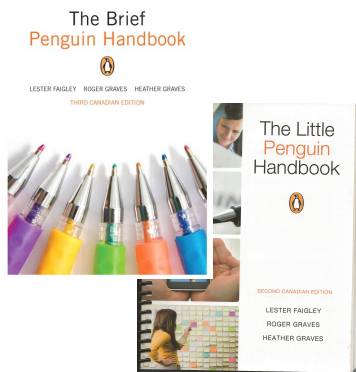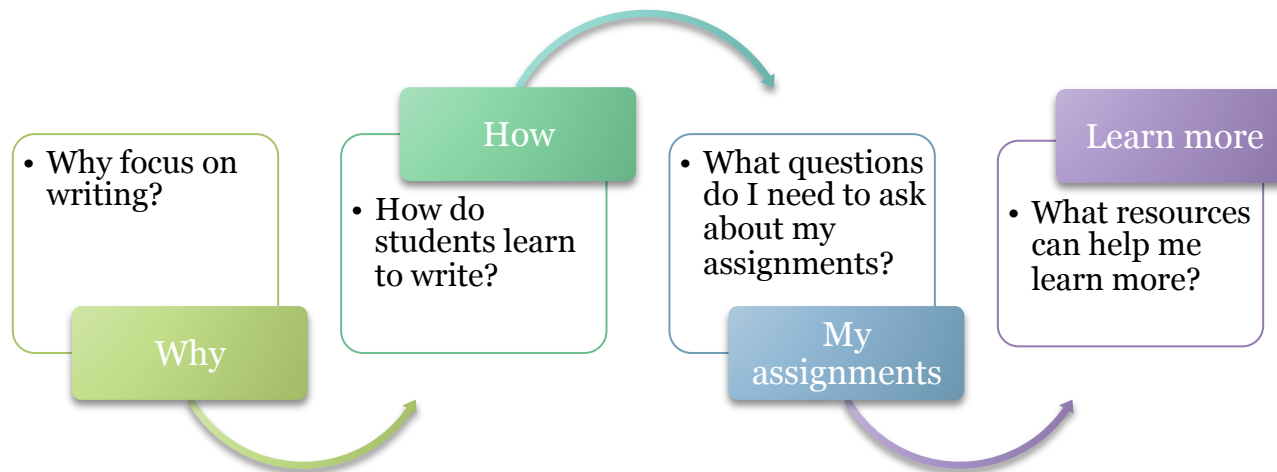# Building a Better Scientific Writer:
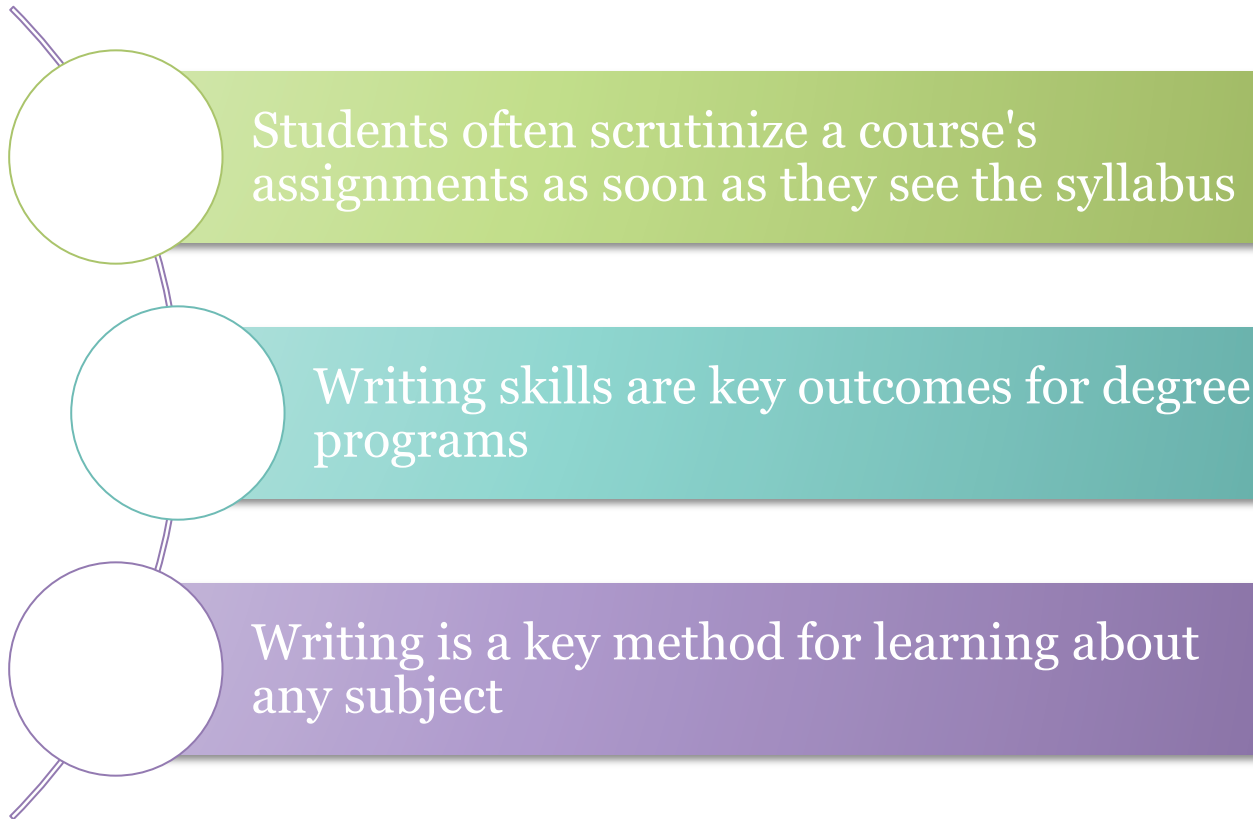# Strategies for Biology Instructors

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Associate Director, Centre for Teaching and Learning
Professor, English and Film Studies
University of Alberta

The Brief
Penguin Handbook

LESTER FAIGLEY   ROGER GRAVES   HEATHER GRAVES
THIRD CANADIAN EDITION

The Little
Penguin
Handbook

SECOND CANADIAN EDITION

LESTER FAIGLEY
ROGER GRAVES
HEATHER GRAVES

Presentation Overview

How

- Why focus on writing?

Why

- How do students learn to write?

