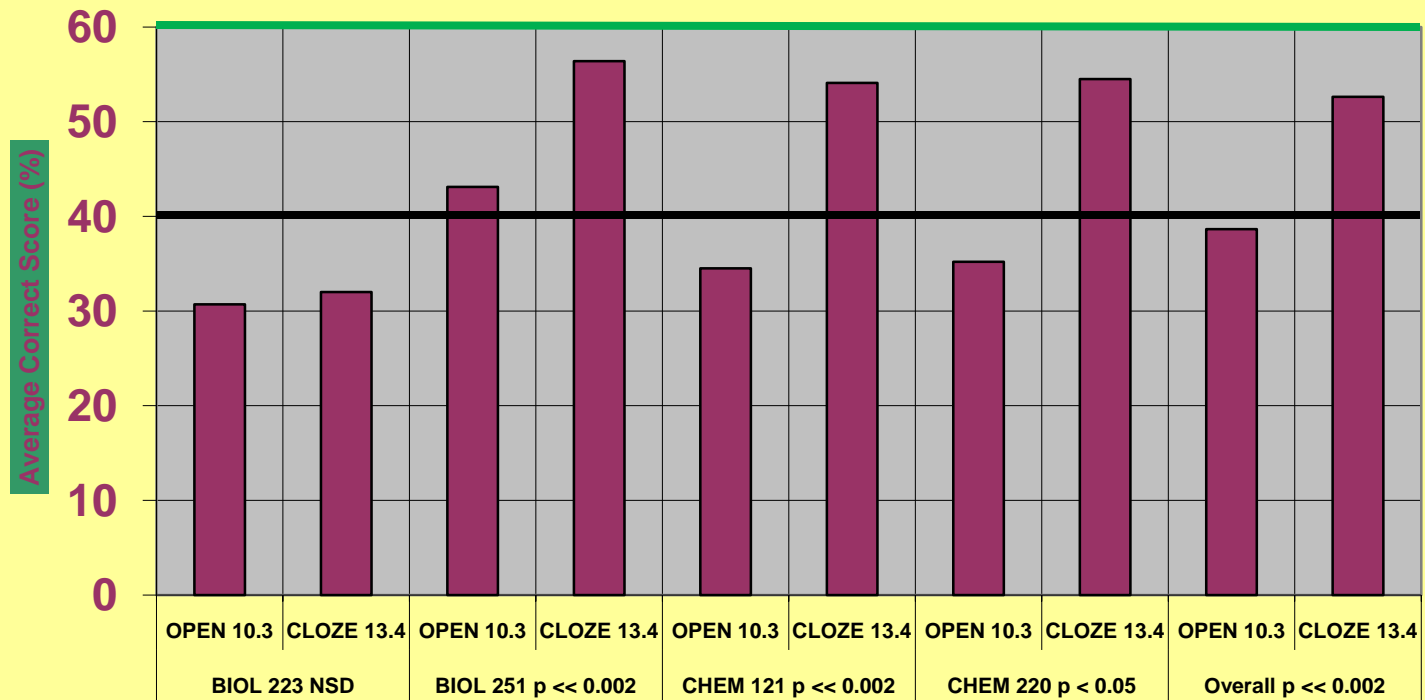


- ✓ Scoring Cloze Procedure:
  - ✓ < 40% correct responses = too challenging for the student to read
  - ✓ 40-60% correct responses = instructional
  - ✓ >60% correct responses = self-instructional for student
  
- ✓ OPEN = Grade 10.3
- ✓ CLOZE = Grade 13.4

# Results



## Background Knowledge and Interpretation Assessment, 2008-03, Cloze Method

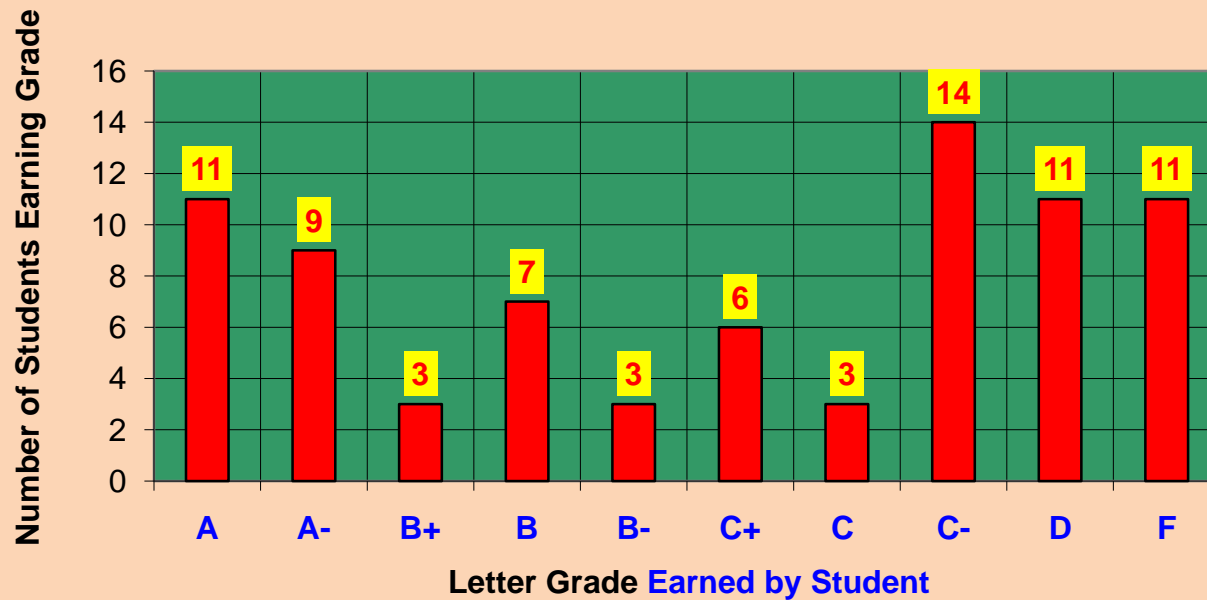


**Course and Grade Readability with Statistical Significance**

# Results



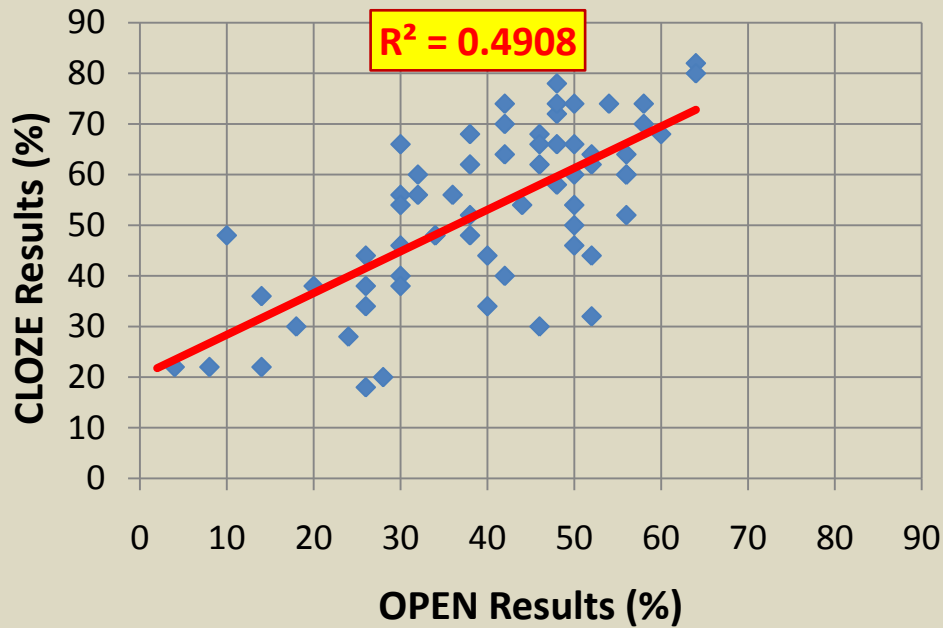
**OVERALL Student-Earned Final Course  
Distribution, Fall 2008, BIOL 223 CO2,  
BIOL 251 CO1, CHEM 121 CO3, CHEM 220 CO1**



