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Of Special Interest

Report On "Workshop Chemistry"

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In this program, students meet weekly in small groups to practice solving chemistry problems aided by a workshop leader.

David Gosser (City College of New York) and Pratibha Varma-Nelson (St. Xavier University, Chicago) presented the *Workshop Chemistry* initiative, "a coalition of faculty, students, and learning specialists organized around a peer-led, team-learning model of teaching chemistry." Through presentations and small group discussions with undergraduates, participants learned about this program, how it has been implemented at two different schools, and how it might fit into their own curriculum.

"Workshop Chemistry" by David Gosser was presented at the "Day 2 to 40" workshop symposium held May 10–11, 1997. The two-day event was held in the Willard H. Dow Chemical Sciences laboratory building on the central campus of The University of Michigan in Ann Arbor, Michigan. Each of the articles that comprise this issue was written by one of the group of reporters whom I asked to attend each session to take field notes and then follow up with the session leader and participants afterwards.

—Brian P. Coppola, Proceedings Editor

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Descriptive Outline

David Gosser began the workshop with an overview of the Workshop Chemistry program and the schools where it is currently underway. After his presentation, Dawn Patitucci described her experience at St. Xavier University as a peer workshop leader, and then Jewel Daniel read some quotes from reflective journals kept by student workshop leaders at City College of New York (CCNY). Participants then heard Carol Munch, currently enrolled in a course at St. Xavier which includes workshops, give a student's perspective on the program. After these presentations, attendees were divided into three groups, each with a a peer facilitator, and were given some example problems from an organic chemistry workshop. The groups worked through the problems with the help of the facilitators, or chose to use that time to ask the students questions about the program. Near the end of the two-hour session, the participants reunited into one group, and Gosser lead a discussion of some of the issues which had come up in the smaller groups.

Report

David Gosser, Pratibha Varma-Nelson, and a host of undergraduates presented an overview of their "Workshop Chemistry" effort, one of five major chemistry curriculum initiatives sponsored by the National Science Foundation. In this program, students meet weekly in small groups to practice solving chemistry problems aided by a workshop leader. What sets the project apart is that the leaders are themselves undergraduates, most of whom have just completed the class themselves.

Gosser explained that the Workshop Chemistry program focuses on the student experience with the goal that the undergraduates become part of a community of learners. Used in addition to lectures or other large class meetings, the workshop is a required and integral part of the course. The small group setting accommodates diverse learning styles and provides mentoring relationships, according to Gosser. "Ideally, students learn how to communicate scientific ideas and work as part of a team at the same time that they improve their understanding of the material and their problem-solving ability," Gosser said.

The workshop leaders in this model are not expected to be chemistry experts, and they are not supposed to teach the chemistry to the students. Instead, they should be "experts in learning the material," having recently taken the class themselves.

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Workshops led by peers also provide students with a more relaxed atmosphere where they may feel more comfortable participating and making mistakes.

The program does have some drawbacks, however, at least in conforming to students' expectations. Some students participating in workshops conclude that their instructors are not doing enough "teaching." According to Dawn Patitucci, an undergraduate at St. Xavier, the Workshop Chemistry model "puts a lot of responsibility on the student, and that can be uncomfortable for some." Varma-Nelson mentioned that teacher evaluation scores often decline as a result of instituting workshops, because students perceive the instructor as doing less (although she also said that the workshops actually took more of her time, because of the extra preparation required). Patitucci suggested that instructors must explain clearly to students the role of the workshop and the peer leader at the beginning of the semester to avoid such misconceptions.

Interestingly, several of the undergraduates present admitted that it had taken them some time to accept the Workshop Chemistry model. Carol Munch, currently a student in one of Varma-Nelson's classes at St. Xavier University in Chicago, told the participants that at first she had been reluctant to participate in the workshop for her course. Munch explained that she had returned to school after years working as an accountant and had expected that she could teach herself as well as any peer leader. She found, however, that the workshops gave valuable feedback she could not get on her own. In addition, Munch said that in the business world she had found no correlation between a job candidate's GPA and their interpersonal skills; she felt that the workshops, unlike most classroom experiences, helped students learn how to operate effectively in a group setting.

Patitucci described her own experience as a workshop leader, learning not to "play teacher." Patitucci said, "It was difficult for me to sit back and let the students figure things out for themselves, without me running up to the board and solving problems for them." Eventually, she learned to give the students more control. Patitucci told about leading a workshop in organic chemistry, a subject she had not studied for several years. One day, she walked into a workshop and, in her words, "choked": "I had just been to our peer-leader training session the day before, and I thought I knew the material, but, when it came time to do the workshop, I had no idea what I was doing; so, my group, none of whom were stellar students, taught me NMR spectroscopy."

