Fusion Science Theater Presents *The Amazing Chemical Circus:* A New Model of Outreach That Uses Theater To Engage Children in Learning

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All chemical educators have experienced the joy and transformation that occurs when students who believe they cannot learn chemistry understand and apply a chemical concept. When the chemistry department at Madison Area Technical College (Madison, WI) was asked to put on a show for children of the student body, we decided the best way to inspire them to study chemistry was to give them a genuine learning experience. We also recognized the challenges inherent in teaching chemistry in an informal setting. Public science shows typically attract a diverse audience that includes a broad range of ages (toddler to teenager), cultural backgrounds, cognitive abilities, and attitudes toward science. A science outreach show cannot teach unless it can capture and hold the attention of the audience. To be effective, it must also be entertaining.

One highly entertaining form of outreach is the chemical demonstration show. Performed by chemical educators and their students in venues across the country, these popular shows feature 10−30 demonstrations that display exciting chemical phenomena. Assessment data from the literature indicate these engaging and enjoyable shows can lead to increased interest, appreciation, and awareness of chemistry in young audience members *(1−4)*. Many practitioners also explain concepts, ask questions, and invite observations about the demonstrations to enhance the educational impact of their shows *(3, 5−9)*. Unfortunately, educational gains were not assessed in these reports, so the effectiveness of these efforts remains uncertain.

To design a show that was both educational and engaging, we looked for practices and techniques that would engage children's minds, emotions, imaginations, and bodies in the act of learning. We found these practices in the discipline of theater. To quantify the success of these practices, we evaluated the impact of the show on children's conceptual knowledge as well as their attitudes toward science.

The result was *The Amazing Chemical Circus* (see Figure 1), a show that laid the groundwork for a new model of science education outreach we call Fusion Science Theater. In this article, we draw parallels between scientific investigation and theatrical performance that reveal common underlying principles at work. We also report on the show's development, form, content, evaluation, and impact. Finally, we outline the Fusion Science Theater model, and briefly discuss the implications for chemical educators and students who wish to enhance their own outreach efforts.

Methods Borrowed from Theater

Playwrights employ specific methods from theater to make the audience care about what will happen next, wrestle with weighty issues, think in new ways, and reach their own conclusions. During *The Amazing Chemical Circus*, the following elements of playwriting were used to motivate and catalyze science learning in the context of an outreach show.

- *Tell a story through questions:* Plays work by planting a question in the minds of the audience early in the story. For example, the question planted in *Romeo and Juliet* is, "Will Romeo and Juliet beat the odds and live happily ever after?" The audience becomes engaged in the play because they want to learn the answer. This device, known by playwrights as the "dramatic question", sparks curiosity, elicits attention, and motivates the audience to wrestle with the problems presented as the play unfolds. A well-crafted dramatic question provides context and urgency to the many smaller questions that are posed, answered, and linked together to form the plot.
- *Engage the audience through characters:* Audience members invest themselves in a play because they identify with the characters and care about their wellbeing. This emotional connection makes the problems and concepts of a play more personal and compelling. Characters can also interject humor,

10.1021/ed100143j Published on Web ■■■

Figure 1. Scenes from *The Amazing Chemical Circus*: (I) Mr. Green and Squirt demonstrate electron activity in the emission of colored light; (II) Ringmaster builds a polymer model during Mr. Elasto-Man's demo; (III) Squirt holds diagrams of gas-filled balloons as Dr. Kaboom explains; and (IV) the cast takes a bow: Anne Kerby as Squirt; Ray Olderman as the Ringmaster; Bill Hausler as Mr.Green; David Shaw as Mr. Elasto-Man; Amy Payne as Dr. Kaboom. All photos by Richard Seibt.

which makes it easier for the audience to process ideas and difficult information.