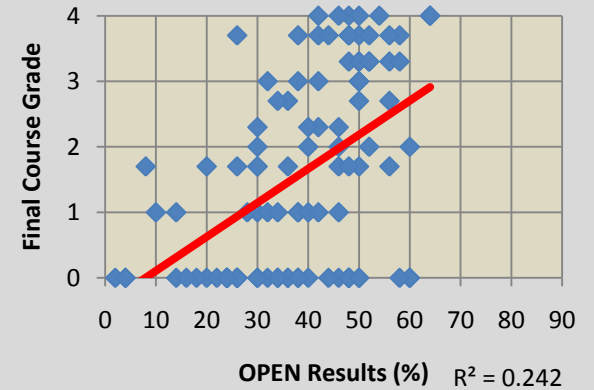
# Results



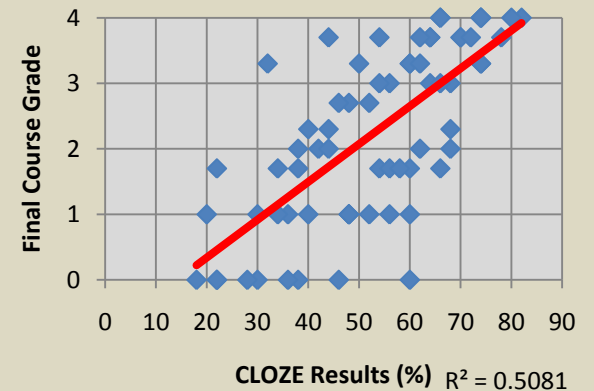
### CLOZE v OPEN 2008-03 Conglomerate



### Final Course Grade vs OPEN Results 2008-03



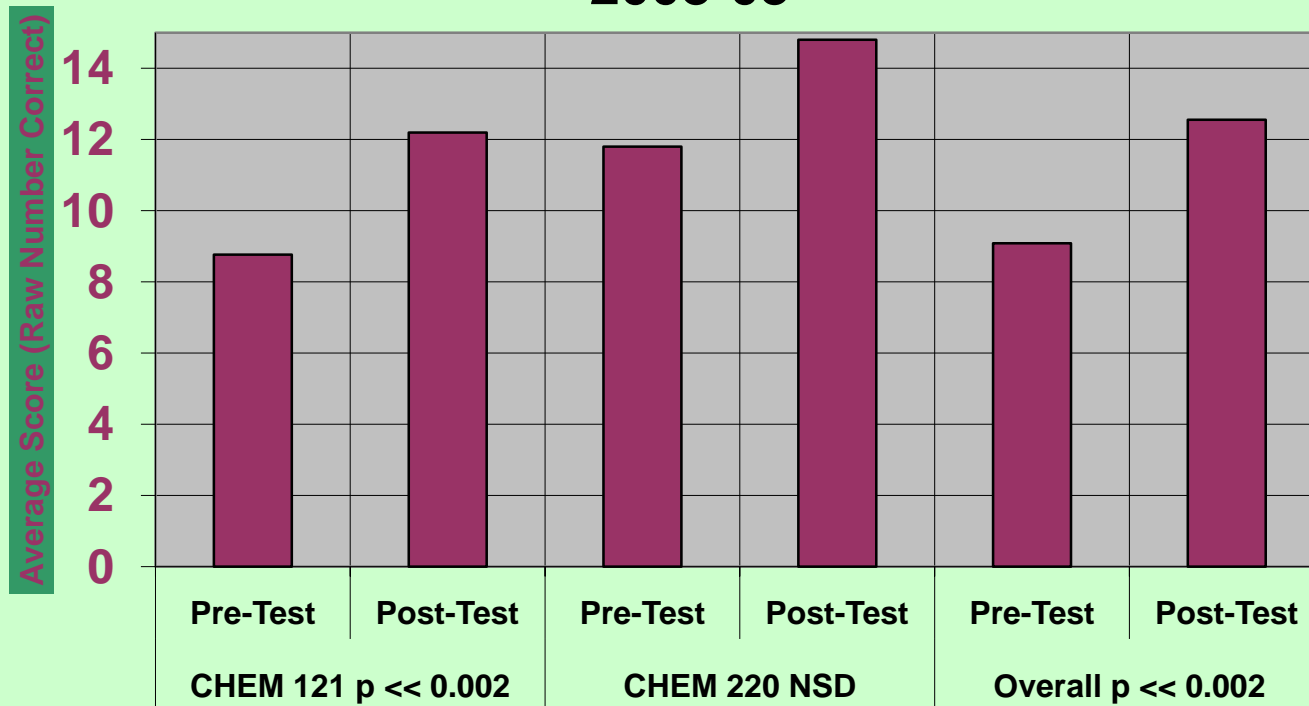
### Final Course Grade vs CLOZE Results 2008-03



# Results



**Math Pre- and Post-Test Assessments,  
2008-03**

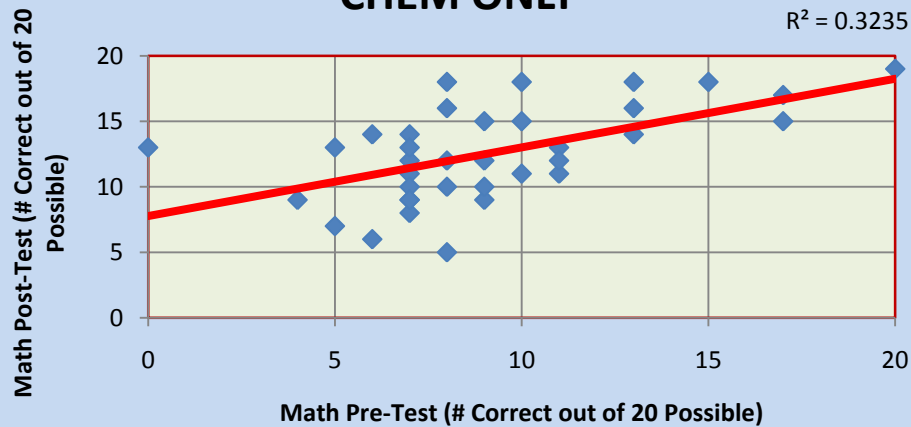


**Course and Statistical Significance**

# Results

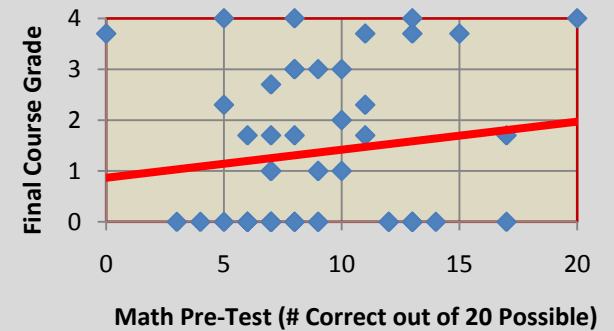


### MATH Post-Test vs Pre-Test 2008-03 CHEM ONLY



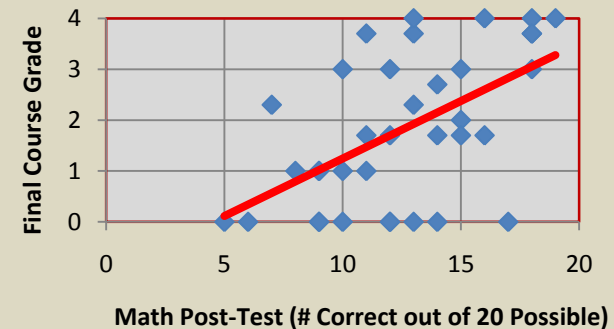
### Math Pre-Test vs Final Course Grade 2008-03 CHEM ONLY