- What questions do I need to ask about my assignments?

My assignments

Learn more

- What resources can help me learn more?

Why focus on writing?

Students often scrutinize a course's assignments as soon as they see the syllabus

Writing skills are key outcomes for degree programs

Writing is a key method for learning about any subject

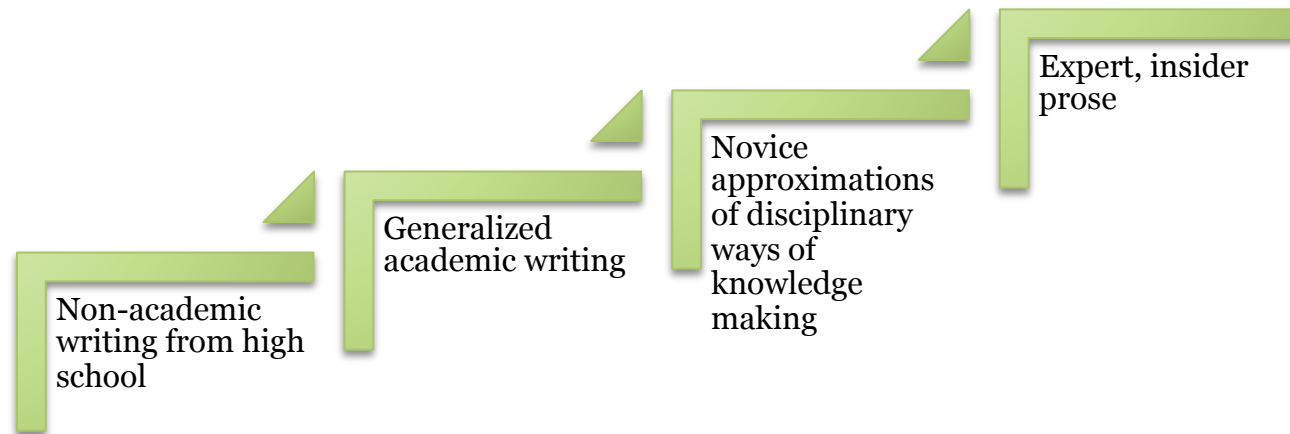Alexander, C. (2007). Literacy Matters: A Call to Action. Toronto: TD Bank Financial Group Study.

Bloom, M. R., Burrows, M., Lafleur, B., and Squires, R. (1997). The Economic Benefit of Improving Literacy Skills in the Workplace. Conference Board of Canada, Ottawa.

National Commission on Writing. (2004). Writing: A ticket to work. . . or a ticket out: A survey of business leaders. Available www.collegeboard.com
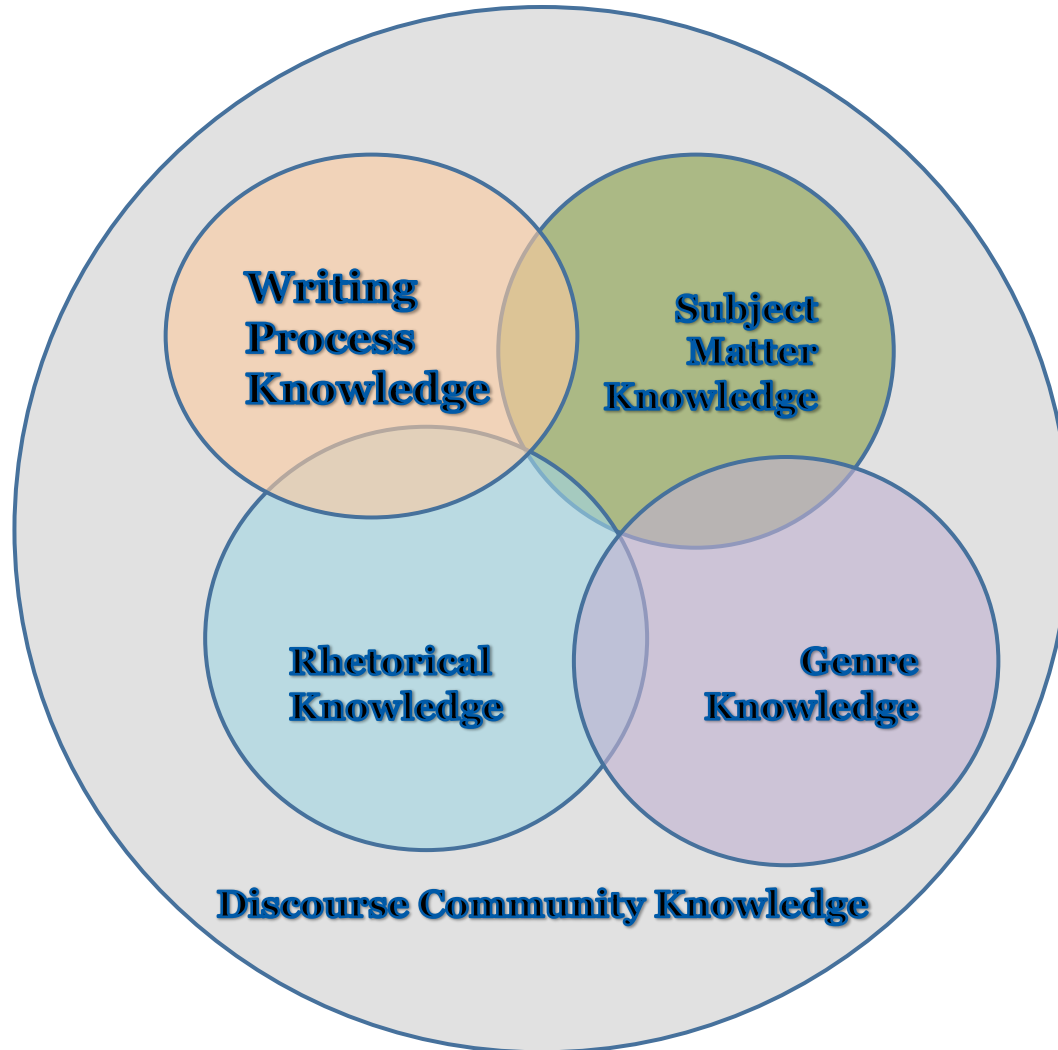
Writing & the economy

The capacity to write well is among the most universal of skill sets required in the modern workforce. At the same time, **preparing students for writing** across the multitude of contexts and modalities they will face in the 21st century economy **is extremely challenging**. It is a challenge worth investing in: Numerous studies over the past decade have demonstrated that raising national literacy rates have a profound effect on the productivity of the Canadian workforce, the quality of life of individual Canadians, and the size of the Canadian economy (Bloom, Burrows, Lafleur & Squires, 1997; TD Bank, 2007; Fisher & Engelman, 2009). TD Bank (2007) found, for example, that a **"1% increase in literacy boosts productivity 2.5% and output 1.5%"** (p. 14) leading to a $32 billion increase in income for each 1% increase in national literacy rates. Writing ability is an important part of that picture, defined by the National Commission on Writing (2004) as a threshold skill that factors into hiring and promotion decisions at 52% of the companies they surveyed.

