

## **FACULTY DEVELOPMENT WORKSHOPS FOR CURRICULUM DEVELOPMENT: EFFECTIVE PRACTICES**

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### **1. INTRODUCTION**

The value of workshops for engaging members of the professoriate in professional development has been validated by a number of evaluation projects: workshops provide valuable networking opportunities (Aiken, Ingargiola, Wilson, Kumar, & Thomas, 1996; Bland & Risbey, 2006; Frick & Kapp, 2006; Steinert, Mann, Centeno, et al., 2006), exposure of participants to new topics and skills (Centra, 1978; Frick & Kapp, 2006; Kreber & Brook, 2001; Latchem, Odabasi, & Kabakci, 2006; Marder, McCullough, & Perakis, 2001; Steinert, et al., 2006), and renewed dedication to classroom teaching (Fahrenholtz, Bieniek, & Graham, 2003; Frick & Kapp, 2006; Marder, et al., 2001; Steinert, et al., 2006). Many initiatives in science, technology, engineering and mathematics (STEM) education (e.g., those funded by the NSF-TUES and ED-FIPSE programs; DOE, 2011; NSF, 2011) include broad dissemination initiatives that often include workshop activities. But what contributes to an effective faculty development workshop? The challenge of offering a workshop for faculty colleagues for the first time can be a daunting task. The aim of this paper is to provide a series of perspectives on the presentation of faculty development workshops. These are based on the experience of numerous instructors, coordinators and participants of workshops offered under the auspices of the Chemistry Collaborations, Workshops and Communities of Scholars (cCWCS) and its predecessor, the Center for Workshops in the Chemical Sciences (CWCS), since 2001.

Over the last ten years cCWCS and CWCS have offered 103 workshops in 28 topical areas at 31 different locations throughout the United States. These have attracted 1,438 participants (1,127 unique individuals) who represent 758 institutions located in all 50 states, Puerto Rico, Guam and the District of Columbia. The workshop series have been funded through

four awards (2001-2015) from the National Science Foundation Division of Undergraduate Education, Course, Curriculum and Laboratory Improvement (CCLI) program. These are distinct from other NSF-supported workshop programs in that they have provided mechanisms for the national dissemination of high quality topical content from a variety of other projects within a pedagogical framework, and make use of extensive hands-on activities. They provide opportunities for: (i) extended interaction between participants, (ii) a strong focus on immersive experiential learning, and (iii) direct impact on the undergraduate curriculum. The CWCS program succeeded the NSF Undergraduate Faculty Enhancement (UFE) program (Frick & Kapp, 2006) which consisted primarily of shorter lecture-based workshops for regional audiences. The topical coverage of the CWCS workshops differs significantly from workshops which focus on specific pedagogical methods rather than curricular content, such as those offered by the Process Oriented Guided Inquiry Learning (POGIL, 2011), Calibrated Peer Review (CPR, 2001), and Peer-Led Team Learning (PLTL, 2009) projects.

Here we describe a series of effective practices for faculty professional development workshops that have been developed and utilized in the CWCS and cCWCS programs. We offer these as recommendations to others who might endeavor to organize their own workshops. This report is based on a meta-analysis of evaluations of the CWCS program that includes the results of extensive end-of-workshop and post-workshop surveys of workshop participants, interviews with participants, observation of participants in workshops and personal anecdotes and vignettes gleaned from long-standing relationships with workshop presenters and organizers. The paper describes the successes of the CWCS program in establishing a program that effectively recruits, engages, and inspires participants, along with some of the pitfalls encountered over the years. It is these experiences that form the basis for our series of recommended practices for workshops that aim to provide faculty with opportunities for professional development. While several of these issues may seem obvious upon reading, many of them, in our experience, are not apparent to all who might organize and present workshop.

## **2. RESEARCH METHODS AND THEORETICAL FRAMEWORK**

The participants in a study to determine the effectiveness of practices utilized in the organization and presentation of workshops are the faculty attendees of 99 CWCS workshops

held in the period 2001-2009, and the facilitators of the workshops from 2008-2010. The population of workshop attendees is described in Table 1.

