

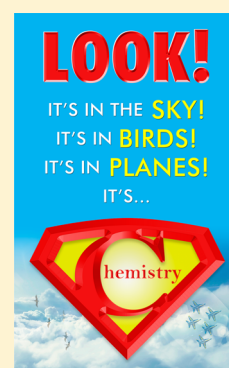
National Chemistry Week: A Platform for Scholarship

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ABSTRACT: National Chemistry Week (NCW) is an annual centerpiece for chemistry outreach orchestrated by the American Chemical Society. During this week, chemical educators promote chemistry through public lectures, demonstrations, and hands-on experiments. These exhibits inspire and motivate students, young and old, to study and appreciate chemistry more deeply. Chemical educators also benefit through participation in NCW, because doing so has great potential to initiate and advance scholarly efforts. How outreach efforts such as those associated with NCW can stimulate and support scholarship in chemistry is described.

KEYWORDS: General Public, Elementary/Middle School Science, High School/Introductory Chemistry, First-Year Undergraduate/General, Public Understanding/Outreach, Professional Development



INTRODUCTION

National Chemistry Week (NCW), an annual community-based program of the American Chemical Society (ACS), will be held this year during the week of October 18–24, 2015. As part of this year's celebration, thousands of volunteers, many of whom are chemical educators, will demonstrate to almost a million people¹ how "Chemistry Colors Our World".² Students of all ages will attend demonstration shows and participate in hands-on chemistry experiments. Many "OOHs!" and "AAHs!" will be heard as people observe luminol-blue chemiluminescence,³ yellow-to-red-to-green redox reactions,⁴ and kaleidoscopic element flame tests (Figure 1).⁵ I hope many demonstrators choose to showcase the fascinating "Disappearing Rainbow" experiment, which uses acid–base chemistry to achieve impressive and mystifying "now you see me, now you don't" color effects.⁶

Anyone who has organized an outreach event for NCW (or for any other reason) recognizes that setting up and choreographing chemistry demonstration shows and preparing safe, hands-on experiments for children requires substantial planning and effort. So much so, I would argue in many cases outreach activities rise to the level of bona fide academic scholarship.

SCHOLARSHIP DEFINED

I am certain some chemists (and even some chemical educators) will take issue with the proposal that preparations and presentations of outreach activities involve scholarship. This is because several academics believe scholarship is solely defined by discovery research and exclusively measured by publications. However, in 1990, Ernest L. Boyer published *Scholarship Reconsidered*,⁷ a highly influential work that defined academic scholarship more liberally. Since then, Boyer's



Figure 1. Flames generated by igniting sponges soaked in mixtures of methyl alcohol and metal salts as described in ref 5. Sponge soaked in methyl alcohol and (L to R) no salt, calcium nitrate, copper(II) nitrate, strontium nitrate, sodium nitrate, lithium nitrate, and potassium nitrate. Image created by Christopher Burleson and reprinted with permission.

expanded characterization of scholarship has gained wide acceptance in higher education by both faculty and administrators. Indeed, the American Chemical Society's (ACS) statement on scholarship⁸ flows directly out of *Scholarship Reconsidered*, and several authors in this *Journal* have discussed possible implications of Boyer's definition for chemical educators.^{9–14} According to a 2005 reflection upon Boyer's work,¹⁵ scholarship can be described using four overlapping domains: discovery, integration, teaching and learning, and engagement.¹⁶ Discovery scholarship is charac-

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terized by the search for new knowledge. According to Boyer, it “comes closest to what is meant when academics speak of research”.⁷ The scholarship of integration involves interpreting research across various specialties to give perspective, inform, and educate. The scholarship of teaching and learning is quite familiar to the readers of this *Journal*; it includes using best practices to help students acquire new knowledge. The scholarship of engagement occurs when faculty members use their expertise in collaborative, synergistic interactions with individuals and groups in the community. In my experience, NCW (and similar) outreach events have the potential to touch upon all four aspects of scholarship. How this occurs in each domain will be discussed below.

■ OUTREACH AND THE VARIOUS FORMS OF SCHOLARSHIP

Engagement

Outreach events naturally and most strongly connect with the scholarship of engagement: that is, working within one’s area of expertise and with people and institutions for the service and benefit of others. Several efforts to provide opportunities for people to explore the wonders of chemistry during NCW^{17–21} and at other times^{22,23} illustrate this aspect of scholarship. These activities excite and inspire future chemists and scientists, educate the public, and foster collaborations between the university and the surrounding community. For example, I will often meet local teachers during outreach events and make plans to visit and sometimes volunteer in classrooms. In some cases, I have recruited teachers to assist me in my own outreach efforts.^{19,21} Outreach events can also significantly benefit college students. Several workers have used outreach efforts as a platform for university students to participate in service learning.^{17–23} As part of a class or laboratory requirement (or sometimes through volunteering), university students are trained on how to safely carry out simple chemistry experiments or demonstrations to be performed during NCW (or other) outreach events. Students then actually carry out the experiment at the outreach event. Having tried this myself in my own classes, I have found this to be a particularly effective and highly synergistic form of work. Both college students and younger NCW participants alike are energized, motivated, and educated through these interactions. Several times I have learned some new chemistry or gained ideas for small research projects by guiding my students through this process.