- *Make metaphor concrete:* Well-written plays convey metaphor in concrete terms (sets, props, masks, or choreography) to engage multimodal learning and deepen understanding. For example, in a scene from *Copenhagen (10)*, the characters of Bohr and Heisenberg move in patterns that evoke the trajectory of subatomic particles. This choreography represents Heisenberg's uncertainty principle while underscoring the uncertainty in their friendship.
- *Provide a framework through genre:* Playwrights choose to write in a familiar genre because it provides a framework that allows the audience to engage and interact with the content of a play. For example, conflicting points of view are more accessible when presented as a debate or a courtroom trial, and the investigative process gains definition when presented as a "murder mystery".
- *Make an impression through spectacle:* Playwrights employ spectacle to draw the attention of the audience to information that is important to the plot. Exciting and arresting displays of lighting, sound, sets, or costumes heighten awareness through the element of surprise.

These elements are not new to informal science education. They have been used in three common formats: stage plays, creative dramatics, and demonstration shows. Stage plays dramatize the stories of scientists, scientific controversies, and the impact of science on the public (dramatic question and characters). These plays are performed in museums, children's theaters, and as touring shows. Creative dramatics is a form of theater education that engages children by having them play a role in a scenario (metaphor and genre). This model has been used in museums, elementary grades, and college-level organic chemistry *(4, 11, 12)*. Chemical demonstration shows feature exciting examples of chemical phenomena (spectacle), and sometimes use questions or characters to set a dramatic context for the demonstrations or to provide humorous interludes between demonstrations *(4, 13)*. This model has widespread popularity among outreach professionals and chemical educators.

Available evaluation data from demonstration shows and stage plays indicate these forms of science outreach can increase children's interest and enthusiasm for chemistry *(1–3)*. Unfortunately, the evaluations have not assessed gains made in content knowledge. Of these three forms, only creative dramatics has verifiably taught chemical concepts and content *(1, 12)*. Our goal with *The Amazing Chemical Circus* was to build upon the best practices from these examples.

Development Parameters

To develop *The Amazing Chemical Circus*, we gathered an interdisciplinary team that included four faculty members from the chemistry department, the laboratory director, and three local theater artists. One of us (H.W.K.) served as the team leader and brought expertise in both disciplines from her experience teaching chemistry and playwriting at the college. The team was united around the goal of developing an outreach show that taught chemistry concepts using theater.

Several parameters were determined before work on the show began. Because the show was intended for children of the student body, we tailored the content toward a younger audience (4–12 years of age). To keep their attention, the show length was limited to 1 h. To emphasize the theatrical nature of the show, we used the college's 100-seat theater equipped with lights and sound.

Because of scheduling conflicts, the entire project was developed within three weeks. Ironically, the time constraints made the instructors and participants more willing to focus, take risks, and work across disciplinary boundaries to meet the deadline.

Development Process

At the first meeting of the development team (project leader, chemistry faculty, and lab director), each instructor chose a set of demonstrations that illustrated one or two simple yet related concepts. Instructors agreed to formalize these concepts into learning objectives and to develop a 10- to 15-min chemistry "lesson" to teach them. The topics of these lessons were emission spectra, polymers, and rate of combustion reactions.

We used two elements of theater to enhance each lesson. First, we adapted "make metaphor concrete" by developing segments we called "act-it-outs". In these segments, children from the audience were invited to the stage to play the role of a molecule, atom, or electron in a dynamic model of the chemical concept. For example, to investigate why liquid fuels and gaseous fuels burn at different rates, we timed how long it took for children (acting as oxygen molecules) to grab balloons (representing fuel molecules). In the first act-it-out, they grabbed balloons out of a cylindrical container (liquid fuel); in the second, they grabbed the same balloons spread out among them on the floor (gaseous fuel). We hoped the act-it-outs would increase audience participation, engage kinesthetic learning, and create a memorable, whimsical visual image.