**Table 1:** Demographics of the workshop attendees (population) and study participants (sample).

	<i>Population</i>		<i>Interview sample</i>
	<i>N</i>	<i>%</i>	<i>N</i>
<i>Job Title<sup>a</sup></i>			
Full Professor	36	21%	15
Associate Professor	35	20%	8
Assistant Professor	46	27%	12
Lecturer/instructor	13	8%	1
Adjunct profession/instructor	4	4%	0
Other	14	8%	1
<i>Department type – highest degree granted<sup>b</sup></i>			
Associates (2-year) degree	241	17%	46
Bachelors	901	63%	221
Master's and doctorate	248	17%	48
Other	48	3%	7
<i>Total</i>	1438		322

<sup>a</sup> Job title data reported for 2009 participants only.

<sup>b</sup>2001-2009 workshop participants, out of 1,127 unique individuals.

Additionally, gender data were collected for the interview participants and those participants from 2009; men comprised 57% of the workshop attendees in 2009 and 55% of the total participants interviewed for all workshop years.

This study relies on several data collection methods, including pre- and post-workshop evaluations completed by all workshop participants, participant interviews with the samples identified in Table 1, workshop facilitator narratives, and workshop observations. Each of these received IRB approval from Georgia State University, Georgia Institute of Technology, or both.

As part of the application process, each participant completed a pre-workshop evaluation. This survey was conducted online and consisted of questions evaluating participants' expected uses of the workshop materials and prior knowledge of the workshop content. At the end of each workshop, written post-workshop evaluations were distributed to participants. Alumni from the 2001-2008 workshops were contacted during the fall of 2008 and spring of 2009 and asked to participate in interviews. All alumni who responded were accepted as research participants (hereafter "respondents"). This sampling method was a combination of snowball, characteristic, and convenience sampling. Because of the varied time which had passed since participation of the respondents in the workshops, and issues with changes in contact information (we had valid email address for 752 of the 1127 unique participants), a more structured sampling method was deemed inappropriate for this analysis. For the interview conducted with the 2009 participants, stratified sampling was used in which representative subpopulations from each workshop were contacted for interviews.

The interview protocol focused on respondents' perspectives of the workshop subsequent to their attendance, how they had made use of workshop materials in their teaching, how they had changed their curriculum or pedagogy, and the reactions of their institutions to their attendance at the workshop and any curricular changes they had made. Interviews lasted between 8 and 45 minutes, depending on the participant, with an average time of 21 minutes. Some respondents had attended several workshops with CWCS, and each workshop was discussed within the confines of one interview, making those interviews inherently longer.

In addition to post-workshop (long-term) evaluations of participant experiences, participant observation and reflective journaling methods were initiated at selected workshops in 2008. For a typical workshop, the researcher (CBR) attended three days of the workshop. He was introduced to the participants upon his arrival and explained his purpose. He observed all aspects of the workshop, including both formal (e.g., lecture and laboratory activities) and informal components (e.g., breaks and meals).

Finally, workshop presenters/facilitators were engaged in discussion to provide narratives about their organization, teaching, and facilitation methods. This process focused on collecting written narratives from facilitators using open-ended prompts. Facilitators participating in this data collection are included as coauthors of this paper.

This paper serves to synthesize these data sets in the development of a list of effective practices for professional development workshops for members of the professoriate. The specific research questions addressed by this work are: (i) Are there best practices for faculty professional development programs, and (ii) If yes, what are those best practices? As such, the appropriate theoretical framework for this work has been systems theory (Gharajedaghi & Ackoff, 1985), wherein the “system” is the workshop and the study seeks to evaluate and optimize the existent variables within that system. An important perspective put forth by systems theory that has fueled this work is the idea that a system cannot be broken into its individual parts as discrete entities because the behavior of the parts depends on the whole. This is a useful base assumption in the arena of workshops and workshop development as it allows for the workshop to be evaluated as one whole rather than needing to focus on the many minutia of each individual experience.

### **3. RESULTS AND DISCUSSION**

Based on input from workshop participants (synthesized from end-of-workshop evaluations, post-workshop surveys and interviews, and reunions at conferences), workshop presenters, and program directors, we offer the following set of observations and suggestions on the organization and presentation of workshops to engage faculty members in curriculum development, revision, and reform. As evidenced by participant feedback to CWCS workshops (e.g. 91.3% would recommend the workshop to other faculty at the time of the end-of-workshop evaluation), many of the components used in the CWCS model are effective parts of conducting faculty professional development programming. However, there have also been missteps along the way that could be used to improve future workshops, some of which are also discussed herein.