Stages of student development

Non-academic writing from high school

Generalized academic writing

Novice approximations of disciplinary ways of knowledge making
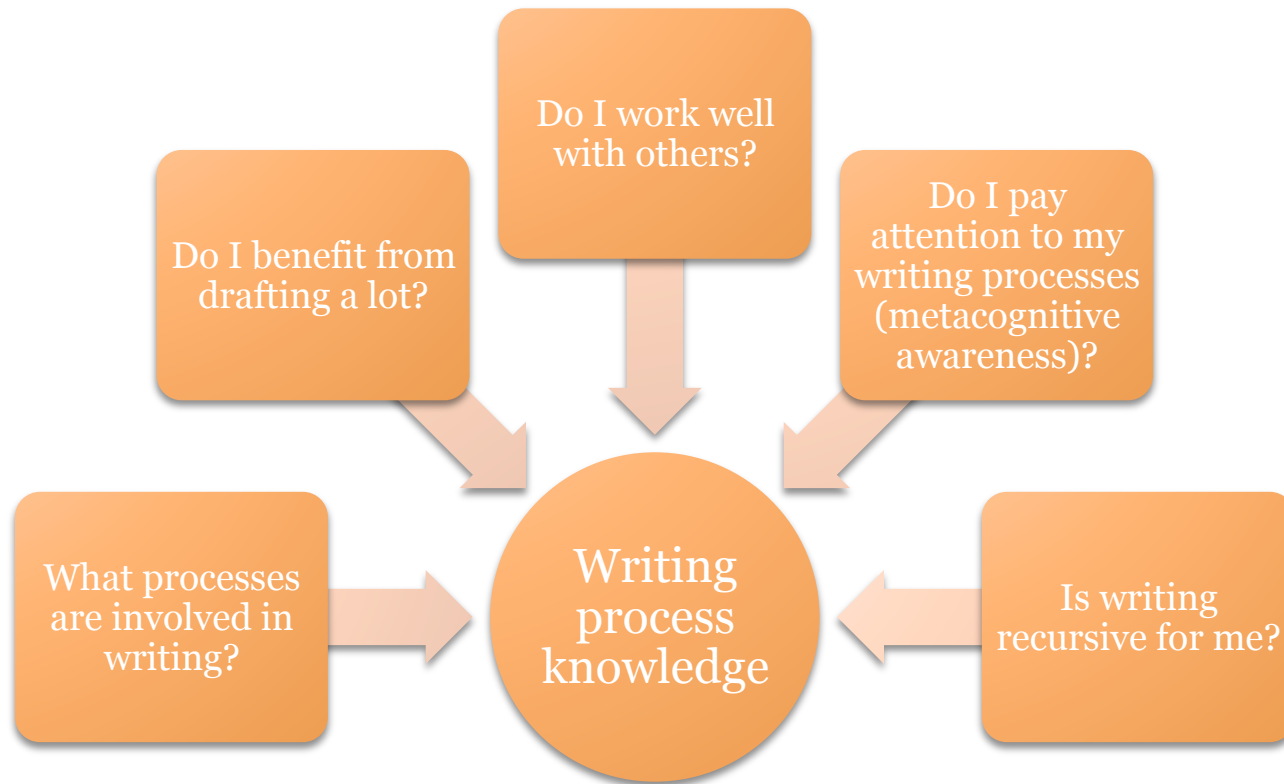
Expert, insider prose

MacDonald, S. P. (2004). Professional and Academic Writing in the Humanities and Social Sciences. Carbondale, IL: Southern Illinois University Press.
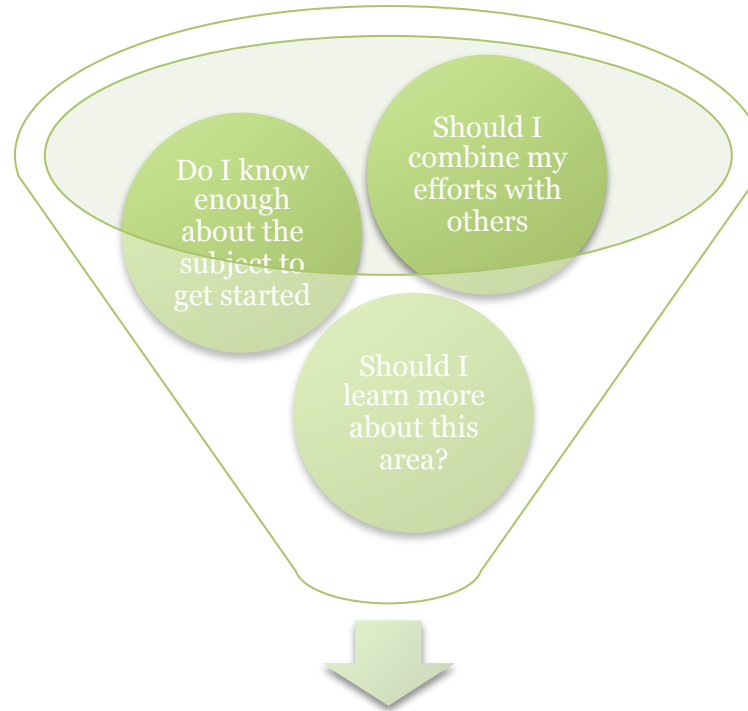
Building a better writer