The second element used to shape the lessons was telling a story through a question. Instructors were asked to formulate an "investigation question" that could be used to structure their lessons and lead the audience toward specific learning objectives. For example, the overall question for the combustion lesson was "What makes the biggest boom?". We hoped these questions would capture attention and keep the audience watching to learn the answer, much like the dramatic question of a play. Next, the instructors worked with the project leader for about 10 days to choose demonstrations and create act-it-outs that were aligned with the investigation question. They did this with apparent ease, even though none of them had training in theater.

While the instructors completed their lessons, the project leader brainstormed ways to link the three independent lessons. Plays presented in museums accomplish this through a plot or fictional story that provides an engaging context for the science content. While plots are highly engaging, these plays must strike a delicate balance because too much educational content interrupts the flow of the story and diminishes the effectiveness of the play. Given the diverse topics selected for our show, our attempts at suitable plotlines introduced more problems than they solved. Plots that were sufficiently complex to link all three lessons were impossible to write, memorize, and rehearse in the short time before the performance. It was also clear that a comprehensive plot would compete with the chemistry lessons and compromise the educational impact of the show. We needed some element that would provide context to the lessons, let the instructors teach unencumbered by a formal script, and give the show theatrical appeal. We satisfied those requirements by abandoning plot and applying the element of genre. By using the playful and well-known framework of a three-ring circus, we could present the independent lessons as individual acts.

To capitalize on the element of character, we created a self-important, broadly comic, sometimes clueless Ringmaster, and his young, knowledgeable, longsuffering sidekick named Squirt. These characters served the show in three ways. First, the Ringmaster, knowing very little about chemistry, always needed more information and asked a great many questions about process and concepts. This dynamic between the characters set up the investigation questions of each act and introduced the methodology of science by exploring questions like "how, why, and what". Second, having the younger character more knowledgeable than the elder engaged the empathy of the youthful audience. Third, both characters introduced the instructors, interacted with the audience, provided humor, and helped coordinate the act-it-outs.

Five days before the performance, the instructors presented their lessons to the development team. The project leader worked with the community actors to write dialogue and antics for the Ringmaster and Squirt. The final script was loosely assembled around a few specific lines and instructions for the Ringmaster and his sidekick. The science lessons were left in outline form to allow the instructors to teach and interact with the audience as they saw fit. The script was also simple enough to perform with minimal rehearsal and memorization. An outline of the show and the entire script can be found in Appendices 1 and 2 of the supporting information. In Table 1, we summarize the plot of Act 3 to illustrate the structure, the use of questions, and the integration of the host characters into the unscripted lessons developed by the instructors.

Rehearsal and Performance

A production team joined the development team for two, 3-h rehearsals and the final performance. The production team included a Madison Area Technical College performing arts instructor who acted as the technical director, theater students who worked lights and sound, and chemistry students who prepared demonstrations and assisted in scene changes between acts. Because the theater was provided free of charge and the participants were volunteers, the cost of the show was limited to chemicals, materials, and props used, which totaled about $200 USD in all. The entire show was conceived, developed, and produced in about three weeks.

The Amazing Chemical Circus premiered on April 8, 2006, with two additional performances presented the following year on April 28, 2007. The theater was filled to capacity for each performance with minimal publicity. Each audience was about two-thirds children and one-third parents. Because much of the dialogue was improvised, the three acts played as lessons taught by engaging, enthusiastic, and encouraging teachers. There was an easy rapport between the instructors and host characters as the latter posed questions, assisted with demonstrations, and facilitated the act-it-out sections. Children in the audience volunteered answers, yelled out encouragement, offered predictions, cheered each demonstration, and eagerly participated in the act-it-out segments. The show ran a full hour, but the audience remained engaged and attentive. A 10-min video clip from the show can be viewed on the Web page of www.fusionsciencetheater.org (accessed Jul 2010).