#### **3. 1. Recruiting**

Who is your audience, how will you connect with them? What strategies can be deployed to attract participants from traditionally underrepresented groups? These present significant challenges, especially for someone new to the endeavor of offering workshops. CWCS has established extensive mailing lists to reach faculty members, primarily at two- and four-year colleges. These include the addresses of chemistry departments at over 700 four-year institutions,

and over 180 Ph.D. granting institutions. These are used to address announcements, consisting of a single sheet to department chairs and to other specific individuals (e.g., “first-year chemistry program directors”, “advanced laboratory coordinators”). An address list of all two year colleges is available for purchase from the American Association of Community Colleges (AACC, 2011) and is used to mail announcements to the “Chemistry/Science Chair”. Over a ten year period, the Center has compiled a list of over 8,000 email addresses of individual faculty members at two- and four-year colleges, and of other individuals with interests in chemical education. To build the CWCS “brand”, and to avoid gaining a reputation for spamming the nation’s chemistry community, we have limited use of the address list to two emails per year. The use of this list attracts the large majority of CWCS attendees; in 2010, 48.1% of attendees reported receiving a direct solicitation by email or standard mail, 13.6% were referred by their department chairs, and 25.2% were referred by other colleagues.

CWCS has partnered with organizations wishing to advertise programs to the cadre of faculty members in our database. This has taken the form of including the partner’s activities in CWCS advertising, rather than simply providing the list to the partner. We welcome enquiries from other potential partners. Similarly, cCWCS is prepared to handle all aspects of the application process for partner organizations using an online application form that has evolved over the last two grant periods (cCWCS, 2011). In response to the post-workshop evaluations, 94.7% of attendees rated the online application as either “good” or “very good” on a five point scale (1 = poor, 2 = fair, 3 = neutral, 4 = good, 5 = very good).

### ***Recommendations***

- Develop strategies to identify potential participants and to collect contact information for this cohort.
- Consider using a list-serve, rather than pasting large email addresses into an email recipient list.
- Develop an aggressive timeline for handing recruitment, applications, and acceptances.
  - Advertise 9 to 12 months in advance of the workshop.
  - Set an application deadline 4 to 6 months ahead of the workshop.
  - Accept workshop participants as early as possible, but no less than 3 to 4 months ahead of the workshop (i.e., Jan-Feb for summer workshops).

- Design applications to collect different types of information (including contact information and demographics), and key features that will be important in deciding which participants will be accepted to attend the workshop (e.g., the level of experience of the applicants, and their interests and expertise).
- For collection of demographic information (gender, race, ethnicity, physical handicaps, etc), consider using the classifications used by NSF. Note the difference between race and ethnicity, an issue that is often overlooked or misunderstood. Give applicants an option to not report these data.
- During an initial review of applications to select the workshop participants, it is wise to omit the demographic data so as to foster a bias-free process. However, this information might be considered later to insure that the workshop participants represent the breadth of the application pool or other program goals.
- Consider developing a “wait list”. Make offers of positions in the workshop to selected applicants with a request for an acceptance of this offer within a short time (see below). Even if this process fills the workshop to capacity, communicate with a small number of individuals that remain on the wait list. If there are late cancellations, you might be able to accommodate these applicants. However, given the challenges and cost associated with making late travel arrangements, it might be best if those on the wait list are within driving distance of the workshop location.

### 3.2. Accepting Participants and Communications

Communication with applicants and those offered positions in a workshop should be detailed and concentrated in a small number of emails. It can be confusing to applicants and participants if information is passed out in a piecemeal fashion. In the recommendations below, we focus on four key email communications to: (i) acknowledge receipt of the application, (ii) invite selected applicants to participate in the workshop and to provide enough detail to give them a perspective on the program, (iii) provide complete details to those who accept a position in the workshop, and (iv) provide a last-minute reminder. The entire CWCS application process was ranked as “good” or “very good” by 89.4% of the attendees in post-workshop interviews.

We have typically found that 5-10% of those applicants who have confirmed their attendance (i.e., 1-2 participants per CWCS workshop) will cancel their participation within a month of the workshop. While a system of refundable deposits might cut down this figure, we have chosen not to deploy this strategy. Instead, workshop facilitators often identify a couple of alternates, usually within driving distance, who can be invited to fill any vacancies that occur because of late cancellations.

### ***Recommendations***

Consider just *four* emails.

