Time To Write

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Managing Complexity, Saving Time, and Deepening Learning in Introductory Biology 152

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When Jean Heitz and Julie Collins saw a demonstration of the Case Scenario/Critical Reader (CSCR) software at a DoIT Engage Summit, the two course coordinators found an innovative approach to support complex thinking and writing in Introductory Biology 152. CSCR is an online program designed at UW-Madison, providing instructors a way to guide students through course readings, lab experiences, or other scenarios. And in Introductory Biology 152, a course with a "small" cohort of 400 students each fall and a whopping 900 students each spring, CSCR has offered a welcome way to offer "more individualized and responsive" instruction for students as they learn to think – and write – like scientists.

Julie Collins

Course Coordinator
Introductory Biology

Heitz and Collins sought out CSCR to support their course's capstone "Independent Project," an eight - ten-page paper engaging students in rigorous research and writing. There are two flavors of the independent project: a meta-analysis track in which students conduct library research to investigate a question in the literature and a mentored research track in which students participate in a lab on campus to generate and analyze novel data sets.

With the range of choices and steps involved in the project, students often miss crucial concepts and goals, such as isolating appropriate variables for analysis and understanding generic conventions of scientific writing. "If you're trying to get students to do something that's complex," says Heitz, "then sometimes it's important to parse out the many pieces when students are first learning." CSCR has offered a compelling method to "parse out" critical concepts and help organize students' research projects.

Indeed, CSCR is a valuable resource for any course instructor who struggles to find time to assist students as they try to master difficult course material, develop research questions, and figure out new writing genres.

Introductory Biology 152's CSCR consists of four "modules" designed to support in-class lab experiences and project planning in roughly the first month of the course. Each module contains concrete examples to "focus students in on key aspects they need to be thinking about even before they set pen to paper to compose their research projects," explains Collins.

Differentiated Learning Tracks

To help students understand where their project fits within scientific inquiry, the first module takes them through examples and questions that differentiate primary research, literature reviews, and meta-analyses. Students also learn what connects all forms of research, such as understanding biological rationale – the information about particular organisms or systems that leads to a hypothesis.

Throughout the modules, Collins notes, "when students get an answer wrong, they're told why it's wrong. When they get it right, they're told why it's right." What's more, students cannot move forward within a module until they have correctly answered each question. To ensure that students do not simply click through the module, they record answers on worksheets that they hand in to their TAs.

The first module closes by asking students to answer questions about their own research track in relation to what they have just learned. For instance, library students work on distinguishing reports from analyses while mentored students work on understanding the biological rationale of the project they have started in their mentor's

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Time to Write
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Managing Complexity, Saving Time, and Deepening Learning *continued*

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lab. These are characteristically difficult aspects of the two projects, and CSCR allows students to work on them side by side. The program allows students "to get more tailored information than could otherwise be provided in lab," explains Heitz.

The second and third modules work to build all students' scientific literacy, sending students in both tracks through examples of former students' papers. These modules also show students how to skim abstracts of research articles for main ideas and reinforce the definition of essential terms like "metric" – a consistent unit of analysis. In class the CSCR activities are paired with small-group work on question sets tailored to students' particular project track.

