Front-Page Science

Wendy Saul, Angela Kohnen, Alan Newman, and Laura Pearce

ENGAGING TEENS IN SCIENCE LITERACY

NSTApress
National Science Teachers Association

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Arlington, Virginia

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ABOUT THE AUTHORS

In 2011 **Angela Kohnen** was a research assistant and doctoral student in the College of Education at the University of Missouri–St. Louis. For five years, she worked as a high school teacher and was one of the pilot teachers in the SciJourn project. Her research interests include writing across the curriculum and the relationship between writing and identity.

Alan Newman is a research professor in the College of Education at the University of Missouri–St. Louis. He spent 20 years as a science journalist and editor, primarily with the American Chemical Society, and holds a PhD in chemistry. On the SciJourn grant, he has served as editor for *SciJourner.org* and science journalism instructor.

Laura Pearce, a classroom teacher for over 20 years, recipient of the Presidential Award for Excellence in Teaching Science, and author of *Nurturing Inquiry: Real Science for the Elementary Classroom* (Heinemann 1999), received her M. Ed from the University of Missouri–St Louis. She works as a research associate for the SciJourn project.

Wendy Saul, PhD, serves as the Allen B. and Helen S. Shopmaker Professor of Education at the University of Missouri–St. Louis. Her work on connecting science and literacy can be found in books and articles, including the copublished NSTA-IRA volume *Crossing Borders in Literacy and Science Instruction: Perspectives on Theory and Practice*. She teaches courses in action research and heads up the professional development efforts on the SciJourn grant.

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In 2006 Cathy Farrar, then a teacher at Normandy High School in Missouri, called Wendy Saul, a literacy professor with an interest in science: "Could you come out and talk to my students? I want them to submit to the DuPont Challenge Science Essay Competition and they don't know how to write."

"I have a better idea for you," Saul replied. "Alan Newman, a science writer with a PhD in chemistry who for years worked as managing editor at the American Chemical Society, is in town. Maybe he'll come out there."

Newman was reluctant; he knew nothing about teaching high school. What did he have to say? Then he did what all good researchers do: he looked at the winners of the DuPont contest. Surprisingly, all the top-ranked essays seemed to follow a journalistic format. And Newman did know science journalism.

Farrar's students seemed to benefit tremendously from the help. In fact, even the weaker students who attended Newman's workshop produced better essays than some of the A students who did not attend the session. And an idea was born.

We wish to first thank Ms. Farrar, soon to become Dr. Farrar, and her students at Normandy HS. We also wish to thank the National Science Foundation and our grant officer for this project, Julio Lopez-Ferrao, for their interest and support for this project.

The three years of work we have sought to capture in this book have been undertaken by a university-based research team, two cadres of teachers, and a group from the local science center, all of whom deserve individual recognition.

The university team includes Joe Polman, PI; and co-PI's Alan Newman, Cathy Farrar and Wendy Saul, as well as Cynthia Graville-Smith, Jennifer Hope, Angela Kohnen, Laura Pearce, Nancy Singer, and Eric Turley.

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FOREWORD

by Joseph L. Polman

I am privileged to work with the authors of this volume, along with a large and growing number of educators and researchers, as part of the Science Literacy Through Science Journalism (SciJourn) team. Our work serves as the basis of this book and for the ongoing effort to understand how the project described in this book can be useful to others inside and outside the classroom. This project has been generously funded by the National Science Foundation as part of their Discovery Research K–12 program, with the goal to create classroom practices that inform and are informed by research. The SciJourn team has asked, "What do children need to be able to do with science and technology news and information 15 years after graduation?" This has led to the formulation of standards of a different sort: ones that focus on knowledge, skills, and dispositions that students will be able to use when making personal decisions and participating in public debates years after they graduate from high school. Importantly, the science, technology, engineering, and mathematics (STEM) content that will inform those personal decisions and public debates are unpredictable and yet-to-be determined.