$R^2 = 0.02$



### MATH Post-Test vs Final Course Grade 2008-03 CHEM ONLY

$R^2 = 0.3065$

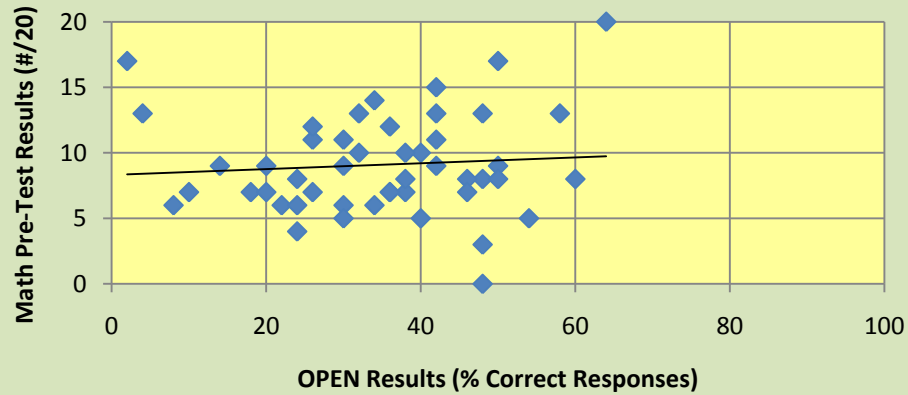


# RESULTS



**MATH Pre-Test vs OPEN 2008-03  
CHEM ONLY**

$R^2 = 0.0069$



**MATH Post-Test vs CLOZE 2008-03  
CHEM ONLY**

$R^2 = 0.3851$

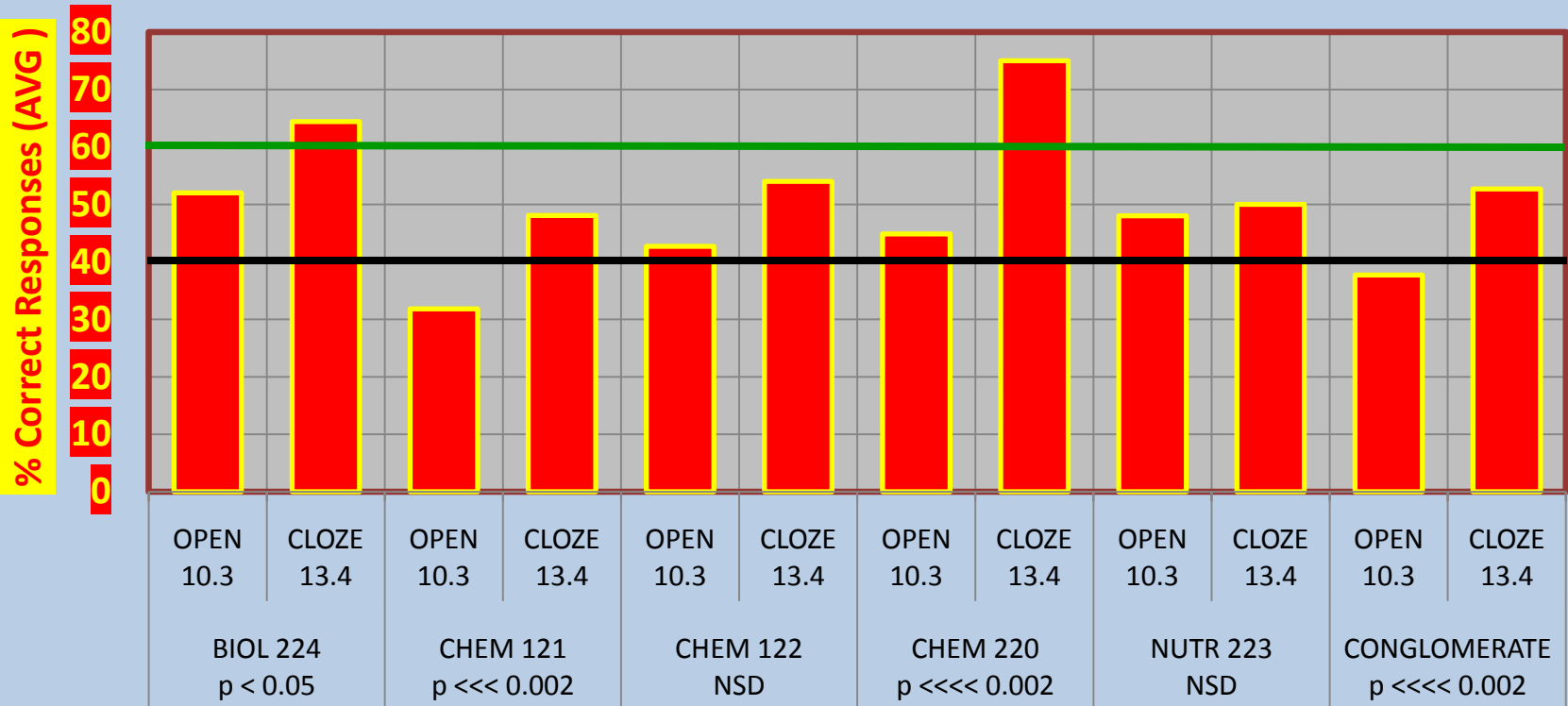




# Results



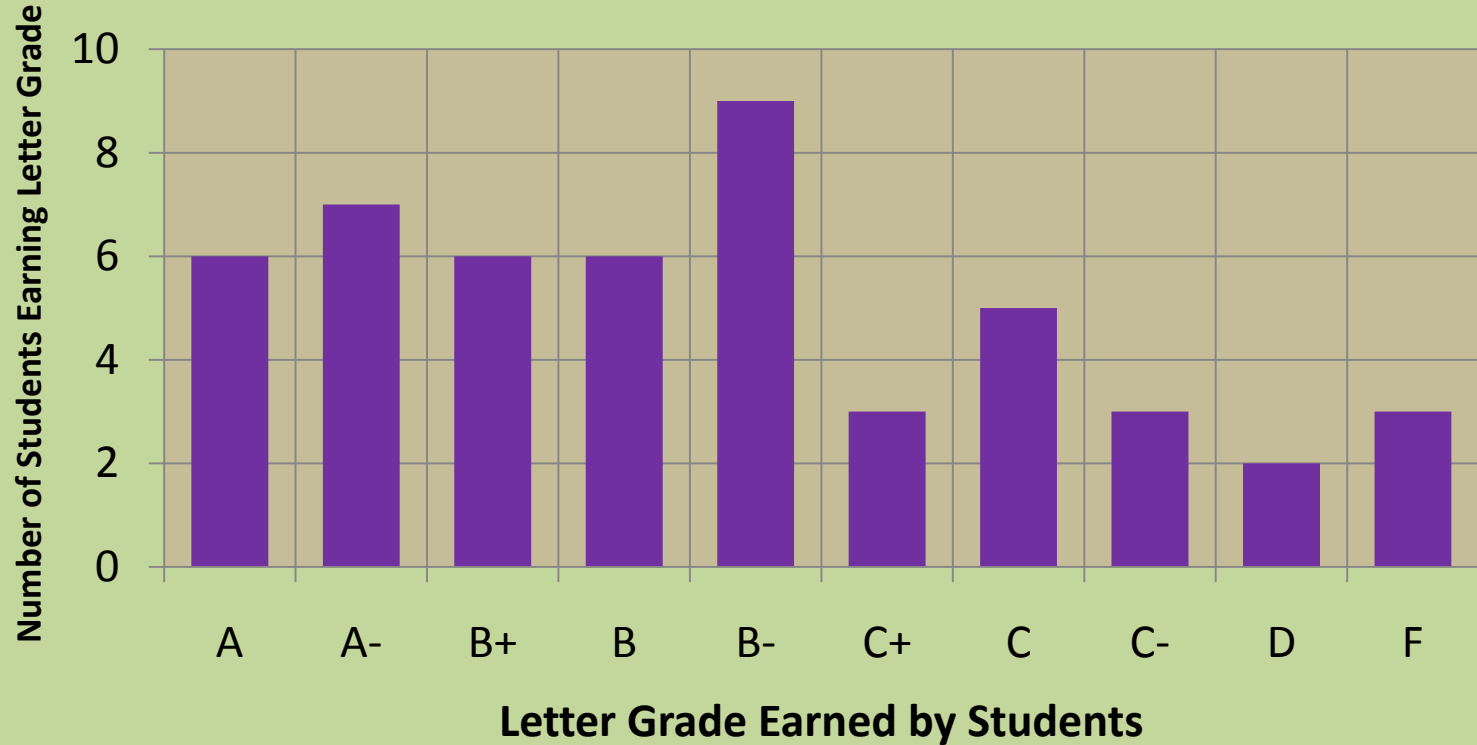
## Background Knowledge and Interpretation Assessment 2009-01, Cloze Method