- Send a personalized response immediately upon receipt of a completed application. *Indicate when the applicant should expect to hear back from you.* This can be automated if you are using an online application process.
- Make an offer of a position in a workshop with a relatively short time for the applicant to confirm attendance (e.g., one week). This email should include some information about transportation, housing, meals and finances, but does not have to contain detailed procedures that can wait until applicants have committed to attending. Creating a website to provide details and which can be updated periodically is also helpful. You might wish to send a reminder if you do not get a response to this invitation within a week, *but if you do not hear back within two weeks it might be appropriate to rescind the invitation.* This point should be made clear in the original invitation to participate.
- Once applicants have confirmed their attendance, and well in advance of the workshop, provide participants with detailed information. It is important to be as clear and as comprehensive as possible in this communication. This should include the following:
  - A detailed schedule – when is check-in, when is the earliest that someone should schedule to depart at the end of the workshop?
  - Travel to the workshop; include details (schedules, prices) about airport shuttles, public transportation, and parking.
  - Remind participants of exactly what expenses will be reimbursed. For example, the CWCS program does not pay for participants' travel to the workshop, but pays for all meals and accommodation. However, taxi fares for transportation from the airport to the workshop hotel, or hotel parking, have been reimbursed for some workshops in high cost areas where these provided significant conveniences. For some of the workshops held in rural locations, a dedicated shuttle has been run to the closest airport.
  - Accommodations (hotel address, phone number)
  - Emergency contact information – a phone number and email address of an organizer.
  - Meals (which meals are provided?)
  - How will reimbursement be handled? What is reimbursable? What limits are there? Are receipts required?
  - Suggestions for participants to bring certain personal items, such as specific clothing (e.g., comfortable shoes if there is an activity that involves walking, attire suitable for the local climate or for working safely in a laboratory).
  - Invite participants to let you know about any dietary or mobility restrictions that you might need to accommodate.
  - If you are aware of particular hardship related to travel expenses, consider offering a partial travel award (e.g., 50% of the cost, up to \$250). In ten years, and with over

1,400 participants, CWCS has made travel awards in only a handful of exceptional circumstances.

Consider putting together an information sheet with extensive details about the logistics for the workshop. This can be attached to this email, mailed as a paper copy, and posted to the website for future reference.

- One or two weeks before the workshop, send an email reminding participants of check-in information. This provides them with an opportunity to respond with any remaining questions, or regrets that they must cancel their attendance. While a cancellation at this late stage in the planning is very disruptive, it is better to learn it at this point than to find out at the workshop itself.

### 3.2. Other Pre-workshop Arrangements

There are a significant number of pre-workshop arrangements to be made. Putting thought into the needs of your participants, and communicating clearly and concisely with them (see above) will save you from dealing with numerous issues during the workshop itself. When selecting accommodations for participants, along with meals and any reimbursable expenses, consider using the federal per diem (or a fraction thereof) established for the workshop location by the U.S. General Services Administration (GSA, 2011). To highlight the importance of administrative issues, in 2010, only one CWCS workshop attendee (out of 206) indicated that he would not recommend the workshop he attended to others; this attendee repeatedly cited issues with housing throughout his post-workshop evaluation.

#### ***Recommendations***

- Arrange for housing the participants together – this might be in on-campus housing, or a nearby hotel with convenient transportation or within *short* walking distance.
- Make sure that housing arrangements are close to accessible and varied food options (unless all meals are catered).
- Provide breaks with access to food and beverages during the day in both the morning and afternoon sessions.
- Mix things up with the schedule, pacing and location of events to give participants a break, keep the days from getting monotonous; and allow participants to regularly stretch and move.
- Create time in the workshop for unstructured participant interaction.
- Prepare to provide participants with the necessary personal protective equipment for any hands-on laboratory work, such as safety glasses, disposable gloves, aprons, etc.

- Prepare workshop materials to distribute to participants. This may include a binder (in which case, leave space for participants to make notes), or a flash drive loaded with resources (which we have found to be more useful than a CD in that it is more portable, additional resources can be added at any time, and it has re-use value). Consider adding a small memento, such as a t-shirt or a lanyard for the flash drive.