I come to this project as someone trained in the *learning sciences*, a field of inquiry that has contributed in important ways to the discussion of educational practices in both formal and informal learning environments. Drawing on insights from cognitive science, educational psychology, anthropology, and computer science, members of the learning sciences community have sought to build a scientific understanding of learning, and to inform the design and implementation of learning innovations (e.g., Sawyer 2006). Views of science knowing and learning born from the learning sciences have had a profoundly positive impact on education; they have directly affected reform and been taken up and elaborated on in influential reports (e.g., Bransford, Brown, and Cocking 2000; Donovan and Bransford 2005; Michaels, Shouse, and Schweingruber 2008) and have also served as the basis for science education standards (e.g., NRC 1996, 2000).

Over the last couple of decades, the learning sciences have focused primarily on how the practices of expert scientists can be used as a model and measure for what it means to "know science." Many of my colleagues and I have worked to help students "talk science," use reasoning and graphical representations, and carry out science inquiry practices, basing curricular suggestions on what practicing scientists do. We have premised our work on the notion that educated citizens in democracies should develop a strong disciplinary understanding.

The tendency to base science learning goals on an analysis of the expert scientific practices is understandable, but it has important limitations, especially if we take seriously the broader view of "science literacy" as learning that has utility years after graduation. In the learning sciences, and science education literature in general, the term *science literacy* is sometimes used synonymously with the ability to carry out the firsthand inquiry practices of expert scientists—see, for example, my own and colleagues' work on educating "little scientists" (O'Neill and Polman 2004). With this kind of focus, the literacy in *science literacy* may become lost. But a science literacy that includes sense making, reading, writing, and communicating about contemporary science topics as they relate to everyday life and policy making is obviously important to life and citizenship. That is the kind of science literacy toward which SciJourn aims.

The model in this case is not the lab scientist, but rather the science journalist. Once we realized that the science journalist was an excellent expert model for the kind of science literacy we were targeting, we used techniques from cognitive science to analyze expert practices of science journalism, namely clinical interviews, think-aloud protocols, and task analysis (e.g., Ericsson and Simon 1993). Those aspects of expert science journalists' practices that aligned most strongly with the science learning goal for 15 years after graduation were elaborated to inform the SciJourn standards (Chapter 4).

Keeping in mind what people making personal decisions and participating in public debates can learn from good science journalists only gets us so far, however. Learning sciences research has taught us a good deal about the cognitive, social, material, and cultural aspects of organizing learning environments, and the SciJourn approach that is described in this book takes those into account as well.

Research has shown that for learning and development to take place, experiences must have an authentic meaning for participants so that they remain engaged. And learners must also have effective scaffolding that builds on their prior knowledge and serves the tasks at hand. Throughout this book, you will read examples of science and technology news stories developed by and reported on by young people and that relate to the students' own prior experiences and interests, whether it be the health condition of a neighbor or family member, participation in a sport or leisure time activity, or a decision to be made in their local community. By engaging teens as citizen science journalists in an educationally supportive environment, young people build the knowledge, skills, and dispositions they need to answer future questions about their hobbies, their jobs, their communities, and their own or a loved one's health.

Scaffolds, activities, and products such as science news stories are important because our current theories and recent research in the learning sciences has reinforced the notion that we must understand learning and development as occurring "beyond the skin" of individuals, and we should view cognition and action as inherently social and cultural. Thinking and acting involve the cultural tools that human beings inherit and are inextricably bound to the situations and contexts within which we act. This is one reason why the strong separation many students feel between school and the "real world" is a problem. It is notoriously difficult for students to use much of the knowledge gained in schools precisely because the social and cultural arrangement of activities in schools is too often unrelated in both the students' and the teachers' minds to future activities. Learning takes place through the social and cultural practices and processes that occur within the context of the many communities each of us encounter in our lives.