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Undergraduates at CCNY participate in a training class to prepare them as workshop leaders. Gosser explained that this seminar covers all aspects of the workshop leaders' role. Topics of discussion include learning theory, fundamentals of group leadership, and the diversity of students and their learning styles. The undergraduates get course credit for the training class (which they can take only once), and a small stipend each semester that they lead a workshop.

In addition, the workshop leaders must each keep a reflective journal in which they relate their experiences as the semester progresses. Jewel Daniel read excerpts from several of the journals written by workshop leaders at CCNY. These quotes demonstrate the workshop leaders' pride in their students' new understanding of chemistry, as well as in their independence and ability to operate effectively as a group.

Varma-Nelson gave attendees a view of how the Workshop Chemistry program can be adopted and adapted to other environments. Like Gosser, she includes the peer-led workshops as an integral part of her courses, and even gives quizzes during workshop to emphasize its importance. However, St. Xavier does not have the resources to offer an additional workshop-leader training class, forcing Varma-Nelson to provide her undergraduate leaders with more informal guidance. She explained that she meets with the workshop leaders weekly to discuss any difficulties they have experienced as well as the plans for the next week's workshop. She holds these meetings much like a model workshop session with the workshop leaders attacking the week's chemistry problems while she facilitates their efforts.

Perhaps the biggest beneficiaries of Workshop Chemistry are the undergraduate workshop leaders. They get extensive experience in group management and communication, and they improve their teaching ability. In addition, they learn the material of the course much more thoroughly than before. Most importantly, they have the opportunity to develop a mentoring relationship with the course instructor as well as friendships with students and other workshop leaders. Patitucci described it this way: "These are all objectives of the workshop model, and I'm amazed that these things happened to me of all people, because the only thing I wanted from St. Xavier University when I arrived there was to get a degree and get out."

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Dialog

The workshop gave participants many opportunities to discuss the Workshop Chemistry program. One major concern to attendees was how to find funding for similar projects at their schools. Varma-Nelson explained that she has used some of her department's supplemental instruction funds to pay workshop leaders' stipends. Gosser also suggested that work-study scholarships can provide some funding.

Participants worried about finding enough good students to act as workshop leaders. Gosser said that he generally has to turn away several students because of a great demand to take part in the project; however, Varma-Nelson, operating at a smaller school, admitted that she has had difficulties at times, especially early on, in finding appropriate undergraduates. She said she has even tried using students currently enrolled in the class as workshop leaders, but that that situation did not work well because other students perceived it as unfair.

When asked how they choose the workshop leaders, Gosser and Varma-Nelson emphasized the importance of the student's interpersonal skills over their chemistry abilities. They said they look for students who interact well with their peers and do not dominate discussions. A "C" student can, and has, made an excellent workshop leader, "struggling along with the students" as they work through the course material.

By breaking up into small groups, each with at least one student facilitator, participants also got another, closer view of Workshop Chemistry. While they worked through the organic chemistry problems which were provided, or in some cases instead of using the worksheets, the participants talked with the undergraduates about their experiences as students and leaders in the program. The undergraduates explained in their words the dynamics of a workshop and the job of the leader. One attendee asked, "When a student is having problems, at what point do you jump in as a workshop leader?" The leader responded that she would ask students to evaluate each other's answers, rather than solving the problems herself. Often, she said, she had students work out the problems on the board to aid discussion afterwards.

Asked about how to deal with strong students who might dominate the workshop, the undergraduates explained that "a good workshop leader doesn't let that happen." Each student is required to talk and to listen, and the students who grasp the material more quickly learn to sit back at times, becoming almost like a second facilitator for the

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workshop, they told attendees. The strong students who succeed in facilitating their peers' learning are exactly those that Gosser and Varma-Nelson would like to choose as workshop leaders for the following year.

The participants were very receptive to the Workshop Chemistry model, and several said that they would like to try something similar at their own schools; however, they expressed concern over finding the necessary money, classroom space, peer leaders, and time to put a workshop project into practice. The workshop helped attendees explore the Workshop Chemistry program such as it had developed at CCNY, as it was translated to St. Xavier, and perhaps as they might adapt and adopt it at their own institutions.

Adoptive Participation

During the workshop, participants gathered as many logistical details as possible about the Workshop Chemistry program. They wanted to know about the ideal room size and setup, the content of the practice sheets used, the training of the leaders, the assigning of students into groups, and so on. Some of what they learned is summarized below.