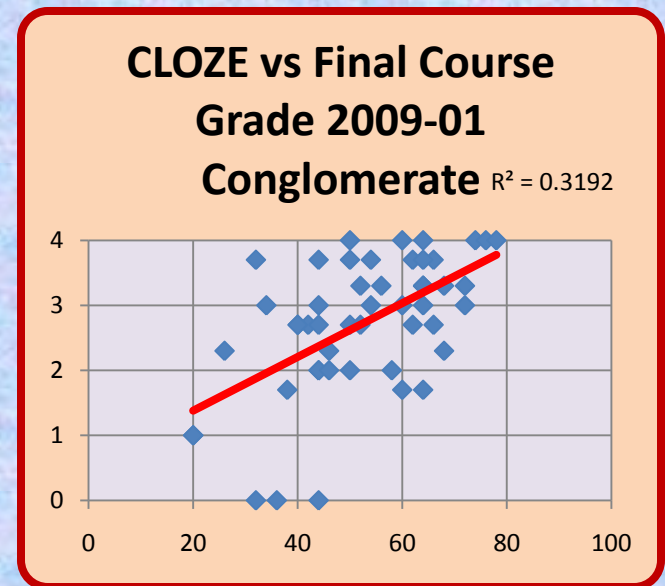
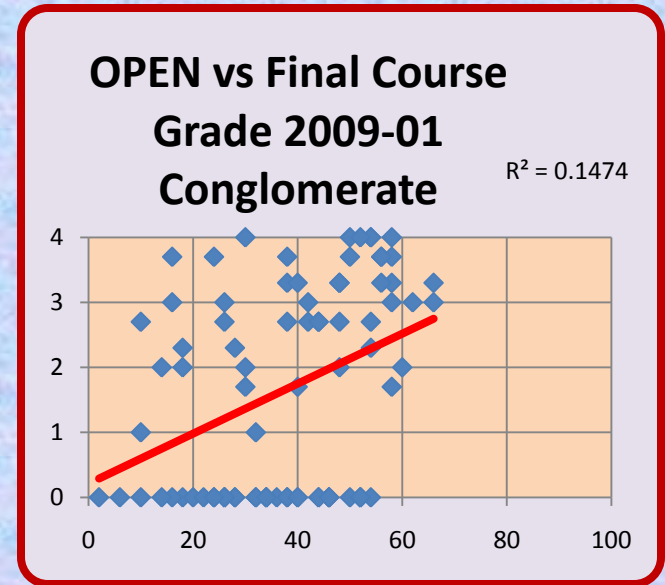
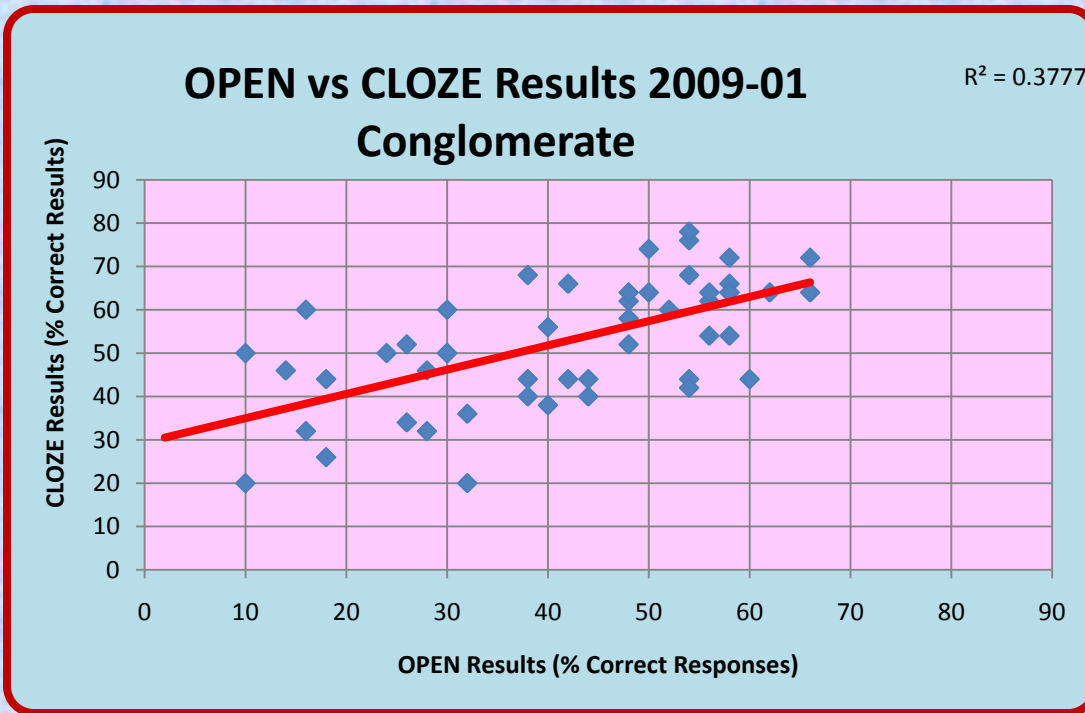
# Results