The SciJourn model conceived, tested, and refined in this book lives within a loosely connected network of learning communities in school classrooms and in a youth development program. Within this network, we have sought to create hybrid spaces that support learning and development, but that also remain connected to the real worlds of science and technology research and development, as well as the local communities in which these sites are embedded. We envision the young participants in each of these learning communities as travelling along trajectories—from their past lives, through the pathways that we create together, and toward futures that they will forge. We know that all of these learners have the potential to become more scientifically literate adults who are committed to and capable of using science and technology information to enrich their lives, and the lives of those with whom they interact. Our goal is that they become the kind of people who are not afraid of science; who recognize how science is relevant to their lives, can find information and make sense of it using multiple and diverse sources, understanding what each has to offer, and placing that information into the context of prior research and applications for society.

I hope that this volume inspires you to create new and unique hybrid spaces that make use of and expand on the ideas you find here.

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CHAPTER 3

CAN I DO THIS? FREQUENTLY ASKED QUESTIONS

Teachers and administrators have expressed certain practical concerns, the answers to which help them decide if SciJourn is possible given the realities of their own school. In these Frequently Asked Questions (FAQs) we seek to address some of these worries, based on practitioners' experiences.

How Do You Find Time for SciJourn Given the Already Overloaded Curriculum?

No matter how carefully this book has been organized or how convincingly we argue for science journalism in the classroom, we understand that teachers operate in the real world, with real time constraints. What we can say, however, is that many teachers who struggle with these same issues—a prescribed curriculum; tests, tests, and more tests; a discomfort with teaching writing; a discomfort with science—have decided that it *is* worthwhile to spend time with science journalism. For many of them, the chance to relate what they know and care about to real-world concerns has become essential to their identity as teachers. And so they have made it a priority to find the time.

There seem to be several basic ways that teachers have folded SciJourn into their curriculum:

- *The mini-lesson*. Short lessons, something like 5–10 minutes a day, spread over a long period of time.
- *Dedicated, full-blown lessons spaced throughout the year* (e.g., SciJourn Fridays). Teachers spend time with lessons that result in a science news article (and sometimes even more than one!).
- *The "blitz."* Over the course of the year teachers may try two, three, or even four SciJourn Blitzes. This means that for one or two weeks at a time they work intensively with students to produce an article. Often it takes students more than one blitz to produce something usable, so students return to a topic they were working on as homework or during the next blitz period.
- *The collaborative approach*. The science and English or journalism teachers work together to build a science journalism program. The research may take place during science time and the writing during the English period. Alternatively, science students may write in one class and a different group of students peer edit in English class, or English students write the article and the science students fact-check it.

  In another instance, science teacher Linda Gaither submitted their first drafts to Becky Bubenik's journalism students who used the SciJourn standards to evaluate the submissions. Becky had the fledgling journalists begin by projecting a sample article on the board and the group brainstormed a list of issues to comment on. A few days later the newspaper students used the same list to respond to more articles from Linda's classes, but this time they worked in pairs. The overall response from the science students was positive and they used the peer edits to revise their stories.
- *Kill two birds with one stone*. In one parochial school, students were required to address a social justice theme, so the teacher embedded that requirement by assigning students the task of writing a news article that involved science and social justice. Helping students move from the editorial stance to a news article proved to be both challenging and productive. In addition to teaching students about the subject content, it also became a platform for exploring issues of genre and audience. In

another school, students were assigned articles that required that they find contemporary, relevant information about an element on the periodic table. (See *www.Teach4SciJourn.org* for detailed accounts of these efforts.)

> *"Science teachers are really hungry to find a way to help their students connect content to their own lives and interests. Their curriculum often keeps students at arms' distance."*—SciJourn teacher

- *A local science event or speaker*. An easy way to gather a story, talk to experts, and get reactions is to cover a science event (see Chapter 6: "What's Your Angle?" and Chapter 8: Original Reporting: Interviews and Surveys). The event can be taking place at the local science center or college, or during a school field trip. Town meetings on science-related issues are also an interesting territory to explore. The key is advance preparation in order to ask the questions needed to put together a story.