### 3.4. Creating a Dynamic Working Environment: The Importance of Social Interaction

Applicants to the CWCS workshop program report that one of the most significant reasons for applying to the workshop is the opportunity to network with other faculty with shared interests. This is driven, in part, by the number of applicants from smaller departments in which they might be the only faculty member in a sub-disciplinary area (e.g., analytical chemistry, biochemistry, etc) or even the only faculty member who teaches chemistry. As such, it is gratifying that participants report in post-workshop surveys that networking was indeed one of the major benefits of attendance. Creation of a relaxed social environment in which participants (and instructors) are familiar and comfortable with one another has become an important feature of CWCS workshops. Thus, all workshops begin with a social kick-off event, and then have many opportunities for continued interaction both within and outside of the classroom setting. At the Green Chemistry in Education workshop, networking has been actively integrated throughout the week.

*Professor James Hutchison of the Chemistry Department at the University of Oregon in Eugene, Oregon, has offered a number of workshops on Green Chemistry under the auspices of CWCS. These workshops are based largely on materials developed by an NSF-CCLI Materials Development grant (DUE-0443128). He comments on the importance of networking and establishing a welcoming environment for participants early in the workshop.*

*Socializing and networking are woven throughout an otherwise content-packed week. The leaders of the Green Chemistry in Education Workshop emphasize the importance of networking even before the workshop formally begins. During the opening reception, held the night the participants arrive, the leaders clearly state that networking during the workshop is a priority and describe the events that will take place to encourage networking. The participants introduce themselves and explain why they have come to the workshop. The importance of networking is reinforced by the presence of former participants who have successfully implemented green chemistry in their institutions (so-called Success Story speakers). A highlight of the reception is a group reading of Dr. Seuss's "The Lorax", a story with a strong environmental theme. This group activity provides a common experience and sets the tone, citing from the book*

*“Unless someone like you cares a whole awful lot, it’s not going to get better, it’s not!”*

*The first full day of the workshop the participants, organizers, Success Story speakers, and student instructors load into vans for a day trip to a scenic lake and picnic in the Oregon Cascade Mountains. The van ride provides time for participants to get to know one another before they dive into the workshop content. The scenic trip, which involves hiking and boating on a pristine mountain lake, provides a shared experience that helps bond the group together. During this and all other events, participants are asked to wear their nametags (including institutional affiliation) so that everyone gets to know each other’s names.*

*Throughout the rest of the week, participants work together as lab partners or on projects to reinforce the connections made during the beginning of the workshop. They share meals in the cafeteria at designated tables or in a side room and participate in optional evening outings to local pubs. During a debriefing session participants share their aspirations for adopting the curriculum and describe the partnerships that they will need. This helps develop partnerships that extend beyond the workshop. The workshop ends with a trip to a minor league baseball team’s game or a BBQ to give participants a chance to connect one last time with our instructors and each other. Finally, e-mail and a social networking site are used to maintain connections to the participants and keep them connected to each other.*

The Green Chemistry workshop boasts a 100% recommendation rating from past attendees, and all 18 attendees of the 2010 workshop indicated that they felt the opportunities to interact with other participants and with the workshop instructors were “very good” (i.e., 5 on a 5-point Likert scale).

### ***Recommendations***

- Have a “kick-off” event at the beginning of the workshop, such as a reception and dinner on the night before the workshop begins. Provide name badges with the participants’ home institution listed.
  - Have the participants introduce themselves, including some personal information in addition to their professional interests and affiliations.
  - Distribute a schedule, list of local eateries for lunch and dinner, and maps.
  - Providing buffet style (with a variety of selections) or ordering from a menu is easier than collecting participant’s food preferences in advance. *Make sure that adequate vegetarian options are available.*
- Be aware that federal grants cannot be used to pay for alcoholic beverages.
- Consider having a workshop dinner with a keynote speaker toward the middle of the workshop. This could be on campus, at a nearby restaurant, or at the hotel.

- Consider having your department host a separate modest reception to welcome your participants as guests. If you are in a department that awards graduate degrees, consider inviting some graduate students who might be interested in faculty careers.
- Consider a field trip, either workshop-related or not.
- Create time in the workshop for fun and group bonding as well as work.

### 3.5. Additional Opportunities to Build Opportunities for Networking of Participants

In addition to the structured social networking that takes place at CWCS workshops, participants also have the opportunity to build relationships with other participants and the workshop presenters and organizers through more informal means. Attendees of the 2009 workshop on Nuclear Magnetic Resonance, for instance, specifically requested both during the workshop and in post-workshop evaluations that there be a scheduled time for building new collaborations among the attendees and developing course content. Many of the relationships developed during CWCS workshops have led to long-term collaborations following the workshops. In some cases, participants have even come back as presenters in future workshop iterations as a result of developing new contacts. To facilitate these interactions, CWCS workshops focus on including group work during laboratory activities, grouping participants as much as possible, and making concerted grouping decisions that encourage participants from similar institution types or from the same region of the country to work together.