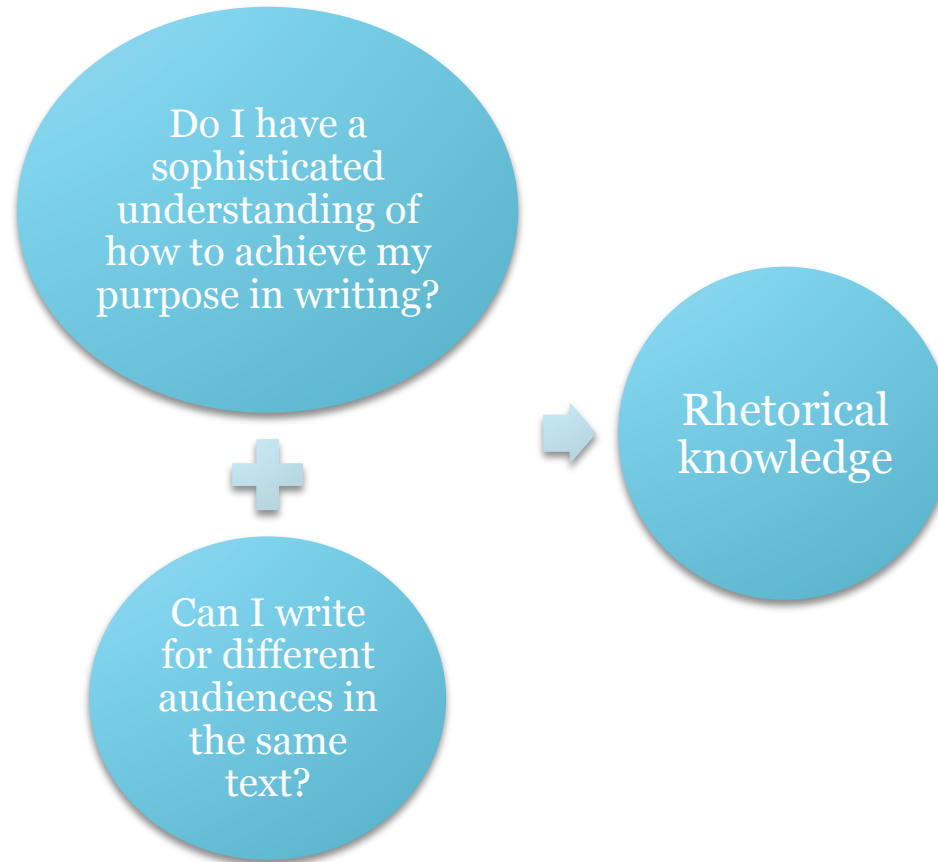Beaufort, A. (2007). *College writing and beyond: A new framework for university instruction*.
Logan, UT: Utah State Press.

Writing process knowledge

Subject matter knowledge

Do I know enough about the subject to get started

Should I combine my efforts with others

Should I learn more about this area?

Subject matter knowledge

Rhetorical knowledge

Do I have a sophisticated understanding of how to achieve my purpose in writing?

+

Can I write for different audiences in the same text?

→

Rhetorical knowledge

Genre knowledge

Have I studied the target text?

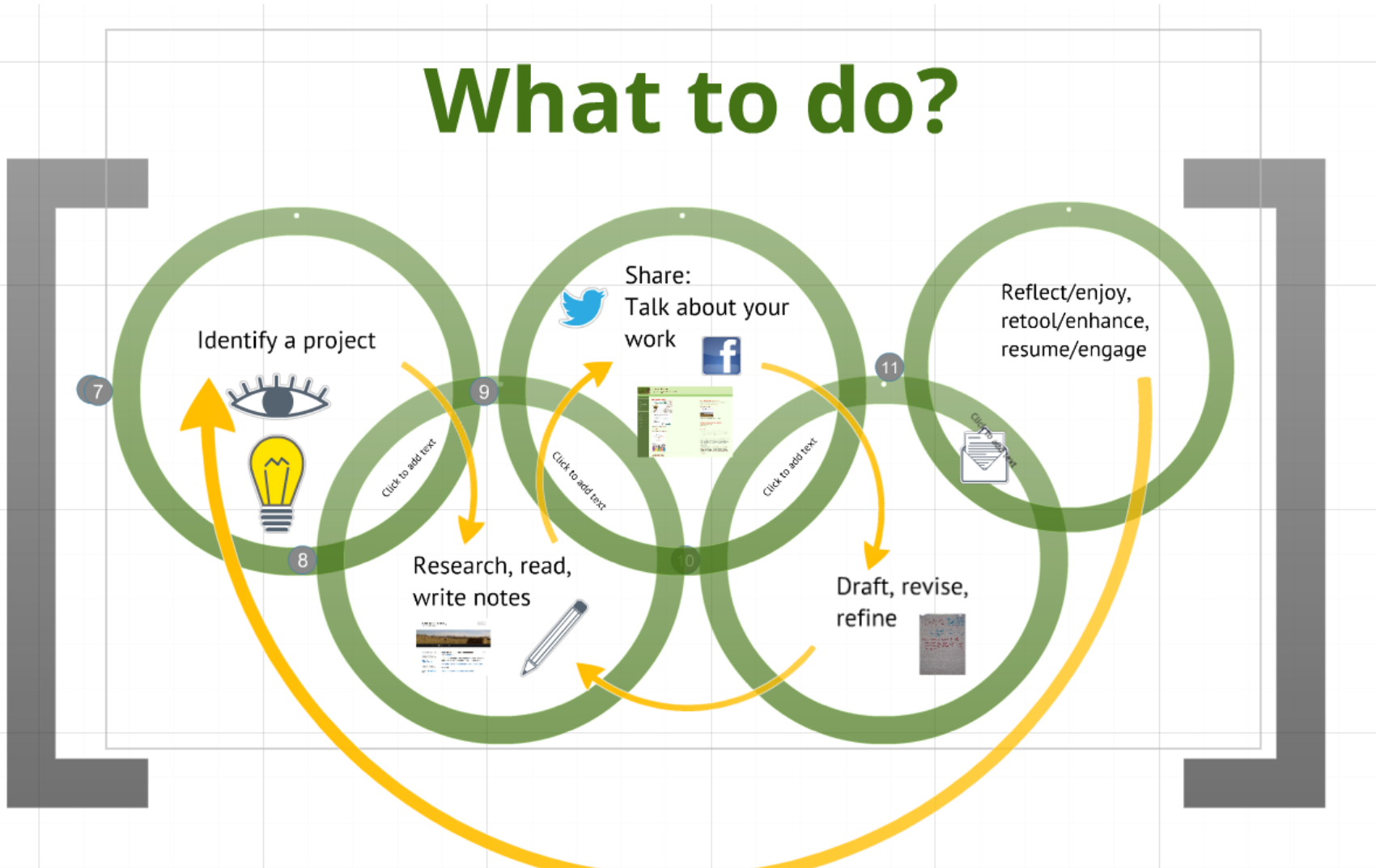What are the limitations and possibilities in this text?