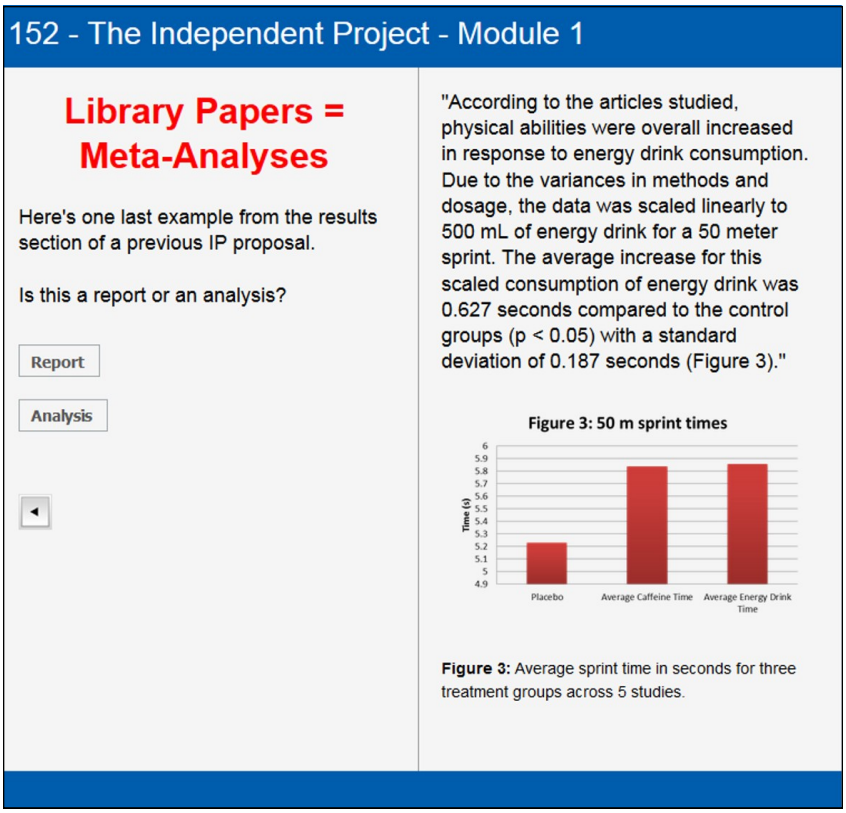

Figure 3: Average sprint time in seconds for three treatment groups across 5 studies.

The Virtual Conference

The fourth and final module, "The Virtual Conference," simulates the individualized instruction of a one-to-one conference with a reviewer about a student's proposal for the research paper. Students will have the chance to work with a TA later in the semester, but these partnerships cannot be set up until after the students' project proposals come in. The addition of the "Virtual Conference" allows students to get answers to critical questions about their project design at just the right time.

The CSCR module "walks students through the questions they should be asking themselves so they can understand what they're doing, why they're doing it, and how they're doing it – and what they hope to find as a result," says Heitz. These central questions include "What's the big picture idea in your lab? What question are you addressing? Why are you addressing that question? In other words, what open question in the literature led you to that, how are you going to do that, and so forth?" Heitz explains.

As the module directs them through these questions, students record their answers on a form available at Learn@UW, creating an outline of their research projects. They write research questions or sub-questions, define key terms, identify gaps in the literature they seek to address, describe methods they'll use, and name metrics and variables. Students submit these conference forms with their project proposals to TAs who then have a "quick way to see what students are missing," says Collins, allowing TAs "to help the students more effectively."

Benefits for Students and TAs

The benefits of the CSCR modules are clear for students in Introductory Biology 152. Students completing library research more clearly understand their task to look for gaps in research and places to push forward scientific knowledge. Similarly, "a lot of the mentored students really struggle to understand what's going on in their lab," and the modules force them to "slow down and start grappling with terms," Collins explains.

"Ordinarily it wasn't until TAs and coordinators saw students' first drafts and then had several one-on-one conversations that students began to understand what a meta-analysis is," says Heitz. "The number of those conversations has definitely decreased. I think because the CSCR modules just make that concept more obvious." Collins also observes that students have had an easier time understanding the difficult concept of "what a metric is." "I've definitely been hearing them talking more about metrics," she says.

Collins and Heitz identify another benefit of the modules: "It has the secondary effect of teaching not only the students, but the TAs," says Heitz. With a staff of 30 – 40 TAs, getting everyone on the same page is no easy task, and the modules help to alleviate confusion, making TA training much more effective.