Spring 2009 Final Letter Grade Distribution



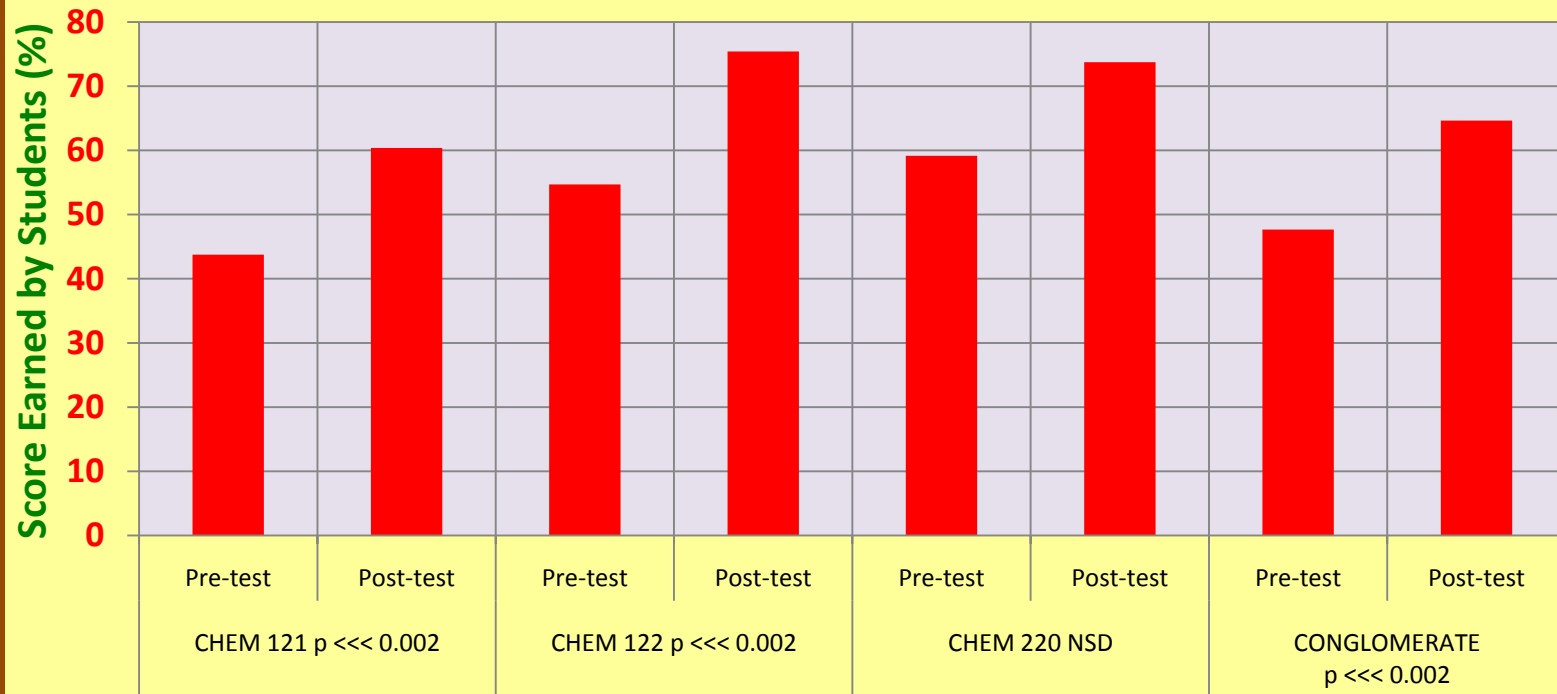
# Results



# Results



## MATH Pre & Post Test Results: CHEM 121 CO3, CHEM 122 CO1, CHEM 220 CO1, 2009-01

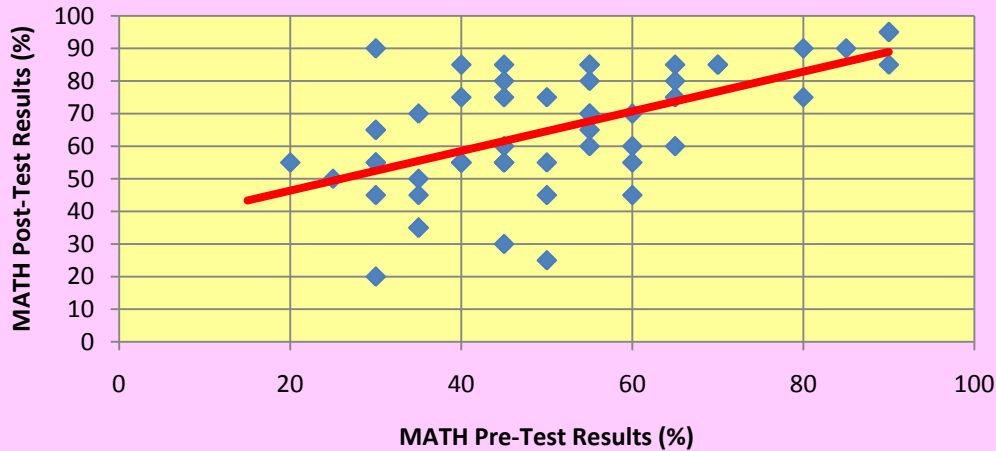


# Results



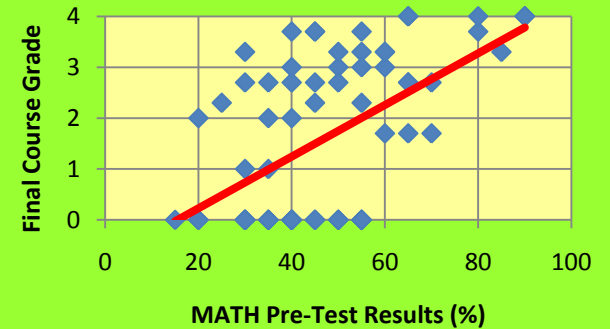
**MATH Pre-Test vs Post-Test 2009-01  
CHEM ONLY**

$R^2 = 0.3355$



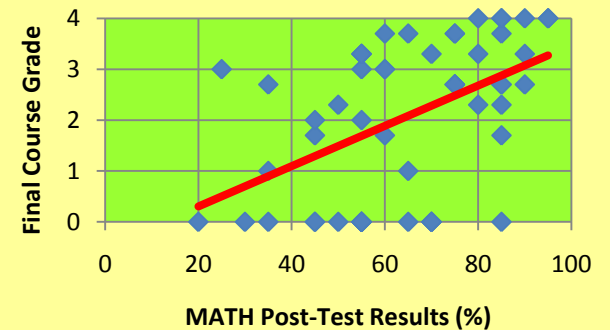
**MATH Pre-Test vs Final  
Course Grade 2009-01  
CHEM ONLY**

$R^2 = 0.312$



**MATH Post-Test vs Final  
Course Grade 2009-01  
CHEM ONLY**

$R^2 = 0.2421$

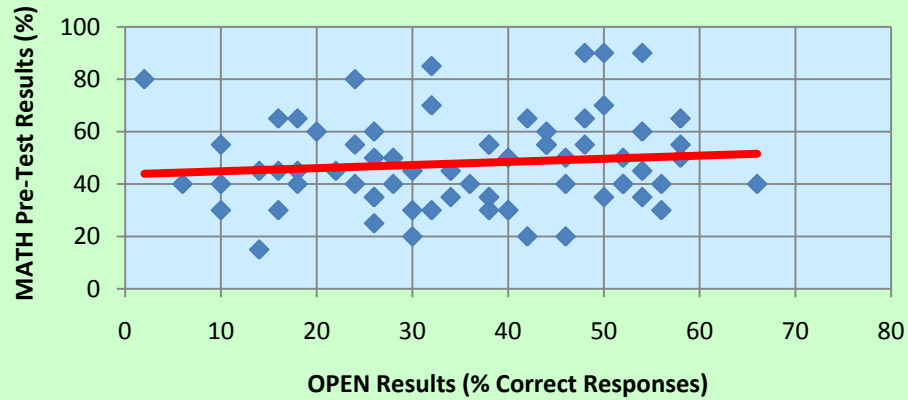


# Results



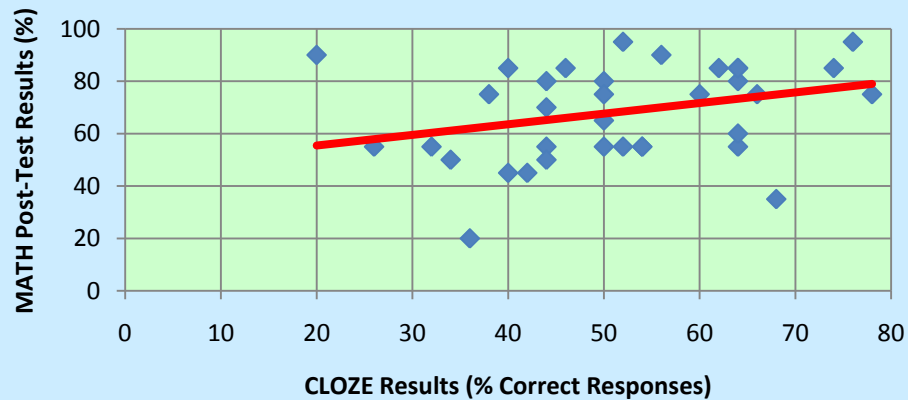
**MATH Pre-Test vs OPEN  
CHEM ONLY 2009-01**