Is this the right genre for the purpose?
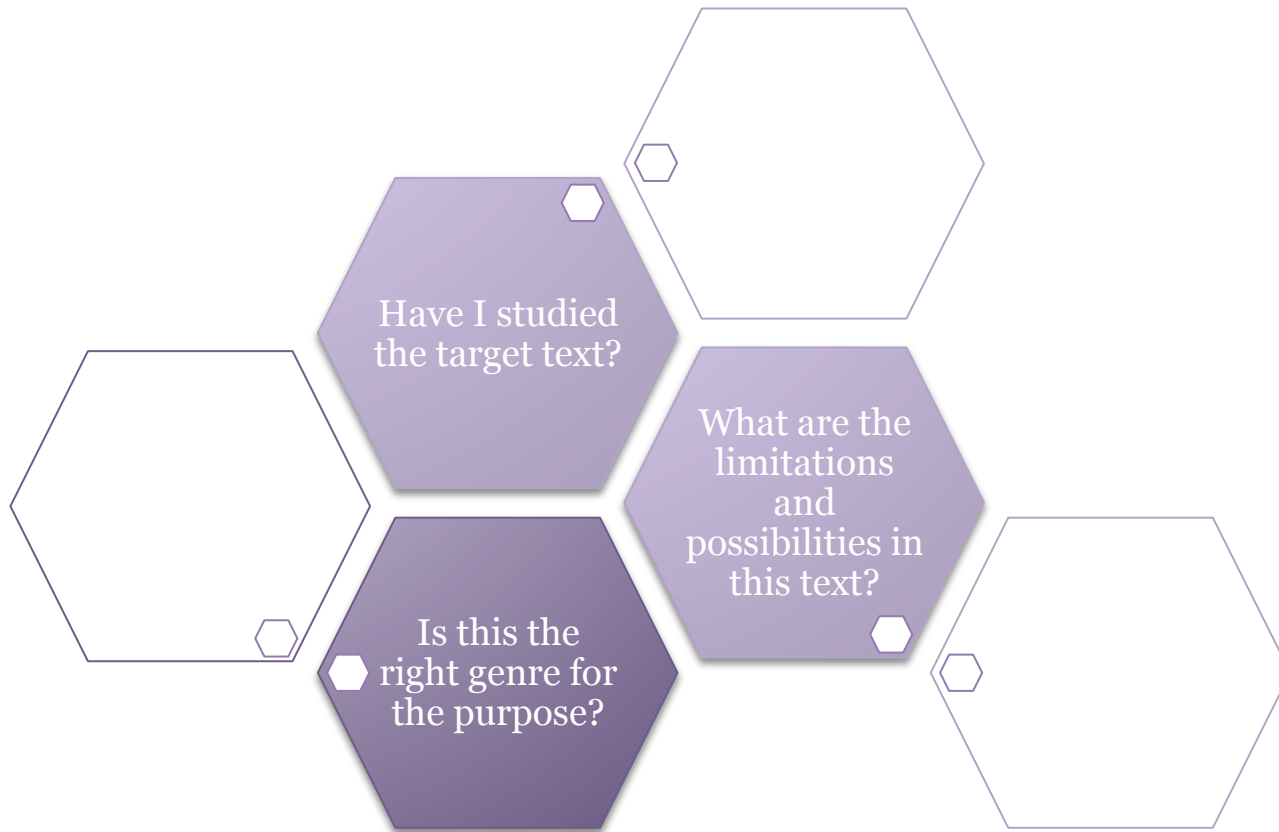
Recursive, iterative, social

Your teaching is like an iceberg

- most of it is under the surface
- syllabus is the 1/10 that is visible
- it appears frozen but is constantly changing and moving, responding to currents
- finished written work by students shows only a fraction of the learning they engaged in

http://upload.wikimedia.org/wikipedia/commons/a/ac/Iceberg.jpg
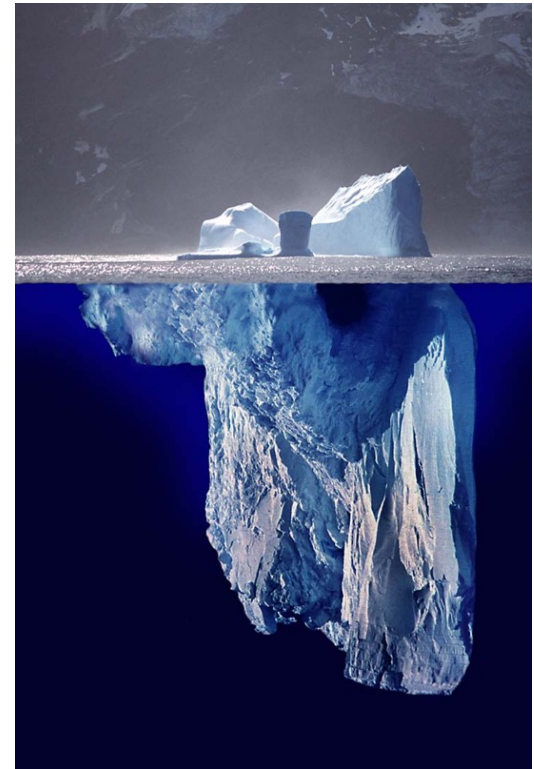
Question 1

- What writing or text-based presentations do you ask your students to do in your class(es)?

- If you do not ask them to write or present, could you?

Question 2

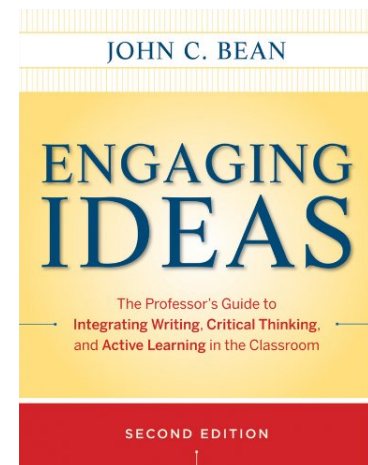- Do you assign the same or similar assignments as other instructors?