Try It Yourself

While the CSCR modules took substantial effort on behalf of the course coordinators to create, test, and implement, Collins and Heitz say it's "definitely worth trying" and note the generous support available from DoIT. "I would 100% recommend that instructors try it," says Collins. "It can handle complex information, but it's not that complicated itself. It's quite versatile." For Introductory Biology 152, CSCR has offered a valuable way to support students' writing while saving instructors and coordinators time in the longrun. Find out more about CSCR and how it may support your own teaching at http://engage.wisc.edu/software/cscr/. ●

Professor Scott Straus on Writing, Research, and Active Learning

Elisabeth Miller
L&S Program in Writing Across the Curriculum

Professor Scott Straus

Department of Political Science and International Studies

I sat down with Scott Straus – Professor of Political Science and International Studies at UW-Madison, award-winning scholar, and former journalist – to talk about the role of writing assignments in his 375-student course, International Studies 101: Global Challenges. Straus assigns what he calls the "Dreaded Paper" – an eight-to-ten-page research project in which students make arguments about, or propose solutions to, a global problem. The paper is challenging for students, for Straus, and for the five TAs who respond to students' writing. Despite these challenges, he remains committed to including substantial writing projects in this large introductory course.

Straus offered some intriguing ideas about the value of giving students options, helping students to refine their arguments, and encouraging students to write as a way of gaining agency in the world. Here are some highlights from our conversation:

Q. Why is writing so important – important enough to fit into your 375-student course?

A. Writing is a fundamental skill in life, and I don't think we at a big university emphasize it enough or give students enough experience writing. Also, because we're at a big research university, I want students to have an experience of doing research so they can understand what this place has to offer. By researching, they become better consumers of original research, and that I think will allow them better to appreciate what goes into lectures and the strengths of the faculty and staff at this university.

But it's really about writing. If you want to use market terms, when students go on the job market, when they graduate with a degree, you want them to be able to communicate well. So that's why I do it. I'm trying to send a signal to students in their first and second year: writing is really important.

Q. Can you tell me more about the paper you assign?

A. Students have two options: one is a more classic kind of research paper wherein students research an issue and make an argument. Students are required to analyze the ways one or more of the global forces discussed in class shapes a global problem of their choice. They conduct research beyond class material and evaluate and synthesize that research.

The second option is a policy memo in which students try to basically tackle a global challenge and then make a set of recommendations to key international actors.

Q. How many students usually take up each option?

A. Definitely the research paper is the dominant one, about two thirds. I think the policy memo intimidated some students. They feel like, "Who am I to make an argument to the secretary general of the United Nations?" But I want them to be ambitious. I think students in Madison are refreshingly not entitled but are sometimes not ambitious enough.

So with the policy memo I'm trying to say, "You're going to be a leader of your generation. Start contributing to these debates," but I don't think that's a comfortable position for students.

Q. So your goal with the policy memo is to get students to take more of an active role?

A. Absolutely, encouraging their ambition, wanting them to have a voice in global affairs. I think also getting students to appreciate the complexity of solutions. It's often easy to see problems with how things are working, but often difficult to think about how you would do it better, so one of my goals is getting students to wrestle with that complexity.

And some students do phenomenal stuff on topics from human trafficking to global energy supply to climate change. They're creative, the recommendations follow from the analysis, so I've been really impressed with many of the papers.

Q. What makes you keep the research paper? As opposed to a policy memo only?

A. Great question. I wanted them to be experienced in a traditional research paper. The idea was, as first and second year students, they'll need to be writing these kinds of papers as they go along.

Q. It sounds like you really value offering students options. Would you recommend the practice of offering options to other instructors?

A. I would recommend it. I like giving students choices. Students have different strengths and different career objectives, and having that choice is a good one. I think it allows students to explore something that they might not have done. And I think as an instructor it's important to cultivate different ways of expanding students' horizons. So the options are one way I try to do that.