$R^2 = 0.0109$



**MATH Post-Test vs CLOZE  
CHEM ONLY 2009-01**

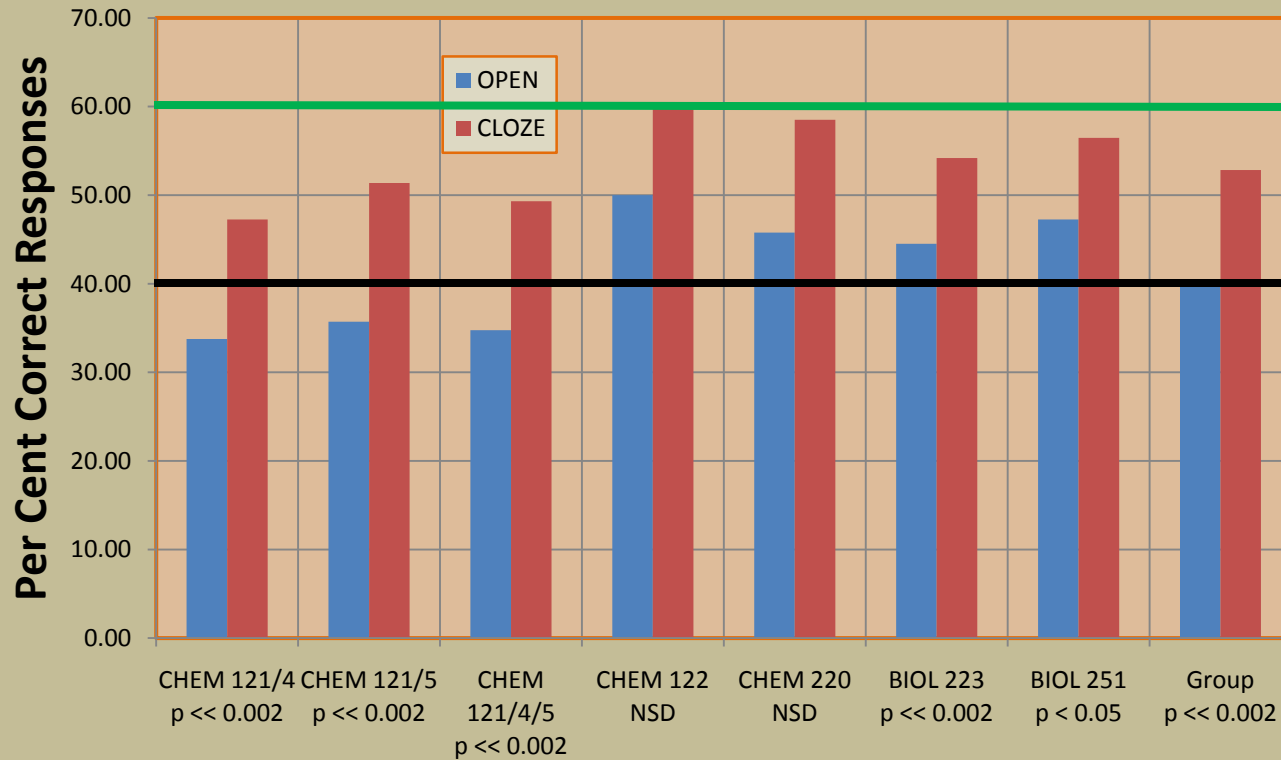
$R^2 = 0.096$



# Results



## Reading Assessment -- 2009-03 Courses

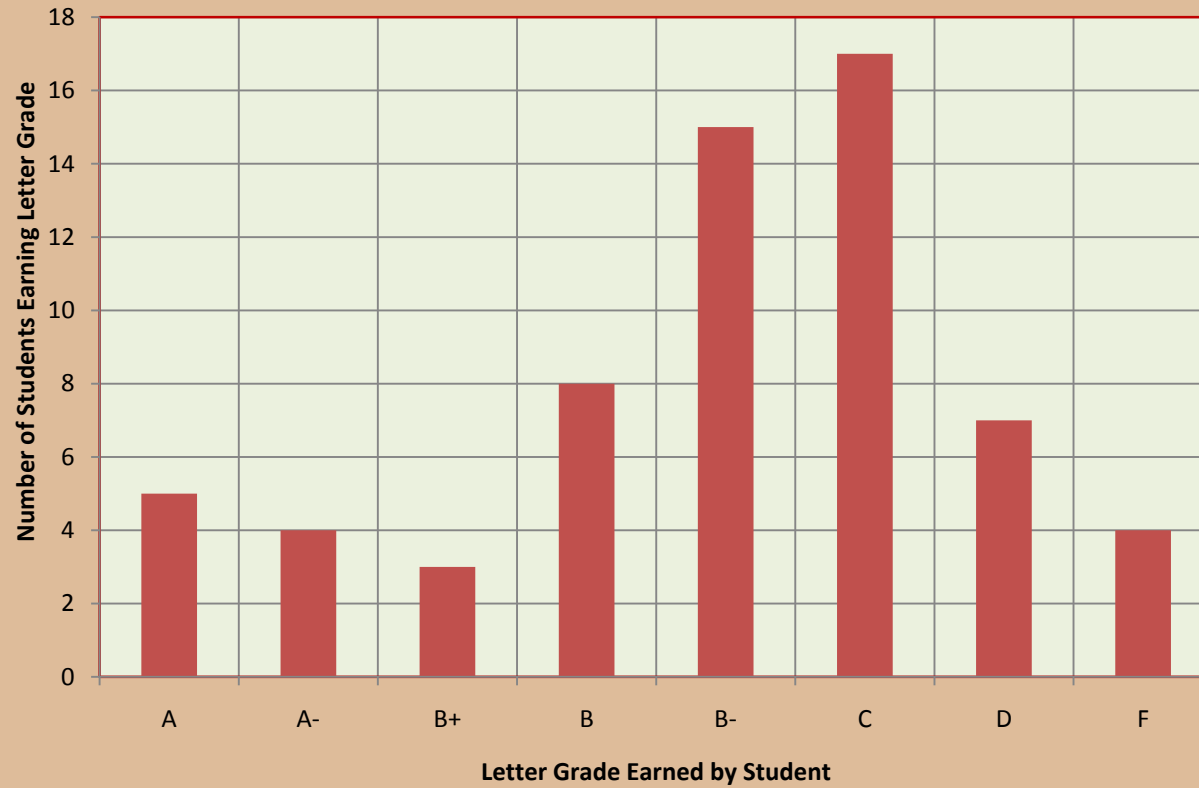


## Student Results by Course

# Results



**All Course Grades 2009-03 Distribution**

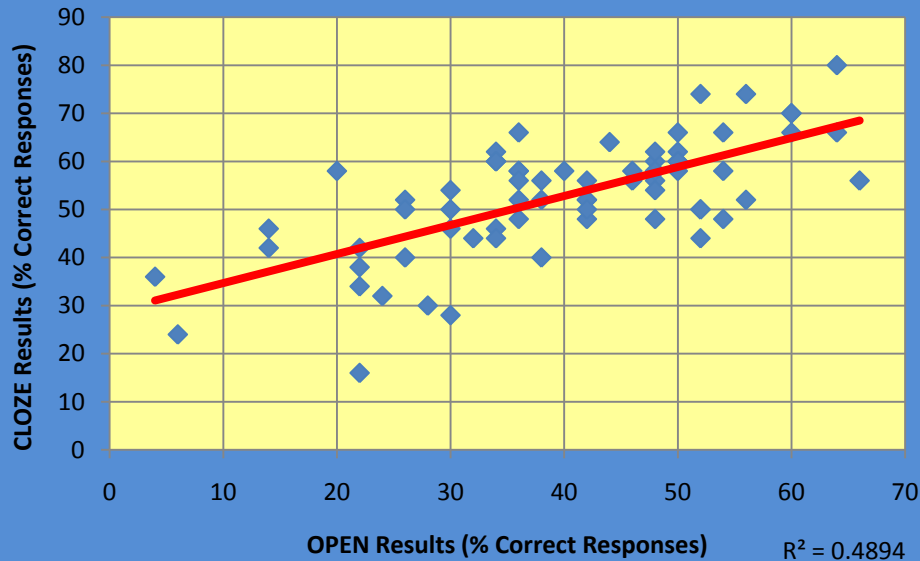




# Results

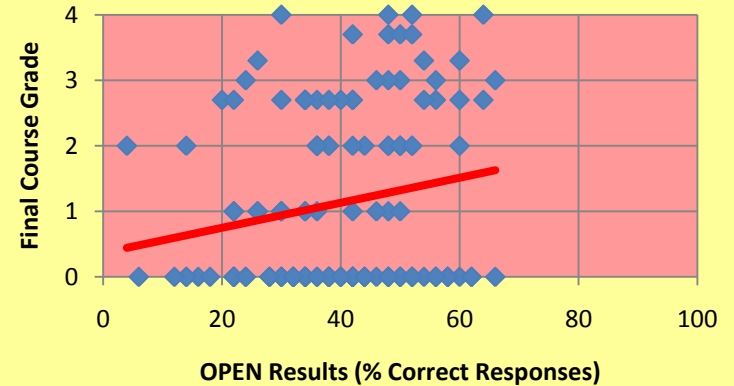


### OPEN vs CLOZE 2009-03 Conglomerate



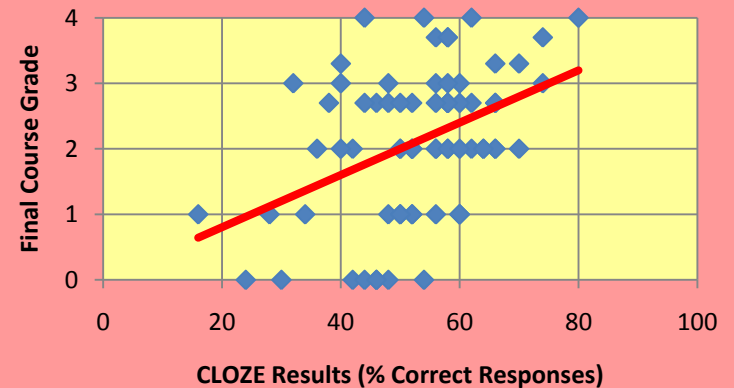
