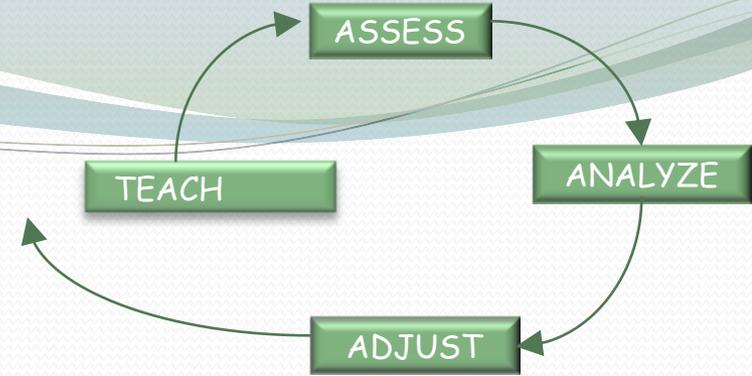


EMBEDDED ASSESSMENT IN AN INDIVIDUAL COURSE:

Writing Better Exam Essays
in Human Physiology

Howard Booth

HUMAN PHYSIOLOGY TEACHING IMPROVEMENT PROJECT



History and evolution into a SOTL project

My conviction: science students need to communicate in their discipline
Revealing misconceptions: Student writing is a prime place to assess their understanding of content but poor writing skills distorts this assessment and lowers exam scores disproportionately.

(Good students were losing many essay points due to poor writing)

The challenge: good writing is hard work for teachers and students

Traditional resolutions: ignore it, require it, or teach it

Hypothesis: If students understood and applied good organizational and proofreading techniques to their writing, essay scores would move up to be comparable to the rest of the exam and provide a truer assessment of their learning.

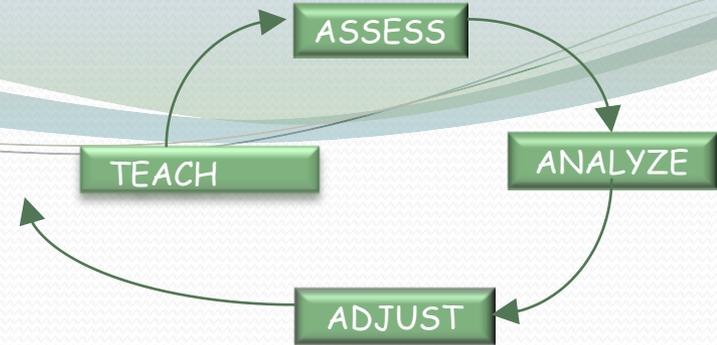
Goal of the project: to improve the Big Essay scores (worth 25% of the exam; 4 exams per semester)

- Through a focused effort to teach students better essay writing skills
- Through a secondary focus on improving organization and coherence

Students Learning Outcome 2: Students will communicate scientific knowledge and concepts in written form.

Students Learning Outcome 3: Students will synthesize scientific knowledge in higher level thinking problems.

TEACH Phase 1: Getting Organized



The SOTL Experiment

Control group: Student exam and essay scores from 2008 (before essay focus)

Experimental Group: Fall 2009 and Winter 2010 classes

- All students: essay score and exam scores

- Subgroup: student scores from Rewrite Workshop

Time Line --- Methods and materials

Pre exam 1: All lecture instructions “how to take the exam” (5 min)

Post exam1:

- All lecture illustration of an excellent essay answer (10 min)

- Essay rewrite workshop: For those “performing poorly” or “want to do better”

 - Instruction-discussion on writing & organization skills (40 min)

 - Re-write exam1 essay: take home, self timed (30 min)

 - Re-Grade: scores, written comments & personal discussion

Post exam 2: lecture discussion/illustration of a concept map of essay (15 min)

Pre exam 4: Opinion survey on rubric & essay scoring

- Inclusion of an additional rubric statement.