I like putting students in the driver's seat and saying "you solve this problem." I want students to be agents: to be active

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Book Review: *Writing Science*

Mattie Burkert
TA Coordinator of Outreach, UW-Madison Writing Center

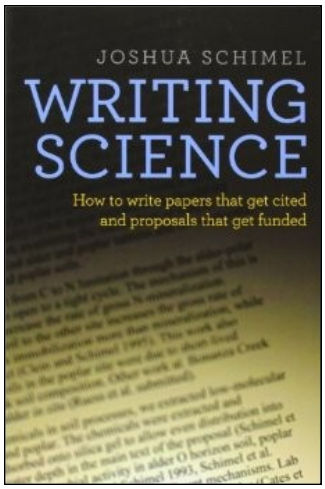
Joshua Schimel's *Writing Science: How to Write Papers That Get Cited and Proposals That Get Funded* (2011) makes the case that scientists must become effective writers in order to have an impact on their fields. As Schimel puts it: "Having your work matter, matters. Success is defined not by the number of pages you have in print but by their influence. You succeed when your peers understand your work and use it to motivate their own" (3). Schimel's book, written in clear and engaging prose, offers concrete advice and skill-building exercises to scientists seeking to develop as writers.

Schimel knows firsthand the importance of writing in the sciences. A soil scientist himself, he serves as Chair of the Environmental Studies Program the University of California, Santa Barbara, where he is also a Professor in the Department of Ecology, Evolution, and Marine Biology. He is the recipient of numerous NSF grants, and his papers have appeared in journals such as *PNAS*, *Science*, *Nature*, and *Ecology*. His book thus draws on years of experience communicating research findings in writing to other researchers.

> **"Success is defined not by the number of pages you have in print but by their influence."**

In the first chapter, Schimel boils his insights down to a single core principle: "It is the author's job to make the reader's job easy" (5). Of course, making the reader's job easy can be hard work, so Schimel breaks this broad goal down into more manageable steps.

In subsequent chapters, he goes on to develop the idea that science writing can be thought of in terms of storytelling. He argues that the OCAR narrative pattern (Opening – Challenge – Action – Resolution) maps onto familiar scientific paper structures, including IMRaD (Introduction – Materials and Methods – Results – Discussion). After offering guidelines for using the OCAR narrative pattern, Schimel zooms in on increasingly local issues, from the internal structure of sections down to paragraphs, sentences, and words.



Writing Science also addresses issues of condensing and editing manuscripts and deals with practical concerns facing scientific writers, from effectively articulating the limitations of one's research to writing for global and public audiences. Throughout, and even when presenting strategies for tackling sentence- or word-level concerns, Schimel remains focused on developing an overarching "philosophy of storytelling" (205) that can help scientists produce audience-friendly writing.

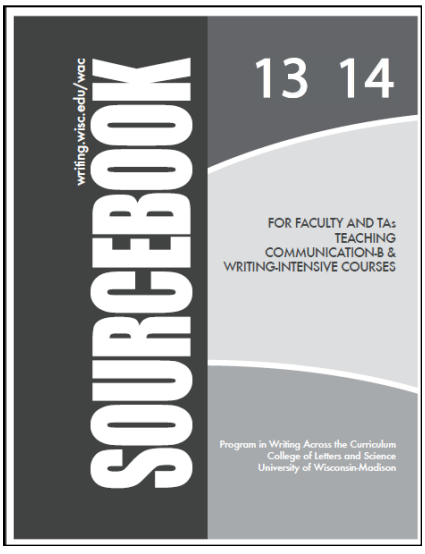
Schimel's book is a useful teaching tool for several reasons. He maintains readers' interest with vivid anecdotes from the history of scientific communication that serve to illustrate his key points; this is not a dry style guide! In addition, Schimel earns readers' trust by drawing on actual published papers as his examples, as well as by encouraging readers to analyze field-specific models; he stresses that conventions and expectations vary based on field, audience, purpose, and genre. Finally, the exercises at the end of each chapter can be adapted into classroom assignments or scaffolded sequences.