Workshop Chemistry involves organizing students into groups of 5–7, who are assigned an undergraduate peer leader. Workshop groups are assigned randomly and generally end up with a mix of stronger and weaker students. Generally, the groups form close bonds, and after a couple meetings, it can be difficult to split up a workshop group, even if necessary.

Ideally, these groups meet around a large table, near a blackboard. Sometimes, two groups will meet in the same room, and their interactions can provide an interesting synergy, according to Varma-Nelson. In all cases, the weekly workshop meetings are a required part of the course. The students are responsible for the week's reading, and receive their problem sheets about two days before the workshop. Some instructors, including Varma-Nelson, give students a 5-point quiz at the beginning of workshop to encourage preparation and attendance.

Workshop leaders use a variety of techniques to get students involved. Often, they have students work problems out at the board and then evaluate each other's solutions. They try to keep any one student from dominating the conversation and to have every student say something. Their primary job, in fact, is to keep the group productively

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working on chemistry. Unlike in traditional recitation sections, no one is teaching. "They're sitting down and solving problems together."

Workshop leaders meet weekly with the course instructor to go over the new problem sheet and discuss any difficulties they have experienced. The instructor acts as a mentor, reading and responding to the peer leader's reflective journals. At CCNY, but not at St. Xavier, undergraduate leaders enroll first in a training course to learn to be effective workshop leaders. The students are paid a stipend for leading a workshop, but several of them said they would still do it without the stipend.

Adaptive Participation

Many participants said that they would like to try something similar to Workshop Chemistry at their own schools; however, concerns regarding the money, classroom space, peer leaders, and time necessary made them consider modifying the program somewhat. Several attendees said they might start with larger workshop groups (10–12 students per group, instead of 5–7) to reduce the number of rooms and workshop leaders they needed. Other participants thought about making the workshops voluntary, rather than requiring them as part of the course.

Further information on Workshop Chemistry can be found at : http://www.sci.ccny.cuny.edu/~chemwksp.

Feedback

"Dr. Gosser, I would hammer away, much more strongly, at the notion that your work is applicable and cheap. It does NOT require a complete overhaul of existing programs, it does NOT require $100,000 expenditures (or even $5,000), and it does NOT require students on the caliber of those found in the Ivy League. At a place like [my institution], we fight the same battles of funding and inertia that everyone else confronts. We see the NSF initiatives with a mixture of admiration and envy, realizing that implementation of the barest fraction of many of their ideas, however desirable, require energies and moneys that NSF has not bestowed upon us. We can, and will try, to get some from NSF, but we are also quite realistic."

"It is this very quality that makes your work unique from anything I heard at this or other conferences. Even this will not be easy (funds to pay students, classroom space,

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the extra time ...) but it IS something that I can look at and say 'THIS can be done at [my institution].' I don't believe I'm the only one from universities like mine-fairly large, public, cash strapped, primarily undergraduate-who would feel this way. I think it's your biggest selling point. Combined with your statement of tapping a resource we haven't considered before-the students themselves-I think you have some ideas here that may not be the flashiest but in the end the most useful ideas to come from the initiatives."

Workshop

"My notion of a workshop was virtually the same as that of the presenters; however, I came into the session under the false impression that this was the only method which the presenters employed in teaching chemistry-e.g., no lectures. I can't imagine how one would teach chemistry strictly in the workshop format. I was relieved to discover that the presenters were not advocating teaching strictly using the workshop technique."

"I think the presentation was effective in giving an overview of the Workshop Chemistry model. The term 'workshop' implies doing something during the presentation and the group discussions at the end fit that goal."

"It matched my notion of the nature of a workshop. After a solid introduction to the program, we were provided with good examples of how the program was done at two schools and then we got to try some of the materials ourselves. It was particularly useful that student group leaders from CUNY and St. Xavier's of Chicago were present to share their experiences first-hand. It gives me confidence that our students could fill these rolls on our campus."

"It had some workshop components, though it struck me as more of a seminar. The undergraduates who had been group leaders were good to listen to-adding a 'realistic' touch to the proceedings. All of them were impressive, especially the one who admitted her initial errors in running a session (wanting to do the work herself rather than letting the students figure it out). The demo of how a workshop would work was fine, though not as effective as the undergraduate comments, in my opinion."

"I thought this matched well with what I expected and wanted. I had hoped for a combination of expert sharing (from numerous angles) and interactive work and sharing."

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“The workshop was excellent and having students as presenters was a welcome difference.”

“This session had a variety of activities. Taking the role of a student in a ‘Workshop Chemistry’ session was useful. I also enjoyed having presentations from undergraduate students who were workshop leaders.”