  Teachers have also used invited speakers—for instance, an expert on hybrid cars or waste treatment—to launch a science journalism unit. In advance of the speaker's visit, the students do some research, listen and take notes while the guest is talking, and then look for an angle they want to use to follow up on a topic the speaker made them think about.

- *The no science fair option*. Teachers have given students the option of writing an article or completing a science fair project. The two activities seemed to take about the same amount of time.

- *The after-school option*. Several of our SciJourn teachers have opted to use the strategies and methods we suggest in after-school clubs or as an elective. Others are looking into the possibility of a summer school class. For several years we have offered SciJourn as one choice for local teens participating in the Youth Exploring Science Program at the Saint Louis Science Center.

Year-to-year, or semester-to-semester, teachers often change their approach and timing. Since our goal is not to produce a curriculum per se, teacher changes make perfect sense. Circumstances change, opportunities for collaboration wax and wane, and teachers find that the project works better in some classes than in others. What we have learned, though, is that even something as quick as SciJourn read-alouds (Chapter 5: Setting the Stage by Modeling) can make a huge difference in terms of students' ability to think critically. It also appears that the more frequently SciJourn lessons are used, the more scientifically literate students seem to become, and the better their teachers become at responding to student work. Research to explore this correlation is currently ongoing.

Can SciJourn Fit the Curriculum?

When we met with the first group of SciJourn teacher participants, most identified their goal as "finding a way to support and add depth to the curriculum." To that end they sought to coordinate student topics with what was being taught in their biology, chemistry, physics, or Earth and space science classes, making fairly specific assignments. Assigning topics that match issues addressed in the curriculum seemed to show much promise; for instance, when studying the elements, a teacher might guide students to write about the authentic and current concern about rare earths. "Could students research issues related to Chinese and African use and export of specific chemical elements? Or perhaps issues related to helium might be easier for students to grasp," the teacher muses. Ties like these may anchor and make the study of the old tried-and-true topics come to life for students.

"I find SciJourn rewarding because my students find it rewarding."
—SciJourn teacher

One place where teachers find an easy fit between the curriculum and SciJourn practices is in what we call read-alouds/think-alouds that invite teachers to model their own understanding of text so that students get a holistic view of what happens when a scientifically literate adult reads. In an Earth science class, for example, the teacher might follow stories with her students about an event, such as the Russians drilling through two miles of Antarctic ice to sample a trapped, liquid water lake. In a physics class, students could follow stories about the latest planets found around distant stars.

Other teachers have tended to focus more on science processes. Two teachers, worried about the end-of-the-year high-stakes testing, asked students to read newspaper articles with graphs and identify the scientist's hypothesis, dependent and independent variable, what aspects of the experiment were kept constant, etc. And since human beings can do more than one thing at a time, the students also learned something about science content and newspaper form along with the science skills and processes the teacher had highlighted.

The teachers who had the easiest time imagining the addition of a science article to the curriculum were those who taught environmental science, forensics, or journalism, since these classes seemed to be more applied and the curriculum less jam-packed. What has happened over time, however, is that participating schools and teachers have recognized the value of science journalism as a way of showing the relevance of science to the lives of informed citizens and offered students more freedom in topic choice.

Regardless of approach, attending to "what's new," whether in chemistry, Earth science, or history, adds a dimension that can't be found in a textbook.

Each department in a high school, trying desperately to cover as much material as possible, has found its own way of "scaffolding" learning. However, in the process, have we actually removed thinking and problem solving from the curriculum? Teachers have sought a way to engage students, to help them see the personal and civic questions they struggle with informed by the rigorous sorting through of information that SciJourn calls for.

What Can I Do to Keep Students Motivated for Such a Long-Term Project?