*Professor Deberah Simon of the Chemistry Department of Whitman College, Walla Walla, Washington, attended the CWCS Chemistry in Art workshop in 2004. Her comments attest to the impact of the workshop on her career and how she has been a co-instructor of the workshop since 2007.*

*The connections I made through the CWCS Chemistry of Art workshop revolutionized my teaching. Finding like-minded colleagues had a profound effect on the trajectory of my career. I teach at a small liberal arts college on the West Coast, but these colleagues are scattered over the entire country, and teach at institutions ranging from other top-tier small colleges to large state universities with extensive research facilities, and everything in between. Yesterday, for example, I was in contact with two chemistry professors, one in Virginia and one in Pennsylvania, about collaborating on a workshop and presentation at a national conference and possibly an international conference, and with another chemistry professor in Colorado about a testing method used for metal object conservation.*

*I consider the leaders of the workshop to be my closest colleagues. We have given several workshops at national conferences and are in the planning stages now of a regional workshop which will bring together over a dozen former workshop participants. And these colleagues are not just chemistry professors – I have gotten to know museum conservators from both coasts and their perspective has had an important impact on the emphasis of my own chemistry of art class. As this network has expanded, I have collaborated with practicing artists who have brought a fresh and immediate perspective to the class. This summer I collaborated with a sculptor and glass artist on a glass etching method he wanted to use in a large installation piece – I knew the chemistry and the practical means of achieving his desired result, and it was a win-win situation for us both. The list goes on. Not a day goes by that I don't feel the impact of my participation in the CWCS workshop.*

### **Recommendations**

- Arrange for housing the participants together – this might be in on-campus housing, or a nearby hotel with convenient transportation or within short walking distance.
- Having participants room together fosters closer relationships and allows for participants to have a “buddy” even before the workshop proper has begun.
- When a hotel is to be used for accommodation (as opposed to less expensive on-campus dormitories) cCWCS has recently implemented a policy of covering the cost of a shared room, giving participants the option of selecting a single room upon payment of 50% of the cost. Approximately half of our participants opt to pay the single room supplement.
- Connect participants with others coming from their area of the country.

### **3.6. Integrating Pedagogy and Pedagogical Content Knowledge**

Both content and pedagogy are necessary components of instructor development. CWCS workshops are generally instructed not only by content experts but also by pedagogy experts. This pairing is necessary for participants to develop an understanding of the pedagogical content knowledge (PCK) appropriate to the new topics they encounter through the workshops. In some cases, the pairing of content and pedagogy experts come in the form of multiple presenters who separately teach either content or pedagogy, while in other workshops there are presenters who combine these areas and also are able to showcase appropriate PCK through their workshop instruction.

*Professor Lawrence Kaplan is Halford R. Clark Professor of Natural Science, Professor of Chemistry, and Chair of the Legal Studies Program at Williams College, Williamstown,*

Massachusetts. He has presented workshops on Forensic Science each summer as part of the CWCS program.

*Participants in the Forensic Science workshop are chosen not only for their interest in the subject matter to be covered in the workshop but for what they can bring to the workshop. During the introductory session on the first evening of the workshop I emphasize that while I may be the expert on forensic science, each of the participants is an expert in some area of chemistry. We all can learn from each other. I emphasize this attitude throughout the workshop, encouraging the participants to contribute their knowledge to both the classroom discussions and the experimental work in the laboratory. This approach not only encourages class participation but also promotes community building since no one feels threatened and they all feel part of a collective group sharing a learning opportunity.*

*The entire workshop experience is begun with a staged crime scene. As the participants process the crime scene and collect and package various items of evidence, they begin to catch the excitement for the investigation they are about to undertake. As suspects are identified and new evidence is submitted to the crime lab, many false leads are followed. This reinforces the idea that not every experiment is successful and not every one leads to the resolution of the crime. This differs significantly from the way experiments are presented in other introductory course where the students conduct an exercise, rather than an experiment, with a known (at least by the instructor) answer and they are graded on how close their answer is to the true answer. In this lab program, the true answers (who dun it) may never be known.*