Sample biology genres

- Paper critique
- Blog assignment
- Science forum discussion
- Scientific proposal
- Monograph review
- Literature review

- Article summary
- Discussion
- Essay proposal
- Project presentation
- Lab report
- Field notebook
- Journal
- Poster

Kinds of informal writing assignments

- The reading journal
- Solving real problems
- Generic and focused summaries

- Pre-test warm-ups
- Annotations
- Using Cases
- Response papers
- Letters
- Synthesis papers
- What counts as a fact?
- The discussion starter

- Believing and doubting game
- Focusing a discussion
- Analysis of events
- The learning log
- Project notebooks
- Analyzing the process
- The writing journal
- Problem statement
- One-minute paper
- Role playing

- Frame paragraphs

JOHN C. BEAN

ENGAGING IDEAS

The Professor's Guide to
Integrating Writing, Critical Thinking,
and **Active Learning** in the Classroom

SECOND EDITION

Question 3

- Do students really connect with those assignments?

  Asked another way, do students respond to them "authentically" or are they jumping through hoops here?

Question 4

- Are you genuinely (don't lie to yourself!) interested in reading what they wrote?

  Even a bit?

Question 5

- Who do you ask students to write for?

- Who actually reads what they write: you, other students, some slice of the public?

Question 6

- Do students write or present in groups?

  Could they?

Exercise 1: Asking good questions

In a file, write a question about some aspect or area of a course you are teaching now or next year.

If possible, focus on an area about which there is disagreement or where there are alternative positions held by people in the field.

If you feel comfortable, post your question to the chat window.

The term paper

- Traditional— "fossilized"

- Pale reflection of the research process in academic fields

- In some contexts, now a pastiche of itself

- Revived in part now through undergraduate involvement in research

Exercise 2: Considering alternative

Create an alternative assignment (alternative to the research paper) that you could assign to students.

Describe it in a sentence or two, and if you feel comfortable post it to the chat window.

Alternatives?

- Moving from a traditional forensic debate

- To

- Hospital rounds + Cash Cab bonus questions

New models of writing

- Model new assignments on research methods that are new or becoming more dominant in your field:
- Participant action research
- Predictive statistical modeling
- Teacher research
- Evidenced-based practice
- Multi-disciplinary science (biochemistry)
- Bioethics, bioethnography

Exercise 3: New models of writing

- Create an assignment for one of your topics modeled on an interdisciplinary approach to research.

Pulling it together

Consider

- Extending the range of genres in the assignments you give to students

- Scaffolding assignments so that the term begins with shorter, less complex assignments and ends with larger, extended work

- Identifying an audience for one piece of writing that is not the instructor

- Assigning students to work in groups on problem-based assignments

WAC Basics

Writing Across the Curriculum: A Quickstart Guide

What is Writing Across the Curriculum (WAC)?

- writing-to-learn activities are short, impromptu or otherwise informal writing tasks that help students think through key concepts or ideas presented in a course

What are WAC principles?

- Students learn to write by learning written genres in the departments where they study
- Student continue to learn throughout their undergraduate careers and beyond
- Writing about the subjects they study promotes student learning of that subject
- Informal writing can be used effectively to rehearse and develop formal student writing skills

Common brief writing genres

The reading journal	Solving real problems
Generic and focused summaries	Pre-test warm-ups
Annotations	Using Cases
Response papers	Letters
Synthesis papers	What counts as a fact?
The discussion starter	Believing and doubting game
Focusing a discussion	Analysis of events
The learning log	Project notebooks
Analyzing the process	The writing journal
Problem statement	One-minute paper
Role playing	Frame paragraphs

Sample writing in the disciplines assignments

Literature review essay	Concept map
Lab	Demographic analysis of neighborhood
Assignments/projects	Arctic news project
Reports, essays, papers	Waste audit assignment
Presentation	Planning project
Short summary	Impact assessment
Reviews	Landscape analysis
Research essay	

Best WAC Books

Bean, John C. *Engaging Ideas: The Professor's Guide to Integrating Writing, Critical Thinking, and Active Learning in the Classroom*. San Francisco: Jossey-Bass, 2001.

Walvoord, Barbara E. and Virginia Johnson Anderson. *Effective Grading: A tool for Learning and Assessment in College*. 2nd ed. San Francisco: Jossey-Bass, 2010.

[Formal Writing Assignments: Suggestions from Writing Studies Research](#)

Writing Across the Curriculum

Formal Writing Assignments: Suggestions from Writing Studies Research

Roger Graves

What Does Writing Studies Research Say?

Bean (2011, Ch. 6) differentiates between formal and informal writing assignments: formal writing calls for students to hand in finished prose. Traditionally, these take the form of term papers; sometimes students identify a topic in a proposal. This approach assumes students are familiar with how to pose research questions and find appropriate evidence to explore those questions.

In contrast to the traditional term paper approach, Bean identifies "alternative" approaches which require students to answer research questions using concepts from course readings. Thaiss and Zawacki (2006) note that there are a variety of ways to create "alternate" kinds of assignments.

Alternative formats might include a personal vision statement, a SWOT (strengths, weaknesses, opportunities, threats) analysis, an interview with a scientist. Alternative arrangements of academic arguments might include presenting multiple perspectives through a personal narrative or posters in additional to a traditional report. A third kind of alternative text would allow for alternate syntax. One example would be to accept the work of non-native speakers of English without penalty for certain assignments. Alternate methods might sometimes be called for in a particular field. Modified ethnographical studies are one example; working on projects with community organizations might prompt collaborative writing opportunities.

Expert writers differ from novice writers because they go beyond "**knowledge-telling**" or standard responses to prompts and assignments and move toward "**knowledge-transforming**" or what we might associate with critical thought (Bereiter and Scardamalia 1987). Students making the move from outside a discipline (pre-university writing) into a

discipline (third or fourth year majors) need to make this kind of intellectual move. Instructors who want to work on this kind of intellectual goal for an assignment need to consider the complexity of this move for students.

Tardy (2009) argues that students in a discipline need to gain "genre knowledge" before they can write well in a disciplinary context. Genre knowledge includes language resources appropriate to the document, processes for composing, rhetorical knowledge (purpose and persuasion), and subject-matter knowledge. Student success an any particular assignment is a function of all of these components.