ASSESS:

Essay 1 Example

“Bill”, A good Student

89% = “A-” on Non-essay Part of exam

Earning A Poor essay Score

16 of 28 is 57% = “D”

25-9 = 16

Part VII **BIG!** Essay (25 pts). Discuss the interconnection of nervous and endocrine systems and the roles of the hypothalamus, pituitary (anterior and ~~posterior~~ thyroid and the adrenal cortex in coordination of the action of hormones on their tissue targets. **SELECT 2** of the 12 terms or phrases to build into your essay. **Circle and number** the 9 terms /phrases **in your essay** when you incorporate them correctly. You need to describe each circled term/phrase with **enough detail** that its meaning is evident. Your writing should be (neat) concise, fact filled and limited to the space provided. (You can use the other terms/phrases just do not number and circle them for grading). **2 pts** per term/phrase and **7 pts** for a complete and well written essay. Thanks (include **what is it? where is it? what does it do?**)

(0-3 bonus points for the extra mental exertion/challenge of putting your thoughts together in a **good to excellent** essay. --score 17 or 18 = 1 bonus pt, score 19 or 20 = 2 bonus pts, score 21-25 = 3 bonus pts) Penalties, you may loose points for: misstatements, BS/nonsense statements, failure to circle and number, splitting or changing a key phrase

Alternative to writing the essay: (24 pts) In the essay space **define and describe** the 12 terms/phrases as they relate to the essay theme. -- 2 pts each term (Include: **what is it? where is it? what does it do?**)
 (These terms/phrases are not ALL you need to adequately complete this essay, they are just guidelines to the depth of your discussion)

- | | | | |
|-------------------|--------------------|----------|--------------------------------|
| 1 Tropic hormones | 4 protein hormones | thyroxin | 6 short negative feedback loop |
| 8 Sensory nerves | 4 cortisol | 2 ACTH | 7 CNS integration & signaling |
| Neurohormones | TSH | 3 CRH | 5 nuclear receptor |

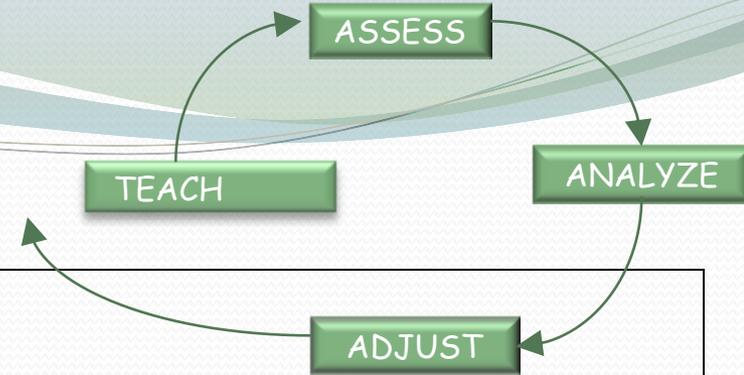
Remember to NUMBER & CIRCLE 9

THE NERVOUS AND ENDOCRINE SYSTEM ARE INTEGRATED AND WORK TOGETHER TO MAINTAIN AND REGULATE HOMEOSTASIS. THE HYPOTHALAMUS IS THE CEO OF THESE FUNCTIONS. ^{1 * explain it} ~~RELEASING~~ TROPIC HORMONES THAT ACT ON THE PITUITARY GLAND. ONE SUCH HORMONE IS ² ACTH WHICH ³ SIGNALS THE PITUITARY TO RELEASE ⁴ CORTISOL. ⁵ CORTISOL IS A ⁶ PROTEIN HORMONE THAT WILL BIND WITH A ⁷ NUCLEAR RECEPTOR AND ACTIVATE GENE TRANSCRIPTION. THIS PROCESS IS REGULATED BY BOTH ⁸ SHORT NEGATIVE FEEDBACK LOOPS (EXACTLY BACK TO THE HYPOTHALAMUS) AND LONG NEGATIVE FEEDBACK LOOPS. THIS ⁹ SIGNALING ALLOWS FOR INTEGRATION BY THE CNS. ¹⁰ SENSORY NERVES ARE DIFFERENT PATHWAY THAT AID THE CNS IN RECOGNIZING THE OUTSIDE WORLD, AND ALLOW IT TO KNOW WHEN ADJUSTMENTS ARE REQUIRED.