Evaluation

To quantify the impact of the show, we recruited an evaluator with expertise in communication to develop assessment instruments and to prepare a study design that met IRB requirements. Evaluation was conducted on both shows presented in 2007. Because the evaluation took place under time constraints within the chaotic environment of a public show, the assessment questionnaires were designed to be short and easy to complete. To expedite the collection of data, and therefore maximize the number of children who could participate, we limited the assessment of the learning objectives to only two of the three lessons (polymers and combustion). Preshow and postshow questionnaires were used to assess children's attitudes toward science and their grasp of the learning objectives. Assessment of children's interest and engagement with the show was included in the postshow questionnaire. A separate postshow questionnaire was given to the parents to obtain their perspective on the value of the show. (See Appendix 3 of the supporting information for the three questionnaires; only the main findings are reported here.)

All questionnaires were distributed as the audience entered the theater. For children who were not proficient in reading and writing, parents were asked to assist their children by reading the questions and filling in their child's answers, but they were urged not to influence their child's responses. Questionnaires from 56 children were received (68% were boys). Respondents ranged

Table 1. The Plot of Act 3: "What Makes the Biggest Boom?"

Segment and Description	Investigation of Learning Objectives
Introduction	
Host characters Ringmaster and Squirt introduce topic of combustion as act of the circus.	Q: What is needed for burning? A: Fuel, heat, and oxygen.
Ringmaster and Squirt introduce guest scientist Dr. Kaboom and ask her questions.	Q: Why is your name Dr. Kaboom? A: Sometimes burning is quiet and sometimes it makes a boom.
Demonstration 1	
Dr. Kaboom burns iron skillet, steel wool, and iron powder.	Q: Why do these forms of iron burn so differently?
Explanation/Model	
Dr. Kaboom explains relationship of surface area to rate of combustion using blocks as models.	A: Oxygen and iron must collide to react. The more collisions, the faster the burning.
Demonstration 2	
Dr. Kaboom burns liquid ethanol in a graduated cylinder and gaseous ethanol in a large jug.	Q: Why did the same fuel burn differently?
Explanation/Model: Act-It-Out	
Volunteers come to the stage to perform physical dramatization of collision theory. Stopwatch is used to time how long it takes children (acting as oxygens) to grab balloons (representing fuel) inside a cylindrical hamper (representing a graduated cylinder) vs those scattered on the floor (representing fuel as a gas).	A: It takes ~20 s for "oxygens" to grab balloon "fuel molecules" in the hamper and only 2 s to grab them when they are scattered on the floor. Conclusion: the faster the reaction, the bigger the boom.
Application of Concept To Predict Outcome of New Scenario	
Dr. Kaboom presents balloons filled with H_2 and a mix of H_2 and O_2 along with molecular diagrams of contents. Audience applauds for which they think will make the biggest boom.	Q: Which balloon will make the biggest boom?
Demonstration 3	
Dr. Kaboom lights balloons.	A: Balloon filled with H_2 and O_2 makes bigger boom because the proximity of oxygen and fuel molecules leads to more collisions.
Summary	
Ringmaster summarizes what he learned; audience helps him remember.	

in age from 2 to 14 (median age was 6.0 years). Because the sample size was small ($n = 56$), we combined data from the two performances. In some analyses, there are fewer than 56 respondents because some children skipped some questions.

Engagement and Interest

Children answered the question "how much did you like the show?" by choosing among the following responses: "not at all ☹"; "a little bit ☺"; "pretty much ☺☺"; and "very much! ☺☺☺". They also answered the question "Would you like to come to more shows like this?" by choosing among "no", "maybe", and "yes". Figures 2 and 3 demonstrate that the children gave very positive evaluations on both of these measures. Most of their written comments were enthusiastic as well (e.g., "I loved the show", "very very very cool", "that was amazing!"). A complete list of the children's comments can be found in Appendix 4 of the supporting information. In addition, the majority of parents said that the show was "extremely" valuable (87%) and said they were "extremely" interested (72%) in bringing their child to more shows of this type.