*As I introduce topics for discussion, I find it better to set the stage by stimulating interest in the material by making it relevant to well known (possibly historical) crimes. For example, the analysis of the bullet fragments from the President John Kennedy assassination can be used as an entry into a discussion of atomic structure. Throughout the workshop, I try to give the participants an idea of the many approaches one can use to engage their students and I strive to model these in the way that I teach the workshop. Science is fun and the material, both lecture and laboratory, should be presented in a way that students catch the excitement and see the practical applications – many of which are directly relevant to their lives.*

#### **Recommendations**

- Integrate teaching styles that are appropriate for the content; in other words, model appropriate teaching of the content.
- Explicitly allow for discussions of the pedagogy within the workshop.
- When appropriate, incorporate time for participants to generate their own lessons and provide feedback.

### **3.6. Providing Content Appropriate for a Wide Range of Participants**

Learning new content is the significant reason for faculty applying to attend CWCS workshops. However, participants come from widely varied backgrounds, teach a broad set of courses, and have different needs. To meet the needs of participants regarding content, workshops often provide a great deal of flexibility and self-paced exploration of activities. The Chemistry of Art workshop is a prime example of this flexibility.

*Patricia Hill of Millersville University in Millersville, Pennsylvania, began offering workshops on Chemistry in Art in 1998 as part of the Undergraduate Faculty Enhancement NSF program (DUE-9752769). She has offered this workshop every year since 2002 with support from CWCS. She describes the exploratory nature of instruction in this workshop and the role of co-facilitators in developing networks of participants.*

*Attendees at the Chemistry and Art workshops participate for a variety of reasons from wanting to develop a specific course that integrates chemistry and art, to implementing a few lab activities in existing courses, to simple curiosity and an interest in art. Given these widely divergent participant goals, the workshop is structured to “flood” participants with information, experiences and pedagogical practices in an environment designed to maximize participant-participant and participant-facilitator interactions.*

*Each day begins with an hour-long discussion followed by a short break. Then each laboratory session is introduced by taking participants on a “walk around”, briefly showing them the 10 to 15 hands-on experiments that will be available during the lab session. After that participants are free to perform any lab they choose. Lab sessions typically last two hours. The sequence is repeated in the afternoon, when 10 to 15 more hands-on activities are made available. Most lab activities remain available to participants throughout the week and participants are free to choose which they wish to complete. Participants are encouraged to perform lab activities with partners or in small groups to promote discussion. Each day is typically capped with another lecture session after dinner and open lab time. A separate “resource room” containing books, articles, videos and DVDs is also accessible to participants.*

*Because so many lab activities are going on simultaneously, the workshop has relied upon multiple facilitators and “mentors” (workshop alumni who have implemented curricular changes using workshop materials) and not just one workshop instructor. The co-facilitators and mentors have deliberately been recruited from the ranks of former workshop participants not only to provide professional development opportunities for those faculty members, but also to provide role models to current workshop participants for implementation of workshop content in a variety of ways. This practice is seen as key to building a sense of community and support among former and current workshop participants, as well as crucial to the viability and longevity of a “chemistry and art community of scholars”. Participants often initially respond to the overwhelming amount of workshop information and activities with excitement as well as some anxiety and confusion, which gradually dissipate as the participants become more familiar with the workshop content and begin to network with each other.*

### **Recommendations**

- Allow participants access to as much of the workshop material as possible electronically (CD, online, flash drive, etc.) rather than on paper.
- Provide example laboratory experiments, lectures, and lesson plans to participants, even if there is no plan to implement them in the workshop itself, so that participants have something to start with upon returning to their institutions.
- Consider how you might provide perspectives on writing successful grant applications.
- Allow participants to choose what material they work with during the workshop. For example, provide more experiments than any one participant might complete, or be interested in, across several levels of chemistry (and then be prepared to stay late when they attempt them all!)
- Encourage participants to work on experiments and evaluate topics that will be of the most use to them, even if that means not “completing” all the work laid out in the workshop; focus on meeting participant needs rather than finishing a set schedule
- Include flexibility in the schedule for participants to go back and explore experiments from earlier in the workshop or to develop and test their own procedures
- Toward the end of the workshop have the participants describe which activities they are most interested in implementing in their own classrooms. Making a written and verbal commitment to adopting even a modest number of activities gives you opportunities to engage participants in an ongoing discussion, and for participants to identify potential partners in the development of their curricula.