Given the difficulties inherent in learning to read and understand science as well as students' oft-repeated aversion to writing, SciJourn teachers realize that students need to be motivated. Here is the key: interest is a huge motivator, more effective than monetary rewards, good grades or almost anything else you can imagine. But how many students are able to find topics and specific examples that motivate them in their basic textbooks? Do students currently find their reading in science important? Engaging? Pleasurable to pursue? Are they at any point free to choose science topics of interest? Do our science classes help young people with the basic work of adolescence (i.e. developing their identities)? How might we bring science journalism to them in small (and gradually increasing) bits?

Research-based pedagogical strategies that seek to support student engagement and learning (Bransford et al. 2000; Micheals et al. 2008) have provided a useful frame for thinking about motivation. Experts say we need:

- *Intellectually and socially authentic activity*. Students work as journalists, rather than listen to a teacher lecture. By becoming journalists, students are responsible for identifying questions, finding sources, evaluating credibility and writing a final product. The teacher provides scaffolding as necessary, but the student is ultimately the worker.
- *Valuing community and distributed expertise*. In almost all of the lessons in this book, students must work through problems to discover and assess potential solutions. Problems range from finding a suitable topic to identifying "experts" to handling contradictory evidence.
- *Cooperative learning*. Although this book generally focuses on articles with single authors, lessons encourage students to work together in other ways. Nearly all the lessons call for a group problem-oriented discourse. We have also included lessons on peer editing and creating classroom resources.
- *Open-ended, student-centered, classroom discussions*. The discussions that arise from these lessons are not the kinds of "discussions" in which the teacher already knows the answer. In many lessons, students

bring in articles or information that the teacher has never seen before. In other lessons, problems or scenarios that have no single correct answer are proposed. In all cases, student voices are central to the learning.

- *Building on/from student interests*. While teachers may choose to use this approach in different ways, once students begin working on their own articles, their questions will drive instruction. Teachers may decide to limit topic choice, but students will have to develop their own questions within these topics if they are to truly act as journalists.
- *Real-world problem solving*. Because science journalism is a real field with many real-world examples to draw upon, students are working on authentic tasks. In addition, we have provided suggestions for publication so that student writing may gain the added authenticity that comes from having a real audience.

This brings us back to SciJourn. If one looks at the topics that students have chosen to write about—hippotherapy, cochlear implants, Potter's syndrome, the timing of penalty kicks—it is clear that neither textbooks nor the curriculum would offer them much information about these subjects that has deep personal meaning and which motivates students to dig further, understand more, and put ideas together. In an era when reading levels are used to determine much of what is offered to students as text, it is refreshing to see these students have an opportunity to struggle with personally meaningful information, motivated by a need to know more. We may be reminded of our own efforts to make our way through medical texts, surely above our reading level, to determine if a symptom is real or imagined.

We have also found that students are motivated by the success of their peers. The first story we received from a struggling high school was from a less-than-high-achieving young man in an advanced chemistry class. What originally got him going was a sense of pride and interest, but by the time the editor received his first story it had been through nine drafts… and it still wasn't great. Our editor continued to work with him, and finally, the first story from the struggling school was published. Of course, other students learned about this student's success and other teachers learned of the success of his chemistry teacher. "If they can do it, I can do it, too." This school probably has more published stories now than any of our other sites. They, and we, are proud of their achievement. Success of this kind also adds to confidence.

Do I Have the Needed Technology?

SciJourn depends largely on students' access to the internet. In many schools we visit there are computer labs, but access to those facilities is limited. The preferable situation is to have in-class access to the web—something that we hope will be the norm in the not-too-distant future.

There are a few teachers who have worked around technological challenges by sending students to the local library or university, assuming they can do computer-based assignments at home, or by purchasing a wireless modem. The modem at least allows a teacher to do read-alouds or show articles on an overhead or white board.

The far more common problem, however, has to do with access to information. Schools have blocked not only sites, but all uses of certain words. Try doing a story on breast or anal cancer when your key terms are censored! Similarly, in many schools with excellent computer access, students are not allowed to use e-mail, which makes setting up an interview or interviewing an expert online nigh impossible. Our best advice is to anticipate these problems ahead of time so that you don't find yourself in the middle of a project, arguing with the principal or tech specialist as the students wait to proceed with their articles.