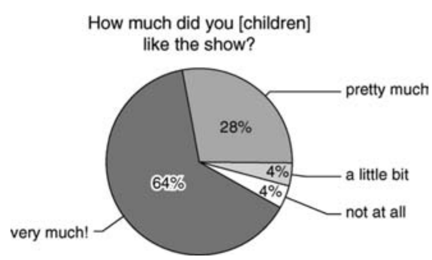

Figure 2. More than 90% of the children surveyed liked the show "Pretty Much" or "Very Much!" ($n = 53$).

Knowledge and Comprehension

Two questions testing concepts demonstrated in the show were included in the preshow and postshow questionnaires.

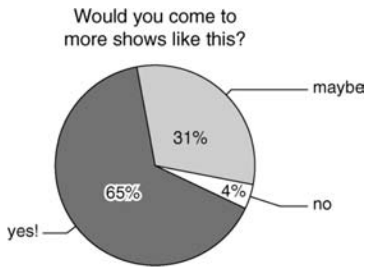

Figure 3. More than 95% of the children surveyed might like to see similar shows or would definitely like to see similar shows (n = 51).

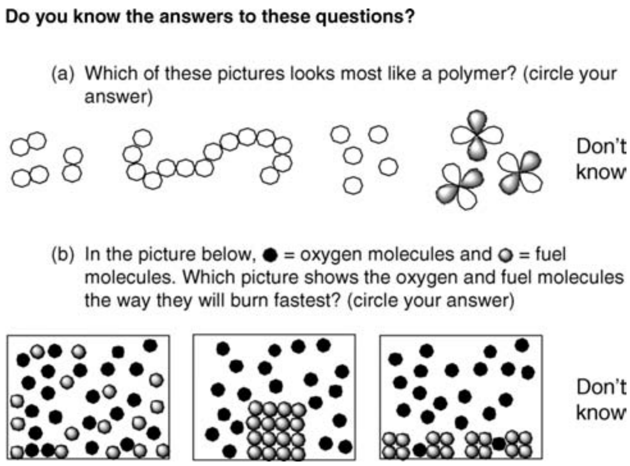

Figure 4. Concept questions that were included in the questionnaires distributed to children.

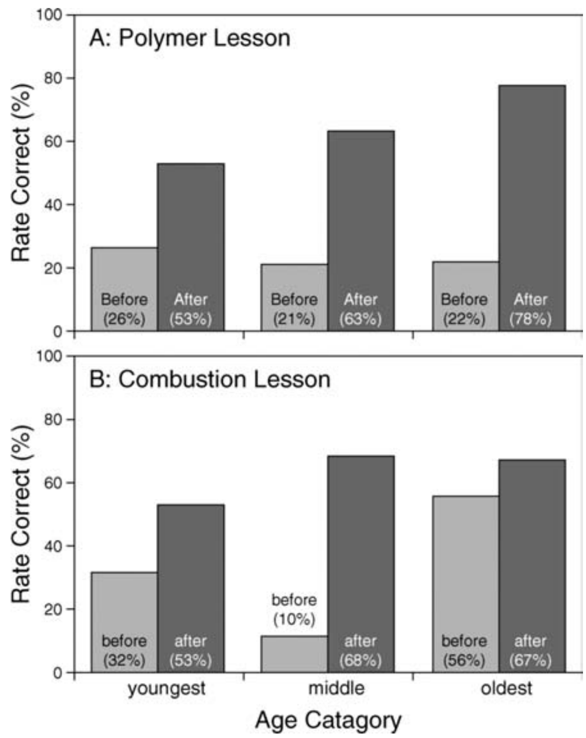

Figure 5. Learning outcomes of (A) the polymer lesson and (B) the combustion lesson. Age groups were defined as youngest, 2−5 years, n = 19; middle, 5.5−7 years, n = 19; oldest, 7.5−14 years, n = 18. For both lessons with age groups combined, a significantly higher percentage of children answered the concept question correctly after the show than before the show (p < 0.001 by Wilcoxon test).