10 completed
- 2 { Essay needs to have more depth
more descriptions of key terms

TEACH Phase 2: The Workshop

Doing the “Experiment”



Workshop Highlights

- **Blue print** - how to write a good paragraph: Theme introduced in topic sentence, supporting sentences in logical order, a conclusion. Science writing is concise, detailed, accurate, breadth of the theme
- **Building blocks**- analyze the question (see printout)- finding out what to include Main theme, mentioned areas of interest, required 9 terms/phrases
- **Organizing the construction site**- organization of logical sequence Outline areas of interest and terms-- flow diagram & concept map
- **Building it**-- apply above -- also, some hints on good construction Set aside enough time, avoid “wordy” superficial statements, use the space provided- not more , not less. Write neatly, 14-18point too small hard to read, too large wastes space. Spell correctly.
- **Building inspection**-- proof read, all “areas of interest” included?’ & terms used correctly, explained, circled and numbered? match your essay with rubric - avoid losing unnecessary points
- **Avoid building disasters**-- **study !** If your blocks crumble----- if you don’t know the content, good writing won’t help much

ASSESS:
"Bill's"
Rewrite

Scored
 92%
 On
 The
 Rewrite

34.9%
 Better

From a
 "D"
 Up to
 an "A-"

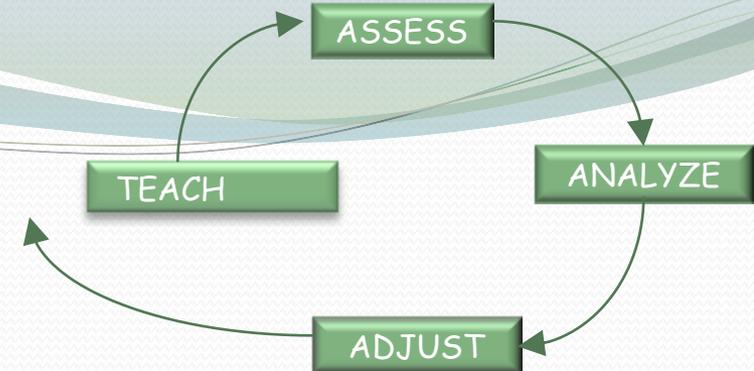
Part VII BIG! Essay (25 pts). Discuss the interconnection of nervous and endocrine systems and the roles of the hypothalamus, pituitary (anterior and posterior), thyroid and the adrenal cortex in coordination of the action of hormones on their tissue targets. **SELECT 9** of the 12 terms or phrases to build into your essay. **Circle and number** the 9 terms /phrases **in your essay** when you incorporate them correctly. You need to describe each circled term/phrase with enough detail that its meaning is evident. Your writing should be (near) concise, fact filled and limited to the space provided. (You can use the other terms/ phrases just do not number and circle them for grading). **2 pts per term/phrase and 7 pts for a complete and well written essay.** Thanks (include what is it? where is it? what does it do?)
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- | | | | | |
|--------------------|--------------------|----------|--------------------------------|-------------------------------------|
| ② Trophic hormones | ① protein hormones | thyroxin | ⑥ short negative feedback loop | Remember to
NUMBER &
CIRCLE 9 |
| ④ Sensory nerves | ⑤ cortisol | ④ ACTH | ⑦ CNS integration & signaling | |
| ⑧ Neurohormones | TSH | ③ CRH | ⑨ nuclear receptor | |

THE ENDOCRINE AND NERVOUS SYSTEMS ARE THE MEANS BY WHICH THE CNS PERCEIVES AND RESPONDS TO THE OUTSIDE WORLD AND BY WHICH HOMEOSTASIS IS MAINTAINED. INCOMING STIMULI ARE CARRIED BY AFFERENT OR ① SENSORY NERVES TO THE CNS. THE HYPOTHALAMUS, A NERVE INTEGRATION CENTER, COORDINATES THE RELEASE OF ② TROPHIC HORMONES WHICH ACT ON OTHER ENDOCRINE GLANDS TO SECRETE OR INHIBIT FURTHER HORMONES. FOR EXAMPLE ③ CRH IS RELEASED TO TARGET THE PITUITARY GLAND. THIS ENDOCRINE GLAND IS REALLY TWO GLANDS FUSED TOGETHER, ANTERIOR & POSTERIOR AND THEY FUNCTION SEPARATELY TO SECRETE HORMONES. AND NEUROHORMONES RESPECTIVELY. ANTERIOR WHEN CRH REACHES THE PITUITARY THE ANTERIOR PITUITARY RELEASES THE HORMONE ④ ACTH. THIS PROTEIN HORMONE IS COMPOSED OF PEPTIDE CHAINS. ACTH TARGETS THE ADRENAL CORTEX LOCATED ATOP THE KIDNEYS BUT ALSO ACTS AS A ⑤ SHORT NEGATIVE FEEDBACK LOOP SIGNALING THE HYPOTHALAMUS TO DECREASE THE SECRETION OF CRH. THIS THESE ⑧ NEUROHORMONES WHICH ARE PRODUCED BY THE NERVOUS SYSTEM FEEDBACK, STAY WITHIN APPROPRIATE RANGES. ACTH AT THE ADRENAL CORTEX STIMULATES THE RELEASE OF ⑥ CORTISOL, A STRESS RELATED HORMONE AND ALSO A ⑨ PROTEIN HORMONE. WHEN IT REACHES ITS TARGET IT CAN BIND WITH RECEPTORS IN CYTOSOL OR NUCLEAR RECEPTOR WHERE IT ACTIVATES GENE TRANSCRIPTION. A SIMILAR PATTERN OF SECRETION AND RESPONSE CAN BE FOUND WITH RELATION TO THE THYROID GLAND IN THE NECK WHEREBY THE HYPOTHALAMUS RELEASES TRH TO THE ANTERIOR PITUITARY WHICH RELEASES TSH WHICH BOTH FEEDS BACK AS WITH ACTH AND ACTS ON THE THYROID TO STIMULATE THE SECRETION OF THYROID HORMONES.