### OPEN vs Final Course Grade 2009-03 Conglomerate

$R^2 = 0.036$



### CLOZE vs Final Course Grade 2009-03 Conglomerate

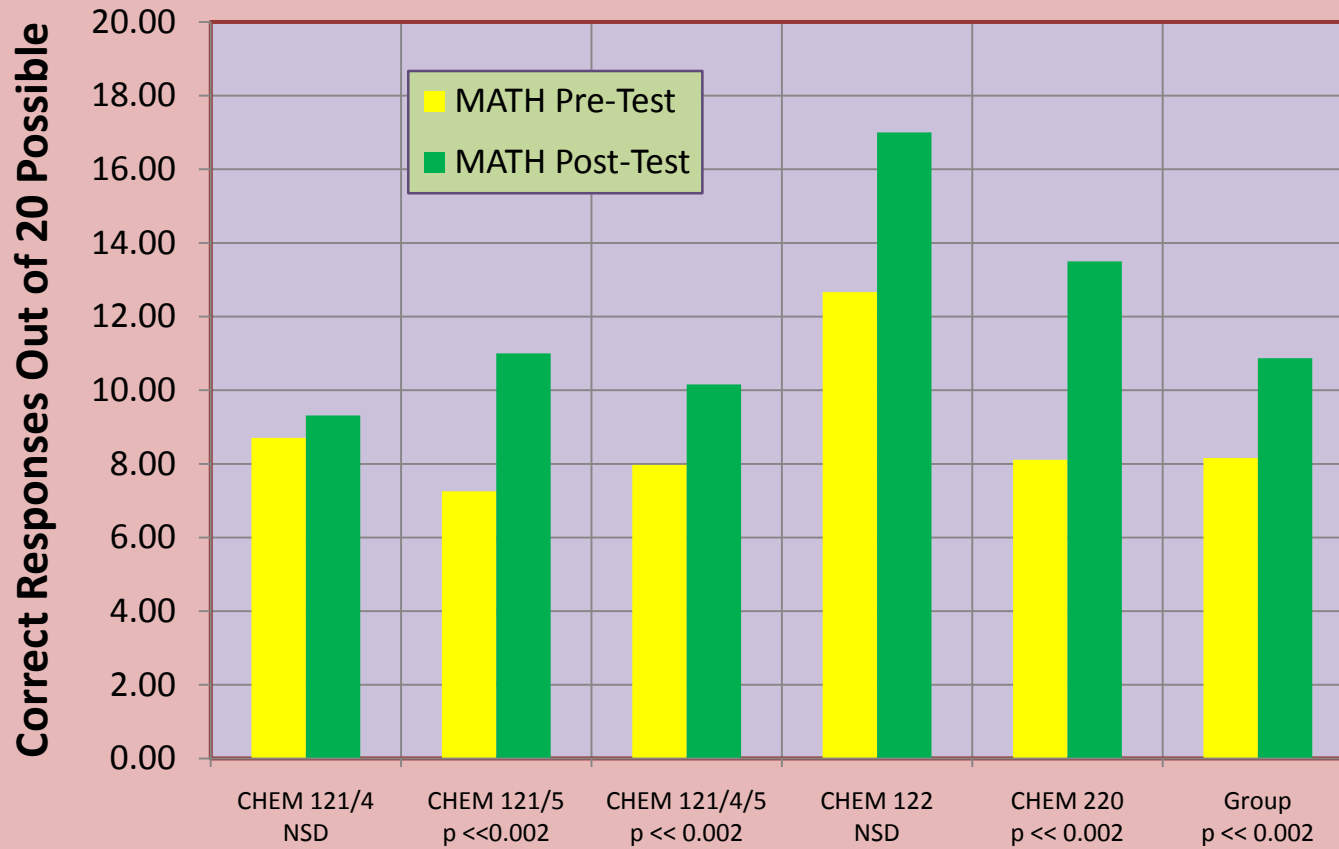
$R^2 = 0.1782$



# Results



## 2009-03 MATH Pre-Test vs Post-Test Assessment Results



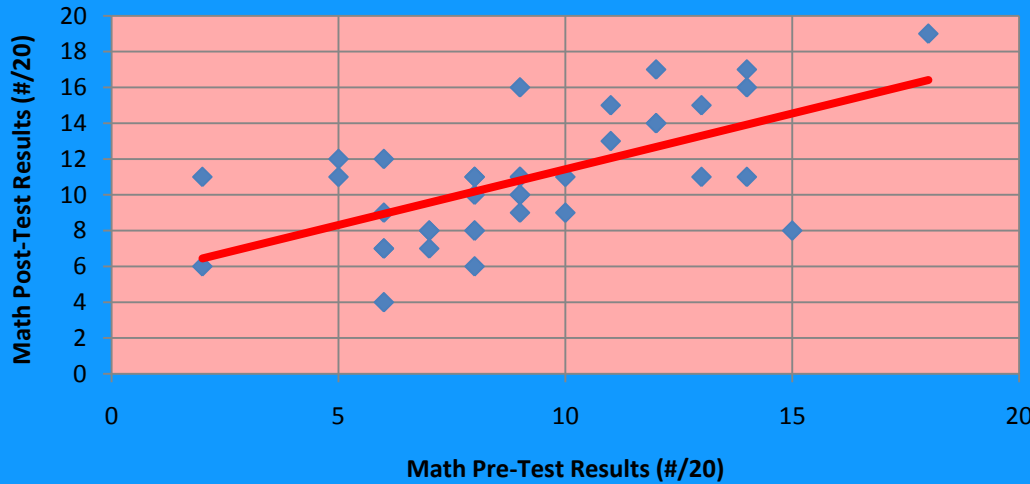
## Student Results by Course

# Results



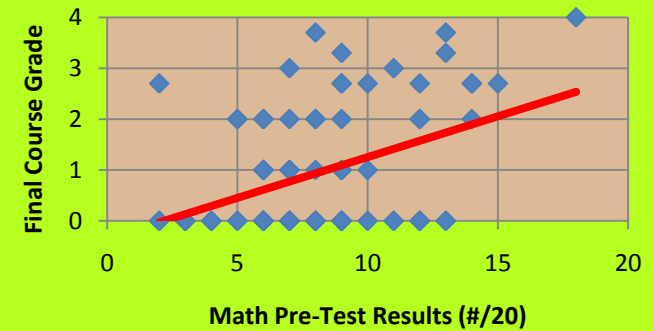
### Math Pre-Test vs Math Post-Test 2009-03 CHEM ONLY