One dealt with polymers; the other dealt with combustion (Figure 4). Answers to these multiple-choice questions were converted to a dichotomous variable indicating that the response was either correct or incorrect. To test for statistical significance, we used the nonparametric Wilcoxon Signed-Rank Test. The percentage of children who answered these questions correctly increased significantly from before to after the show (polymer question: 23.2 vs 64.3%, $z = -4.27$, $p < 0.001$; combustion question: 32.1 vs 62.5%, $z = -3.4$, $p < 0.001$).

Because of the wide age range, responses from children were divided into three age groups of approximately equal size to reflect their presumably increasing background knowledge of science (youngest group, ages 2−5, n = 19; middle group, ages 5.5−7, n = 19; oldest group, ages 7.5−14, n = 18). Figure 5 shows that improvement occurred in all three age groups (polymer question: youngest, 26.3 vs 52.6%; middle, 21.1 vs 63.2%; oldest, 22.2 vs 77.8%; combustion question: youngest, 31.6 vs 52.6%; middle, 10.5 vs 68.4%; oldest 55.6 vs 66.7%).

Attitudes toward Science

Five statements expressing attitudes toward science were rated before and after the show. The attitude statements were “Science is exciting”, “I can understand science”, “I'd like to learn more science”, “I'd like to be a scientist”, and “Science is fun”. Ratings were made on a scale with a range of 0−3, as follows: 0 = “not at all ☹”; 1 = “a little bit ☺”; 2 = “pretty much ☺☺”; 3 = “very much! ☺☺☺”. A “don't know” option was also provided. To determine whether any of these attitudes changed significantly from before to after the show, and whether any of these changes varied as a function of the child's age, we conducted a mixed-design analysis of variance on the data for each attitude. The age group (youngest, middle, oldest) served as the independent factor and pre- versus postassessment served as the repeated-measures factor. “I don't know” responses were treated as missing data.

There was a significant increase in agreement with two of the statements. “Science is exciting” yielded a significant before−after main effect: $F(1,45) = 13.3$, $p = 0.001$. The mean on this measure was 2.2 before the show and 2.6 after the show. “I can understand science” also revealed a significant main effect from exposure to the show: $F(1,46) = 18.6$, $p < 0.001$. The mean agreement with this statement was 1.7 before the show and 2.3 after the show. In addition, there was a significant interaction between age group and the repeated measure on the “I can understand science” measure: $F(2,46) = 8.5$, $p = 0.001$. This interaction resulted from the relatively large increase in feelings of competency among the youngest group (youngest, 1.1 vs 2.5; middle, 1.9 vs 2.1; oldest, 2.0 vs 2.2).

Discussion

As supported by the data, there is strong evidence that *The Amazing Chemical Circus* is educational as well as entertaining for children 2−14 years of age. This is a unique accomplishment in the discipline of chemical education outreach. While other outreach shows have reported a positive influence on children's attitudes toward science *(1−3)*, to our knowledge, *The Amazing*

Table 2. Theater Elements Used To Enhance the Educational Impact of the Show

Elements of Playwriting	Adaptation for the Circus Show	Example from Act 3 of the Circus Show	Why the Device Enhanced Science Learning
Tell a Story through a Dramatic Question	Investigation question	What makes the biggest boom?	Structures lesson as investigation (inquiry) Focuses lesson on learning outcomes Helped in design of concept questions for assessment
Engage the Audience through Character	Host characters	Ringmaster and Squirt	Engages audience "person to person"
Make Metaphor Concrete through Example	Act-it-out	Children act as oxygen molecules colliding with fuel represented by balloons	Enhances participation Engages multiple learning styles (kinesthetic, visual) Emphasizes the use of metaphor in science Fun and whimsical Audience engaged by watching people they know on stage
Provide Framework through Genre	Genre	Three-ring circus	Provides familiar, entertaining, cohesive context for acts or lessons
Make an Impression through Spectacle	Demonstrations	Combustion of iron (frying pan, steel wool, and powder), ethanol (as liquid and vapor), and hydrogen and hydrogen/oxygen mix in balloons	Arresting visual display Illustrates concepts of learning outcomes Provides information to audience to answer the investigative question

Chemical Circus is the first show that has demonstrated a positive impact on their concept knowledge of chemistry.