Suggestions when designing assignments:

1. Include interactive components. Brainstorming, feedback to drafts, WAC group writing tutorials.
2. Pose a meaning-making task. Pose a discipline-specific problem; pose a research question; ask students to support one interpretation or side of an issue or another.
3. Clear explanations of expectations. Be as clear as you can be about what kind of document you expect students to hand in. Include a copy of the scoring guide or criteria you will use to evaluate their work.
4. Create a rubric for each assignment. Assignment-specific rubrics can save time and energy and eliminate confusion among students.
5. Begin by focusing on what you want students to hand in. Start with a vision of the document you want students to write, and then work backwards to identify what they will need to do to create that document

[Grammar and Errors in Student Writing](#)
[Responding to Student Writing: Suggestions from Writing Studies Research](#)

Writing Across the Curriculum

Grammar and Errors in Student Writing

Roger Graves

What Does Writing Studies Research Say?

Bean (2011) offers an excellent summary of the research in writing studies regarding grammar. Perhaps the best place to start, however, is with Hartwell's definitions of grammar:

Grammar 1 = native speaker's innate knowledge of their native tongue.
Grammar 2 = linguistic sciences descriptions of the way language works
Grammar 3 = linguistic etiquette/usage
Grammar 4 = school grammar
Grammar 5 = stylistic grammar

Grammar 1 is known to all school-aged children and adults. Grammar 2 is a scientific model of Grammar 1, and it is not useful in learning Grammar 1 for native speakers of English. Grammar 3 is not grammar at all but usage. Grammar 4 is, in Hartwell's terms, "unconnected with anything remotely resembling literate adult behavior" (p. 364). Grammar 5, or style, can be taught either implicitly through extensive use of the language (one school of thought) or explicitly through the study of prose style (the other school of thought).

Clearly we cannot teach Grammar 1 or (unless we are teaching a linguistics course) Grammar 2. Grammar 3, or usage, and Grammar 5, style, is similarly outside of the usual focus for instructors in courses that are not focused on writing. Grammar 3, school grammar, has been the subject of hundreds of studies since 1900.

Pressure to teach grammar as a way to eliminate errors in student writing comes from assumptions about these grammars. As Connors and Lunsford (1988) showed, however, the rate of errors in student writing per 100 words has remained relatively constant over the last century at about two (345). In a survey of research into the various ways grammar has been taught over this period, Smith, Cheville, and Hillocks (2008) found that hundreds of studies of various methods of teaching traditional school grammar to improve the quality of student writing is at best ineffective. At worst, it takes time away from strategies that do work to improve student writing (process approaches, genre approaches), and it also focuses assessment on surface errors and correctness—two features of writing that are easier to identify and appear "objective." School systems create tests that focus on errors and correctness at the expense of audience and purpose, and the result is that students may be able to produce "clean" texts that communicate very little.

Where do errors come from?

Research with student writers at the university level shows that they are capable of correcting the majority of errors they make. Many errors result from poor editing proofreading (Haswell 1983, quoted in Bean p. 75), and Bartholomae showed how students self-correct when reading texts aloud (1980, quoted in Bean p. 75).

Shaughnessy (1977), working with open enrollment students at the City University of New York, showed how errors are best seen as failed attempts by student writers to grow and develop. Without these errors, those students would not try new prose structures and therefore not improve. She advocated that instructors look for patterns of errors in student writing, bring those patterns to the attention of the students, and then work to correct the underlying mistaken rule that students were applying.

[Scoring Guides and Rubrics: Suggestions from Writing Studies Research](#)

Writing Across the Curriculum

Scoring Guides and Rubrics: Suggestions from Writing Studies Research

by Susan Chaudoir

What Does Writing Studies Research Say?

Bean (2011, p. 292) suggested that the more clearly instructors define their marking criteria at the outset of an assignment, the better the final product they will receive. Instructors should define, in advance, their writing assignment expectations, and put them into scoring guides to help make those expectations explicit to students. Students then get a feel for what instructors are looking for and can self-correct as they write the assignment (Glenn, Goldthwaite, & Conners, 2003).

Thaiss and Zawacki (2006) and Nowacek (2009) remind us that assumptions and opinions about good writing vary widely between instructors and students. Scoring guides can eliminate that variance by creating norms of what constitutes good writing. For instance, Diederich's (1974) study asked 53 professionals in six different occupational fields to grade 300 essays on a scale of one (1) to nine (9). Every essay received at least five different grades and one-third of those essays received every grade on the scale. Diederich was able to train readers to score accurately and more consistently through the use of scoring guides and rubrics.

Carefully designed rubrics can increase reliability and consistency in marking assignments and reduce marking time (Lindemann, 2001). Generic rubrics are of limited use because they do not give specific information to students about the requirements for each assignment.

Specialized or customized rubrics enable the student to self-regulate and the marker to assess more precisely the degree to which the criteria have been satisfied by the student. Instructors looking for a time-effective marking system may want to consider using customized rubrics to explain specific expectations, moderate feedback to students, and reduce marking time for everyone involved.

Five suggestions when using rubrics:

1. Explicitly define your criteria. Students want to know how marks are awarded for each assignment.
2. Provide criteria at the outset. You may receive a better final product.
3. Train readers to use the scoring guide. The marking will be accurate and more consistent.
4. Customize rubrics for each assignment. Task-specific rubrics can save time and energy.
5. Decide what works for you. Your specific expectations can be categorized in simple or highly specified rubrics.

Teaching Writing in Large Classes

Writing Across the Curriculum
Teaching Writing in Large Classes

Roger Graves

What Does Writing Studies Research Say?

Bean (2011) distinguishes between active learning—classrooms which demand that the student manipulates knowledge in some way—and passive learning or lectures based on the transmission theory of knowledge. Bean quotes Bligh (2000) to show that lectures are about as good as any other method of transmitting information, but he takes pains to point out that when the goal shifts to having students critically assess that information, standard lectures fall short.

The key to teaching well in large courses appears to be that second aspect or goal: critical assessment and knowledge transformation. To achieve this kind of learning in a large class format, instructors need to break up the lecture with student-centered activities (Bean 2011, p. 203). Many of these activities involve writing in some way.