Integration

Outreach events provide fantastic opportunities for chemical educators to conduct integrative work. Events such as NCW provide a forum where chemical educators can help people make sense of issues of science in society and to better understand and appreciate scientific information and reasoning. Ability to do so is becoming more and more important as our society is increasingly bombarded with misinformation on social media about issues relating to climate change, genetically modified organisms, the safety and efficacy of vaccinations and chemical food additives, and so on. By interacting with the community during outreach events, chemists can help to eliminate chemophobia,²⁴ which will help the public to more rationally reflect upon issues of science and assess the risks and benefits associated with various chemical technologies. Highlighting slogans (see the abstract graphic) and images (Figure 2) at outreach events can help to emphasize the ubiquitous and beneficial nature of chemistry, guiding people to consider that



Figure 2. Image created for promotional materials associated with the “Super Science” theme for the 2015 Cougar Science Camp. As part of this theme, it was discussed how science can be used for the good of society, much like a super power. Image created by Derrick Robbins and reprinted with permission.

“chemicals are not to be feared or worshipped, they are to be understood”.²⁵ The impressive outreach program developed at McGill University is a great example of the scholarship of integration in action that includes public lectures, radio broadcasts, and chemistry courses for nonmajors.^{24,26,27} These scholars inform the public on an incredibly broad range of topics running the gamut from nuclear science to the chemistry of food. At my institution we have been able to reach people in our community in a similar, albeit much smaller manner by centering our science camp on particular themes. For example, we have discussed the chemistry of the solar system or how chemistry benefits society.

Teaching and Learning

Fusion Science Theatre (FST), the brainchild of Holly Walter Kerby, is an excellent illustration of outreach linked to the scholarship of teaching and learning.²⁸ FST uses elements of theater during chemistry demonstration shows. Members of the audience often participate by “acting out” chemical principles to be learned. These outreach events are used as a laboratory in which various theatrical elements and teaching methods are developed. Data are collected and evaluated to test the efficacy of the designed approaches on student comprehension of, interest in, and attitudes toward science. Methods and practices developed in the FST outreach program have also been tried in university-level courses. All practitioners of chemical outreach events should aspire to evaluate their programs in a manner similar to what is done by FST.

Discovery

NCW and other outreach events can even lead to avenues of chemical research. Participants at outreach events will routinely ask questions about chemistry demonstrations that I cannot adequately answer. Often I can find the answer at a later time after a library or Internet search, but occasionally these questions lead my students and me into the laboratory to conduct experiments in search of answers. Interestingly, other practitioners of chemical outreach report that questions from the public have led them to chemical research in the laboratory.²⁴ In a few cases, these experiments have led to years of study and even publications. Perhaps my favorite example of this occurred when a participant at summer science camp asked me how the cloud forms when dry ice is placed in water.²⁹

■ A FINAL THOUGHT

It could be argued that Boyer's report was primarily motivated over concern that college faculty disproportionately emphasized research over teaching. Boyer argued that colleges and universities needed to "break out of the tired old teaching versus research debate and define, in more creative ways, what it means to be a scholar".⁷ As a result, Boyer's work was tremendously helpful in reinvigorating the importance of the scholarship of teaching and learning. It has been noted, "Since the publication [of Boyer's] report, the largest advances have been made, as might be expected, in the scholarship of teaching and learning".¹⁵ Indeed, several articles in this *Journal* have discussed the significance of the teaching and learning mode of scholarship.^{9–12,14,15,30} On the other hand, little discussion has taken place on integration and engagement. It is my hope others will also begin to discuss and emphasize these two elements of scholarship so Boyer's vision of the faculty's "mosaic of talent" can be more fully realized within the community of chemical educators.

■ CONCLUSION

NCW is not only for kids and the public. NCW activities can also benefit your students, your institution, and your own scholarly efforts. So get out there and show your community how "Chemistry Colors Our World". In the process of doing so, you might find your own world to be a bit more colorful.

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Notes

Views expressed in this editorial are those of the author and not necessarily the views of the ACS.

Thomas S. Kuntzleman teaches chemistry in the Department of Biology and Chemistry at Spring Arbor University and is a frequent contributor to the *Journal* and the Chemical Education Xchange (ChemEd X). He is very active in awakening public interest in science, presenting chemical demonstrations and activities to children several times a year, including as director of SAU's popular Cougar Science Camp and the annual Halloween in the Science Lab celebration.

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The image shown in the abstract graphic was created by Derrick Robbins and is reprinted with permission.

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