Much better 14/25 to 24/25 Bonus pt

ANALYZE: What we were looking for and what we found



The Results

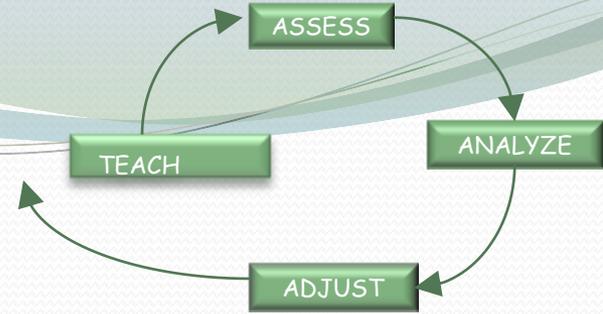
- The quality of the re-writes improved:
 - F'09, 13/28 (46%) to 23/28 (82%) a gain of 36 %
- Improvement carried into exam 2 and beyond
 - 13/28 to 19.8/28 (up 70.1%) on exam 2.
- Overall exam scores moved up over 5% from 74.4% to 79.7% .
- Numerous positive student comments about the experience and their increased comfort with essay writing. “ I loved the essay format- very helpful” F'09.
- Participation increased from 15/60(25%) F'09 to 38/61 W'10(62%) (up 37%)
- Rubric Opinion Survey to assess student misconceptions or concern on scoring
- Change was greatest in the poorest writers, about 65% improved dramatically

Data Chart of Essay Score Averages before (W'08) and now (W'10)