Exploratory writing tasks
Bean advocates tying lectures to writing tasks so that students cannot perform the writing tasks unless they listen closely to the lectures. He uses the term "low-stakes writing" to create a category of writing that includes asking questions, posting ideas to Moodle-based discussion lists, and writing paragraph-length responses to ideas from the lecture (Bean 2011, p. 203).

Bean notes that exploratory writing at the start of a lecture can be used to cue students to connect previously learned material to today's lecture. Here is a list of kinds of short writing assignments that can be used to move from passive to active learning:

- Assign one minute papers prompted by a questions such as "What is puzzling you about today's lecture?" Ask one or two students to read their papers or collect them and read one or two aloud.
- Require students to submit one or two paragraph summaries of a previous lecture. These provide excellent feedback that instructors can use to adjust their lectures.
- Pose your lectures as questions about ideas in your field, and then ask students to summarize your stance or answer to that question. Students learn that your lectures as arguments rather than information (Bean 2011, p. 204).
- Create a formal (graded, extended) assignment that requires students to use lecture material to complete it.
- Model critical thinking by structuring your lecture around a question you had and then taking students through the process you went through as you tried to answer it.

Use online discussions
"Low-stakes writing" can be usefully assigned to online forums—Moodle discussions, blogs, and Twitter feeds. The key here is the prompt for this writing. The best prompts require students to begin by connecting to something said in a course reading, discussion, or lecture and then add their own take on that idea or issue.

WAC Clearinghouse: [Biology resources]()

The WAC Clearinghouse

Home   My Page   Journals   Books   Resources   WAC Network   CompPile   REx   Related Sites

Google™ Custom Search

Home › Resources › **The WAC Bibliography**

The WAC Bibliography

Welcome to the WAC Bibliography. The bibliography, developed and presented in collaboration with CompPile, was developed to support teachers across the disciplines who are interested in using writing and speaking in their courses; scholars who are interested in WAC theory and research; and program administrators, designers, and developers who have interests in the latest work in faculty outreach, program design, and assessment.

⊞ Add a Source

To view entries in the bibliography, follow the links to the right. If you are a member of the Clearinghouse, you can recommend new sources for the bibliography.

— Justin Jory
Bibliography Editor

Biology

Agutter, Paul S.. (1987). Precision testing: A method for improving students' written work in biochemistry. *Journal of Biological Education 13*, 25-31.
   Keywords: biology-course, biochemistry, WAC, pedagogy, data, science, terminology, precision testing, data, improvement, reading-skill

Ambron, Joanna. (1987). Writing to improve learning in biology. *Journal of College Science Teaching 16*, 263-266.
   Keywords: biology-course, write-to-learn, WAC

Ambron, Joanna. (1988). Clustering: An interactive technique to enhance learning in biology. *Journal of College Science Teaching 18*, 122-127.
   Keywords: biology-course, write-to-learn, heuristic, pre-writing, clustering, interactive, WAC, interactive

Ambron, Joanna Theresa. (1989). *Implementing writing across the curriculum: Strategies in the biological sciences [doctoral thesis]*. New York: Columbia University Teachers College.
   Keywords: WAC, biology, journal-writing, freewriting, microtheme, clustering, implementation

Andrews, Roy. (1991). *Marine biology: An opportunistic approach*. http://wac.colostate.edu/journal/ [full text]. *Plymouth State College Journal on Writing Across the Curriculum 03.1*, 37-39.
   Keywords: WAC, biology-course, marine biology, write-to-learn

Bayer, Trudy; Karen Curto; Charity Kriley. (2005). *Acquiring expertise in discipline-specific discourse: An interdisciplinary exercise in learning to speak biology*. [Link]. *Across the Disciplines 02*.
   Trudy Bayer and her colleagues report the results of a study with 70 senior undergraduate biological science majors enrolled in a required course on Writing and Speaking in the Biological Sciences. Their study indicates that students demonstrated significant expertise in enacting a highly discipline-specific oral communication task. They attribute these results to a combination of students' ability to successfully deploy discipline-specific discourse to their own tacit knowledge of their field and instruction in both the disciplines of rhetoric and biology. (Published June 26, 2005) [WAC Clearinghouse]
   Keywords: data, WAC, biology, oral, interdisciplinary, speech, WID, expertise, expertise

Bowles, Philip David. (1994). *The collaboration of two professors from two disparate disciplines: What it has taught us*. ERIC Document Reproduction Service, ED 386 744.
   Keywords: teacher-cooperation, WAC, interdisciplinary, Loma Nazarene College [California], early-start, literature-biology, team-teaching, teacher-story

Burns, Roxanne H.. (1994). Helping students succeed at a creative writing assignment in the biological sciences. *American Biology Teacher 56.6*, 364-366.
   Keywords: biology-course, human-anatomy, write-to-learn, WAC, process

Cannon, Robert E.. (1990). Experiments with writing to teach microbiology. *American Biology Teacher 52.3*, 156-158.
   Keywords: biology-course, WAC, assignment, evaluation, student-opinion, microbiology, virology, immunology

Clark Deborah J.. (2005). *The use of peer evaluations to foster critical analysis of writing in biology*. Segall, Mary T.; Robert Smart (Eds.), Direct from the disciplines: Writing across the curriculum; Portsmouth, NH: Boynton/Cook.
   Keywords: WAC, peer-evaluation, biology-course, critical-analysis

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Author: Search
Title: Search

View Categories
Writing in the Disciplines
Writing to Learn
Program Design [⊞ More]
Faculty Concerns
WAC in Two-Year Colleges
WAC in the Schools
WAC in the Disciplines [⊞ More]
WAC Assessment
Pedagogy [⊞ More]
Writing Processes
Writing Conventions
Genre [⊞ More]
Research
WAC and Writing Centers/Learning Centers
Writing Fellows Programs
WAC and Second-Language Writing
Service and Experiential Learning
Literacy
Community
Inquiry
Technology
Discourse Analysis

http://wac.colostate.edu/bib/index.cfm?categoryid=18

[STEM database for WAC](#)

[http://www.refworks.com/refshare/?site=044461177646400000/RWWEB102745464/WTL](#)

Links to resources

- My site: http://www.ualberta.ca/~graves1/

- My presentations: http://www.ualberta.ca/~graves1/documents/FacultyandResearch.htm

- UAlberta WAC site: http://www.humanities.ualberta.ca/WAC/

- WAC Publications: http://www.humanities.ualberta.ca/WAC/Publications/Publications.aspx