### 3.7. Evaluation

An essential component of a successful workshop is thoughtful and integrated evaluation of the program. This means asking questions for which the answers are useful in development of new workshops and modifying the current one. Attendees are often eager to provide feedback on their experiences, especially when they feel their input may help make programming continue to be available in the future. In addition to an array of other comments when asked if they had any additional comments during a post-workshop interview, 61 of the 322 participants (18.9%) offered the sentiment ‘Please continue to fund this program!’ without prompting them in any way in this direction.

#### *Recommendations*

- Include questions in your application which gauge the applicants’ knowledge, prior experience and current use of topics and/or materials to be covered in your workshop. This will allow you to make a selection of participants who are best prepared to benefit from the workshop, and may serve as the basis for pre- post-assessment.

- Have the participants complete an end-of-workshop evaluation before leaving the workshop. This should be done in such a way that the participant's identity is held in confidence from the workshop presenters and organizers. In the last period of the workshop, have them complete a survey in which they will report their:
  - satisfaction with the workshop presentations and activities,
  - satisfaction with the organization of the workshop (accommodations, meals, schedule, etc),
  - level of knowledge of the material. This can be compared with the knowledge they reported in the application to determine an impact of the workshop,
  - plans for the implementation of topics and materials from the workshop in their own teaching activities.
- Evaluate the workshop again after some time has passed so that participants can comment on the ease of implementation of the workshop materials, the utility of the materials to their specific courses, additional thoughts that arose for them after the workshop, and the response of their departments to changes they have suggested or made based on their workshop experience.
- *Use the evaluation information to improve the programming.*

#### 4. FUTURE CHALLENGES AND OPPORTUNITIES

Despite the high value of the previous CWCS workshop series, attendees have repeatedly expressed a desire to be able to participate in a variety of post-workshop activities. We have developed and evaluated a number of components for selected workshop topics to engage participants in extended professional development. These include advanced workshops (for returning workshop alumni), opportunities to offer outreach programs, and conference symposia.

While workshops are an effective medium for faculty development, their impact is significantly limited if considered in isolation. Upon return to their home institution, workshop attendees can face numerous institutional barriers, including resistance to changes in the curriculum, lack of availability of load reduction to facilitate curriculum development, lack of funds to implement experiments or demonstrations, and a sense of isolation if the faculty member is the only one from that institution to attend the workshop (Marder, et al., 2001; Moeini, 2007). Brent and Felder make a strong case for development of learning communities for faculty development with significant follow-up activities, institutional recognition, and support (Brent & Felder, 2003). Various models for Faculty Learning Communities (FLCs) exist (Steinert, 2000). However, as with most other faculty development initiatives, they are primarily focused on individual campuses (FIPSE, 2010; SBCTC, 2006).

With the rapid popularization of online communities (e.g., Facebook, MySpace), simple-to-use tools are now available to introduce and bring together individuals who share common interests. To effectively engage faculty members in the use of online tools to interact with one another the resources must be accessible without significant investment in mastering the technology, the materials must be of high value, and there must be a critical mass of participants (Moeini, 2007; Steinert, McLeod, Conochie, & Nasmith, 2002). However, it should be noted that personal, face-to-face, interactions at events such as workshops will remain important in developing lasting collaborative relationships.

## **5. CONCLUSIONS**

As with most curricular activities, there are best practices when developing, disseminating, and conducting faculty professional development workshops. This work has indicated that those best practices range from the minute (e.g. providing sufficient refreshments during breaks) to the grand (e.g. integrating pedagogy, content, and PCK actively throughout the workshop presentations). Even so, missteps in any of these areas can greatly impact participant experience. CWCS has developed effective mechanisms for navigating the process of running faculty professional development workshops, and can act both as a model for other programs and as a collaborator, providing insight, infrastructure, and resources to those interested in developing their own faculty professional development programming.

In the future, the rebranded cCWCS plans to build systems to address some of the issues discussed herein, namely to build online communities for participants in our workshops to facilitate post-workshop collaboration and to provide alumni with development mini-grants to allow faculty time to work on curriculum development. Through these endeavors, we seek to increase the support infrastructure for attendees and improve the effectiveness of the workshops both during the workshop itself and well past the end of the workshop.

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