Leon Shohet, Professor of Electrical and Computer Engineering at UW-Madison recently purchased a copy of the book to help students learn to prepare publishable manuscripts. He reports success, saying, "I was able to take many of the examples and suggestions in the book and incorporate them into a writing plan for each of the students."

Writing Science is an excellent resource for faculty who want to show their students that writing is not an afterthought to the real work of investigation, but rather a vital skill for scientists who want to make an impact. ●

Looking for inspiration for new or existing assignments? Ask us for a copy of our faculty Sourcebook! We'd be glad to send you one!

Please feel free to email Elisabeth Miller at elmiller5@wisc.edu



PROFESSOR SCOTT STRAUS ON WRITING, RESEARCH, AND ACTIVE LEARNING *CONTINUED*

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writers and consumers. That can happen through either paper assignment.

Q. A key piece of students taking agency, for you, has to do with making strong arguments, right? How do you support students in understanding how to argue?

A. First, in my lectures, I try to model what an argument is. So I'll describe something, but then come down to a more specific set of claims to try to show students how that's an argument and why that's valuable.

The biggest challenge I've found with student papers in general is a tendency to be very descriptive. Students are very good, for example, at telling us how many people are starving and a little bit of what the causes of the starving are, but less good at developing a specific argument about why it's happening or what might be changed.

Second, in order to help them develop an argument, I emphasize that they need to start with a question. You can't just do a paper on food security. You have to have a question, such as "Why has food security become worse in the 2010s compared to the 2000s?" or "Why is it worse in one region versus another region?" If students don't have a question, it's difficult for them to develop an argument.

And third, I talk about making arguments interesting. Students should be able to say, "I like that! That's compelling to me" versus, "There's food insecurity because there's not enough food in the world." I often say to students, "if you were describing your argument to your parent or your friends, you don't want their eyes to glaze over."

Q. Do you include any kind of process work for students leading up to the paper?

About a month before the due date, students hand in a sheet that lists their topic, main question, three sources, and any concerns they have. So the idea is to get them focused early on. TAs then give written feedback on the sheets and follow up with students if it's necessary. Some of the TAs respond to students by email, and some write responses on the students' sheets and hand them back.

Then I give a specific lecture on writing. Basically I go through some writing fundamentals, including sentence construction and paragraph organization. I really encourage them to read their papers aloud to hear how they sound. I encourage them to proofread at least three times, and I go through citations.

I have also generated a page of "problem" sentences over the years, and I put that up and ask students what's wrong with those sentences. I really emphasize that I'm not trying to make fun of students. I'm not trying to make them feel bad, but these are just common mistakes that I see.

Q. Are there ways that you support TAs in working with so many students on writing?

A. It's definitely hard on the TAs, and that's the biggest challenge. The TAs have been incredibly gracious, and they see the value of writing, but it does take time to grade these papers and work with students.

I try to be responsive to that. I have moved to midterms that are 60 percent multiple-choice questions to balance TAs' time commitment. I also give TAs a lot of time to grade the students' papers—usually about three weeks. And I make myself available to read over anything or to give a second opinion. Also, as a teaching team, we collectively read five papers and grade them and reach a consensus on how we grade them.

I really feel strongly about the value of writing and there's no reason why we shouldn't do it in big classes, as long as faculty work to respect TA workloads. ●

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For more information, contact Brad Hughes at bthughes@wisc.edu

THANKS TO OUR COMMUNICATION-B TA FELLOWS!

Ashley Hinck
Communication Arts

Adam Krause
Zoology

Noelle Crooks
Psychology

Honored for their outstanding teaching in Communication-B courses, these three TAs helped plan and lead the January 2014 training in Writing Across the Curriculum for over 40 new Communication-B TAs from across campus.

Thanks for your incredible work!

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