$R^2 = 0.3925$



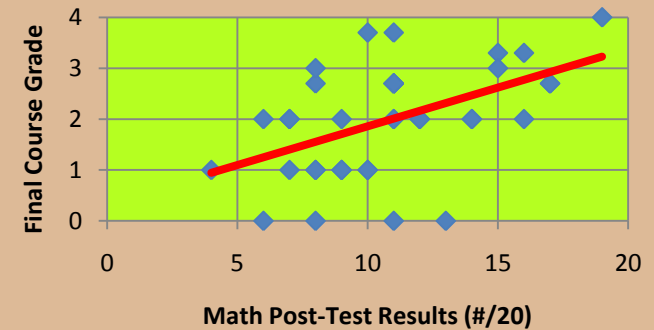
### MATH Pre-Test vs Final Course Grade 2009-03 CHEM ONLY

$R^2 = 0.1768$



### MATH Post-Test vs Final Course Grade 2009-03 CHEM ONLY

$R^2 = 0.2412$

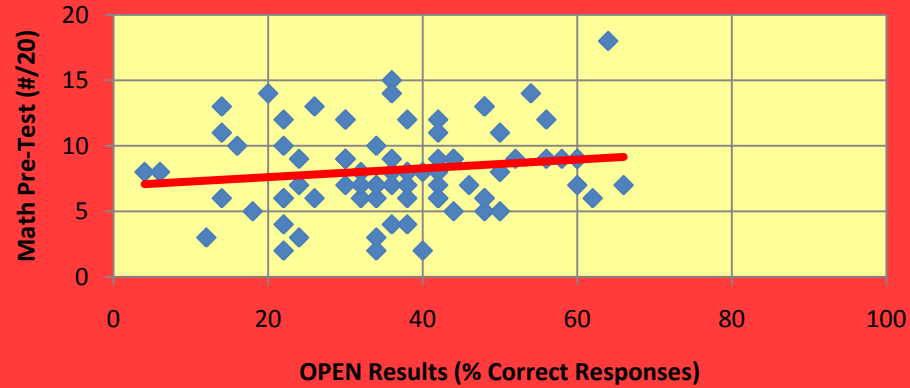


# Results



**Math Pre-Test vs OPEN 2009-03  
CHEM ONLY**

$R^2 = 0.0199$



**Math Post-Test vs CLOZE 2009-03  
CHEM ONLY**

$R^2 = 0.1901$



# Results and Discussion



- MATH – on average, students score a low F on the pre-test
- MATH – on average, students score a high F on the post-test
- To combat this: wrote a “MATH Primer” – it is now at 450 questions. It is worth points for turn-in.
- It looks superficially as if it helps ... some.
- Spring 2009: post-test given within one week of completing Primer
- Fall 2009: post-test given at end of semester



# Results and Discussion



- READING: on average, 10<sup>th</sup> grade reading is too challenging for students, OPEN
- READING: on average, 13<sup>th</sup> grade reading is instructional for students, CLOZE
- Purchased books for Reserve in Library and gave assignments in it by student self-reporting, Spring 2009.
- No difference between the three groups, Fall 2008, Spring 2009 and Fall 2009 in CLOZE.
- More info difficult to get due to different groups of people and attrition

# Conclusions



Differences are real ... at least statistically.

Reading skills improve throughout the semester and are probably due to “re-use” and “practice”.

Math skills improve throughout the semester and seem to “stagnate”, i.e., the time of the semester that the post-test is given doesn't seem to matter.

Pre-requisite and co-requisite courses need to be enforced.

# Future Assessment Plans



- For Reading:
  - Add on one more CLOZE and see if the students can approach/meet grade 15 skill level
  
- For Math
  - Use a standardized MATH placement exam to see what MATH course the students test into at the beginning of the course and at the end of the course
  
- For CHEM
  - Consider bringing back the ACS exams – students WERE ahead of the national curve – are they still?
  - MATH pre-req needs to be enforced
  
- For BIOL
  - Consider obtaining NLNAC's Standardized A&P exam



# Post Notes

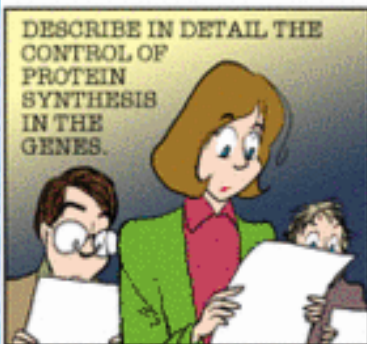
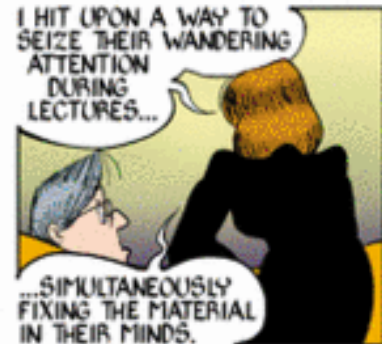
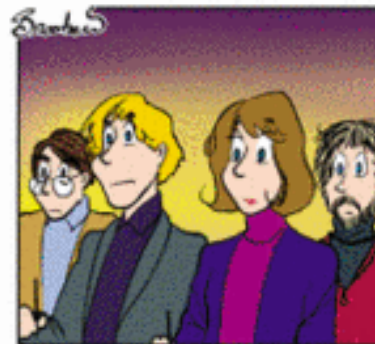


- ✓ Students who come to office hours regularly (at least twice a week) earn 1 letter grade higher a final course grade than those who do not.
- ✓ Students (self study) do equate earned grade with study time.
- ✓ Students do use other resources to study.
- ✓ Common exam questions have taught me that little learning occurs in the freshman courses – more occurs in the sophomore courses – it may be due to a lack of familiarity (at first) as well as a result of repetition (at 2<sup>d</sup>, 3<sup>d</sup>, 4<sup>th</sup> ...).
- ✓ MATH remains a problem: MATH 100B, CHEM, NURS 300. MATH, SCI, NURS all use math – it may behoove all of us to find a way to work together across NSHE to find a “math fix” – if there is one.
- ✓ Homework: what used to be instructable in 5 problems now takes 15-25 and, in some cases, 100 problems.
- ✓ Of students who remain in the course, 80+% pass the course with a grade of “C” or better.

# Post Notes



- ✓ Students may also need to be involved in assessment – many don't care for the additional work that is required of them – perhaps their “buy-in” will improve that involvement.
- ✓ ALL faculty and ALL administrators need to be 100% involved in assessment ... if not, we get a “mobile” effect.
- ✓ Other students matriculate with other faculty ... and show reading difficulties after completing pre-req courses successfully – implications? ... or not? Again, HOW do we apply “assessment”?
- ✓ Assessment in some cases may appear to indicate improvement, when it may simply be due to attrition – in some courses, there is as much as 50% attrition.
- ✓ Are X-mas break and Summer break too much time between semesters? Trimester? Quarter systems “better” for retention?
- ✓ Students who withdraw from a course are not easily separated, statistically, from the students who remain by MATH or READING assessments, i.e., their differences seem to be more of those of commonalities.



9 Chickweed Lane – date unknown