Is It OK to Work Outside My Area of Expertise?

Whether a function of personality or a philosophy of teaching, some teachers are very uncomfortable not knowing more than their students; they believe it is their job or responsibility to be able to offer those in their charge advice and information. In SciJourn, the goal is for teachers to understand more about the process of finding and using credible information, but not necessarily know more about the content.

We have found that there is a difference, however, between science teachers and journalism teachers who have engaged in this project: the science teachers are more able to spot factual errors, but this happens largely with respect to background information or context. We offer a number of hints in Chapter 9: Channeling Your Inner Science Teacher: Considering Context and Accuract, which are designed to help teachers help their students. Our best advice is to remember that students get better at finding and assessing information with experience. The same is true for teachers.

Students in Our School Have Been Taught to Write Using the Five-Paragraph Essay. How Does That Relate to SciJourn Writing?

The five-paragraph essay, for those unfamiliar with the term, is a form often used by school systems to train students to write in such a way that evaluators will give full credit for essay answers. Typically, the student is taught to make an assertion (e.g., dogs can be an important support to humans). Then the student offers three supporting details (e.g., dogs have been used to help the blind, to treat post-traumatic stress disorder, and to help abused children). Then, the student summarizes the points in a concluding paragraph (e.g., dogs really are man's best friend).

First, it is important to notice in this and similar examples that the topic is much broader than anything found in a *SciJourner* article. But there is another

"[SciJourn] was just worth it all because for every kid that got published there was another kid who was inspired to do a little bit more."
—SciJourn teacher

problem as well; the five-paragraph essay is typically about structure and not much about logic. Students tend to look for three paragraphs to plug into the formula without thinking about connections between and among the examples. In this case of the dog essay, there is only a broad connection to the opening assertion and virtually no connection between the examples, i.e., the three uses of dogs. A news article, by contrast, demands logical thinking. To talk about support dogs with abused children, one would have to understand how support dogs are being used. How are they trained? How many abused children are being helped? How do we know it helps? Where has this been done? What other treatments are available?

Clearly the structure of an essay—beginning with a thesis, supporting that thesis, and ending with a conclusion—is much like the kind of writing expected in literature and history courses in college. However, these academic essays rely on logic absent from the five-paragraph essay in its diminutive form. Still, students *are* learning the form; students often submit news articles—even after weeks of training—that look just like the five-paragraph essay. If this happens in your classes try a lesson that helps students compare the two forms (see our writing and revision chapters, 10 and 11, or *Teach4SciJourn.org* for exercises that may need to be repeated and referred to again and again).

Who Gets Published? Is That a Good Thing?

Teen writers seem to inspire the next generation of teen journalists and that is why we publish the online news magazine, *SciJourner.org*. The other reason is that the website offers examples for teachers and students, models that can be useful in various ways. These articles have "worked."

In our implementation of the project, those students who were published were those most engaged, not those who are necessarily the best writers or traditionally the best students. Some teachers have worked with students through multiple drafts, accepted "creaky" writing when the content was good and guided authors to credible sources, all in an effort to get a publishable story.

What is good enough to be published is a difficult bar to place and depends on the editor. However, we strongly reject the idea of publishing stories to make students feel good or because they met some arbitrary goal such as one revision. Authenticity means that the story should, in the eyes of the editor, meet high standards.

Please note that publishing an article in the science section of the school newspaper or even in the local paper (yes, some of our communities have allocated space for teen journalists if their articles are good enough!) is just as rewarding. And sometimes just the act of gathering information to address a science-based curiosity (Can you really erase memories? What happens to donated organs?) is often enough to spur students to learn and think more critically and scientifically. Having an opportunity to share their insights, as well as information that they have decided *not* to use, with classmates and get "credit" for this sharing is an added benefit.