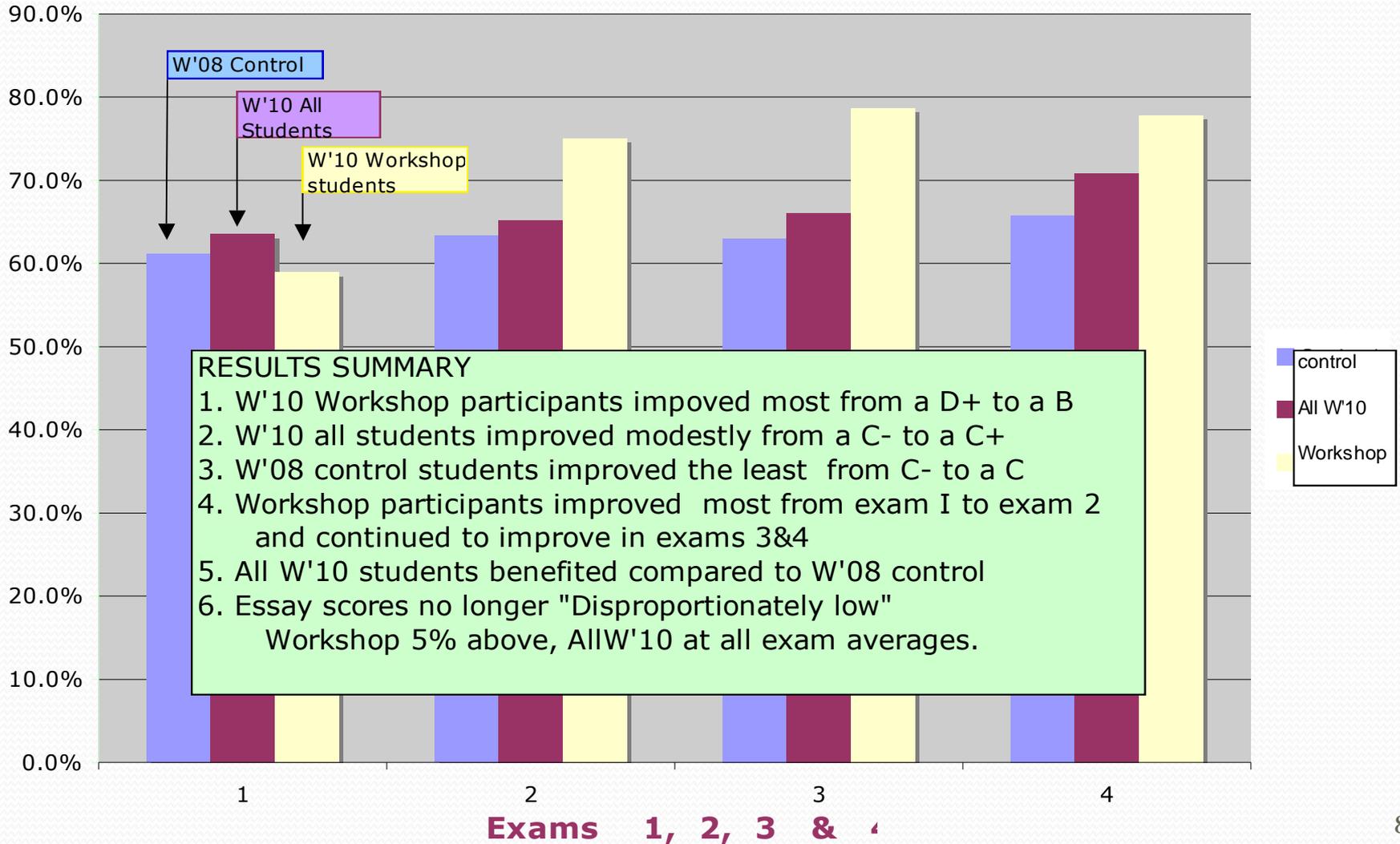
	Exam 1	Exam 2	Exam 3	Exam 4
All students Average	17.8	18.3	18.5	19.8
% change number/28 possible	63.5%	65.2%	66.1%	70.8%
Workshop student averages	16.8	21.0	22.0	22.0
% change number/28 possible	59.9%	75.5%	78.6%	77.8%
W'08 Control all students' essays	61.7%	63.3%	63.0%	66.1%

And see the Graph next slide

ANALYZE : Results Graph and Summary



Graph of Essay Score Averages Before and Now



ANALYZE:
Rubric
Survey Results

Opinion Survey on Big Essay Points Distribution (scoring rubric)

Please circle the letter before the statement to indicate your level of agreement with it.

- a= strongly agree 5pt
- b= agree 4pt
- c= neither agree nor disagree 3pt
- d= disagree 2pt
- e= strongly disagree 1pt

(Any comments explaining your thoughts would also be very helpful,. Thanks)
40 students responded (out of 53 still attending near the end of the semester)

Conclusions:

1. Understanding the essay scoring is not much of a problem
2. It's easy to fix it for the few who were concerned

(add a statement to the exam)

1. (a b c d e) As I read the essay question itself, I think I have a clear idea of how I can earn full points.

Results: 4 @ 2pt, 3@ 3pt, 24@ 4pt 9@ 5pt = average 4.0 out of 5.0
Analysis: Most didn't see rubric scoring as a problem, but 7 (20%) did have concerns here.
Comments: " very clear"

" the essay questions are usually straight forward and you know you they are supposed to be answering." ,
" once I went to the workshop I was able to better understand how the essay was to be written"

2. (a b c d e) A separate check list and explanation, not part of the question itself explaining point distribution (scoring rubric), would make this process more understandable.