Things to Take Home
“I plan to use student leaders in my course this fall, if I can pull it off.”

“As a graduate student at a large university, I teach recitation sections. I have attempted to run my sections as workshops in the past, but student resistance broke my nerve and I fell back into the old pattern of lecturing at the chalk board. This session inspired me to try again and to try harder. It drove home how important it is to get the students to do the work, as opposed to me lecturing them.”

“I only have 11 students this summer and I had been planning to only hold one recitation section per week, but based on what I heard at this session, I will now try to have two much smaller sections.”

“I am hoping to adapt the Workshop Chemistry model...for use in a new course directed at students entering general chemistry who have had no high school chemistry or who are ‘at risk’ of completing the first semester successfully.”

“I think the adaptability of the concepts in this workshop will depend very much on the department I eventually teach in. However, the concepts sound good if we are short-handed in terms of graduate students.”

“If the logistics and money problems could be solved, I would like to set up similar tutorial groups that are guided by our students. It looks like a valuable supplement to the lecture portion of our general chemistry course.”

“I think it is probably quite useful to have students broken up into smaller groups since they will feel more comfortable and therefore more likely to participate in working problems. At this point, I’'m not completely convinced that I should allow the direction of these small problem-solving groups to be handled simply by undergraduates who’ve had the Gen Chem sequence (and done well).”

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“I think the encouragement of successful students to help less successful students (and the steps that the peers use to make that happen) will be useful.”

“I am very interested to try out the student facilitators idea. I teach both inorganic and environmental chemistry classes of 25–35 students, and I have always encouraged group work and discussions...I know that my current class often worked together, and I think that educating the students about how to help one another learn might make such unofficial group work more effective. I believe the interactions described by the students, in which the better (and more sensitive) students learn to ask leading questions, rather than simply provide answers, could be fostered in a small class even if funds are not available for official group leaders.”

“The revelation that teaching evaluations were actually a little worse (since the students perceived the professor as spending less time on the course) was useful to me, as a nontenured professor. I will have to think carefully about how to address this aspect of the approach.”

“I would love to set up a workshop for my section of general chemistry. I am not sure, however, how to get around various logistical problems. We have several sections of general chemistry and the students may not be willing to have an extra class meeting to do this when the others do not require it, especially since they already do not get more credit for taking a course with a laboratory. They may also not be able to fit it into their schedules. My chair does not really think it will work here because the students will just see it as extra work. Then I could not be sure that those who needed it the most would come. I am also not sure that I have the skills to teach the workshop leaders effective ways to run a workshop. I may still do it but at this point I would have to make it optional, perhaps giving the students extra credit for attending regularly.”

“This is one of the few workshops at the 2-to-40 symposium or others I''ve attended that seemed realistically doable at a University like [ours]. We aren’t going to be installing 40 computer multimedia labs any time soon, nor are we going to be cranking up five atomic absorption spectrometers for our 1,000 gen. chem. students. That’s not to say I wouldn't love to try it, but sadly, reality does enter into the picture once in a while.”

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“The whole notion of running a ‘recitation’ session with undergraduates working on a problem set not in the text, in groups of ten or less, is one that seems so obvious now, but never occurred to me before. It seems quite simple and quite cheap to implement, and the results sound like they could be quite extraordinary. Thus, I’m quite impressed with the idea’s simplicity.”

Improvements?
“I did not think the break into actually working problems was necessary to understand the nature of the method they were describing.”

“I thought that this session was very well done. It did seem that the two leaders were having difficulty coordinating the presentation though.”

“One suggestion would have been to have examples of more than organic chemistry workshop materials and then participants could have been grouped according to their interest/area of teaching expertise.”

“Could have used some more information on how students are chosen to be group leaders.”

“One question ...: It seemed that the analysis of the 'impact' of the 'workshop chemistry' program was extremely qualitative—workshop leaders’ (undergrads) journals were exhaustively examined, and some students’ comments were presented, all of which were extremely positive. What about negative comments made by students or workshop leaders? Were there any? In addition, are there any more quantitative measures that one can use to assess the impact of the program on the students’ abilities to learn material outside of the workshop environment?”

“I would have been interested in hearing more about the training of the peers (with a bibliography of training materials, or examples of training materials).”

“I can think of no substantive improvements. The workshop was excellent.”

“Provide more materials that have been used during the workshop sessions. Provide more information on training the leaders. I would like more information on how the students taking classes with these workshops view them, what they like and dislike, how wide a range there is in student opinion, etc.”

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Workshop Participants

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