Students who aren't published still benefit from being exposed to the SciJourn standards. We have seen over and over classrooms adopt language on credibility, multiple sources, and context, for example, after going through the project. Some students who don't complete a story initially may even strike out on their own to create a new, better story later in hopes of being published. The key, again, is personal engagement with a topic.

Can My Students Handle This?

Two experienced biology teachers with whom we work came up with an interesting alternative to the science article. They have their students construct PowerPoint presentations instead (see Chapter 6: "What's My Angle?"). Some of the motivated students have even turned their PowerPoints into submitted pieces. This seems to serve well as a kind of stepping stone. Other teachers have differentiated by having some students do photos with captions or voiceover slide shows. More suggestions like this can be found in Chapter 12: Beyond Words.

What About When the Topic Makes Me Uncomfortable or Ethical Issues Might Arise?

Some science stories, such as drug use, sexually transmitted diseases, or teen pregnancy, can take you and the author into some tough places, especially if the student is collecting school data or conducting their own interviews. Many schools have rules that would make these topics *verboten*, even if the interviews and surveys are anonymous. The worry is that some names might be leaked. It is important to check with your administration and lay down rules at the beginning on what topics are off-limits. (If you follow our approach, you will be tasked as editor with approving topics before the writing begins.)

Other teachers have simply said no articles on evolution, abortion, stem cells, etc., arguing that nothing anyone will write will sway opinions on polarizing topics, and they simply don't want to fight those battles. In our experience, these are not the topics teens want to write about anyway, since they usually lack a personal connection.

However, we have run into several student-written health stories that raise ethical issues. For example, stories in which the student reveals personal or family medical history, admits to not receiving treatment for a medical condition, or suggests that the school or another institution is turning a blind eye to a dangerous practice. The last item has often taken the form of a sports story in which players admit to multiple concussions or a cover-up of a contagious medical problem.

Journalists would consider all of these good stories but might protect sources by not naming them. Moreover, an extra burden falls on sources under

18 years old (see Chapter 8: Original Reporting: Interviews and Surveys). We always check that adult family members are OK with being named—many are—and protect those who do not wish to be identified. The other issues, such as inadequate health coverage and school problems, require a conversation with the school administration. What we don't do is leave a student exposed to possible repercussions from a story, just as a newspaper stands behind its reporters.

I Would Like to Keep Track of What My Students Have Learned. Any Ideas?

To better understand the meaning of their SciJourn work from a student perspective we offer two concrete suggestions; one involves individual learning logs and the other is more akin to a KWL chart created by the class. For the learning log to work well, you must allocate time for students to record their thoughts, questions, setbacks, and successes as they go along. Alternately, the class—under the teacher's direction—could keep a large three-column chart in the classroom. In the left column, students list what they already know or do in relationship to the different topics covered in this book. For example: What do they know at the beginning of the unit about the topic at hand (e.g., How do they currently search for information? or What do they know about source credibility?). In the middle column, students list their questions or problems, attending especially to the way they currently work. This list can be expanded as students encounter new problems. In the right column, students write, perhaps as part of a class summary at the end of the unit, the pertinent things they have learned. The result would offer tangible evidence of what students have gained from their SciJourn work.

Can SciJourn Work as a Group Project?

So many teachers have wanted to see science writing as a cooperative learning activity. This is challenging because at some point, someone needs to be the lead writer. We have seen successful teams in which members are given assignments, such as an interview, collecting targeted data, or taking photographs, but the job of putting it all together and making it work, has always fallen to one person.

Do I Have to Follow This Book in Order?

You can pick your path through the book and use chapters to reference issues as they arise. The book's order follows how a typical SciJourn project unfolds and chapters highlight the important issues that often arise.

I'm Sold! What's the Most Important Thing to Do Before Getting Started?

You're not going to believe this, but by far the most important thing you can do is to write an article yourself. Good teachers don't have students do labs they haven't tried, right?

References

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