Results: 1@1, 5@2pt, 9@3pt,18@4, 7@5pts = average of 3.6 out of 5.0
Analysis: Quite a strong feeling this would help. But reading the comments left me thinking this wasn't very important to them. ("can't hurt")
Comments:

"good idea, This will allow students to have an exact account for all points"
"your scoring method is already clear"
"helpful for first exam, I felt very uncomfortable writing it because I had no clue what to expect. A grading rubric would let me know what you were expecting"

3. (a b c d e) Confusion about how I earn the essay points concerns me as I write the essay ("not knowing" where you might gain or lose points interferes with your thought progression as you are planning and writing the essay).

Results: 2@1pt, 13@2pt, 9@3pt, 8@4pt, 5@5pt, = average of 2.9 out of 5
Analysis: Near neutral not strong feeling or comments. Not much of an issue for most
Comments:

"While I'm writing the essay I'm just trying to do the best I can. I'm not worried about the points." " No, depth of answer and lack of time are my concerns", "This can be troubling because the point system isn't cut and dry"

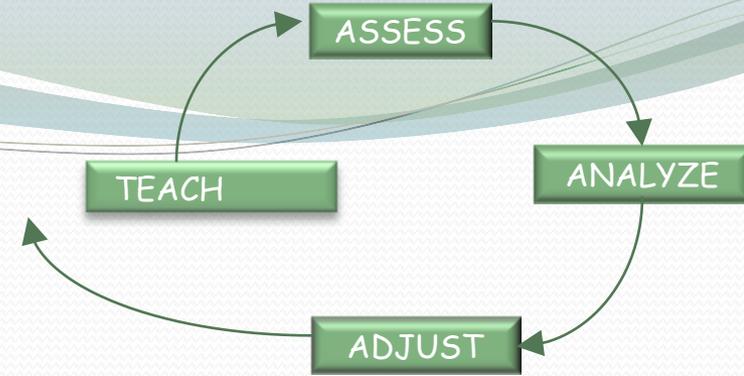
4. (a b c d e) I think more information on the scoring rubric would improve my essay scores.

Results: 3@1pt, 7@2pt, 14 @ 3pt, 14@4, 1@5pt = average of 3.1out of 5
Analysis: Again almost neutral over all but about 30% at least favored the idea. Comments:
"more information never hurts", "a scoring rubric doesn't enhance or inhibit my writing."

5. Any other suggestions?

"A grading rubric at the beginning of the semester would be helpful, I felt very nervous about the first essay, after that it gets easier"

ADJUST: Continuous fine tuning

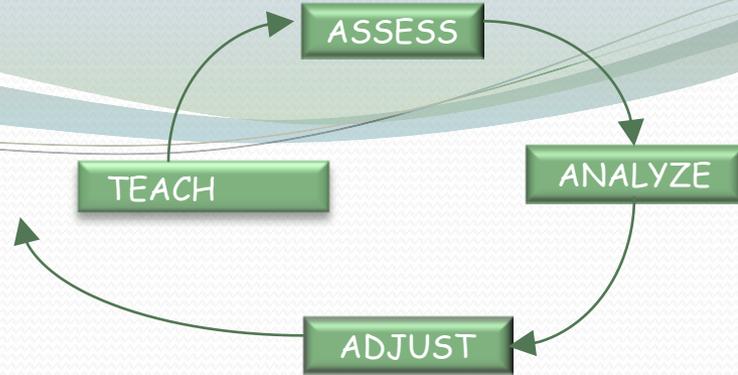


1. Already have incorporated a series of changes

- Three “editions” of workshop notes
 - half page outline of my talking points
 - full page on writing
 - two page handout on writing, organizing, proofreading and rubric
- Adding concept map to lecture presentation W’10
- Expanded “workshop” to a take-home option W’10
- Last week upgraded the handout and sent e-copies to all of my spring students as a Pre Exam 1 study sheet.
- Plan to subdivide workshop participants into working groups this spring.

Conclusions

Yes, teach
it again !



Experiment was a success:

- hypothesis supported
- embedded data collected
- students engaged & learning outcome goals were met
- essay scores improved and now more accurately reflect learning (no longer disproportionately low)
- improved essays: better assessment of misconceptions

Cost/ Benefit Analysis

- costs: clocked about 10 hours per semester
- benefits:

students write better--realize& appreciate it-- “you care” course & the department get assessment quantified
I followed my convictions --teaching “good” writing in science improvement keeps teaching interesting and enjoyable

Bottom line: It was, and is a success at many levels