In some ways, the most important achievement of *The Amazing Chemical Circus* was the emphasis on learning in the creation and design of the show. This education-first approach created a script that reflects traditional classroom lesson construction: three short lessons that targeted specific learning outcomes and used selected demonstrations to illustrate them. The success of this approach suggests that teaching skills may be more important than showmanship in crafting an educational outreach program.

The Amazing Chemical Circus engaged the audience through the application and adaptation of elements borrowed from the discipline of theater. These elements, their adaptations, concrete examples, and functions are summarized in Table 2. Science-outreach professionals have used these concepts individually, but to our knowledge, we are the first to use all five elements in a cohesive package.

Although all of the elements were useful, we believe the most powerful tool was our adaptation of the dramatic question from playwriting into the investigation question that launched and guided each act or lesson. Many science theater plays have a human-interest story at their core and communicate science content as contextual information. Although these stories are successful in engaging the audience, the plot also steals attention, focus, and interest from the science content *(14)*. *The Amazing Chemical Circus* dispensed with the human-interest story and used an investigation question to teach the science directly. In other words: Science was not part of the story; science *was* the story. When we took this tack, a remarkable thing happened: The qualities the dramatic question imparts to a human story—suspense, focus, and urgency—were incorporated into the science lesson.

The investigation question was also key because once it was posed, the rest of the lesson was needed to answer it. Chemical demonstrations became more than spectacle because they provided valuable information that served the learning objective. Act-it-outs modeled essential concepts to convey understanding in a way that was kinesthetic, visual, and participatory. As in all inquiry-based learning, mastering the learning outcomes became more than acquiring information for information's sake; the learning was the sought-after, satisfying answer to an intriguing question.

The elements of genre and character were used to frame the inquiry-based lessons as well as guide and engage the audience. The circus theme allowed us to set the three lessons in the well-known context of a three-ring circus. This heightened the audience expectation and appreciation of the demonstrations and teaching. The host characters of the Ringmaster and Squirt connected with the children and took full advantage of the circus theme to lessen the fears some children might have about learning science.

The last column of Table 2 lists concrete ways that elements from theater imbued the show with qualities widely regarded as best practices in science education. These include:

- Inquiry, introduced by the investigation question and heightened by presentation of the lessons as the acts of a circus.
- Participation, incorporated into the learning process through the act-it-outs and interactions with the host characters.
- Engaging multiple learning styles, using act-it-outs that engaged visual and kinesthetic learning; interactions with the host characters that engaged verbal and interpersonal learning; and the investigative question that engaged logical learning.

This outcome suggests that theater practices used in the show did more than keep the audience entertained and attentive. Incorporation of these practices made the chemistry lessons and our presentation of them more engaging for the children in the audience. This supports our initial contention that theater can be a valuable tool for creating chemical outreach shows that teach as well as entertain.

Implications for Enhancing Outreach Efforts

Given the educational impact of the show, and the short development time, we believe the techniques described here are robust and highly transferrable to other outreach efforts. Any group that is currently performing demonstration shows can perform *The Amazing Chemical Circus* with similar ease and results. Although an interdisciplinary team was essential for the creation of *The Amazing Chemical Circus*, an interdisciplinary team is *not* needed to perform the show. Chemical educators, or students under their supervision, can play the role of the instructors in each act. Performing arts students, community theater artists, or dramatically inclined chemists or chemistry students can play the parts of the Ringmaster and Squirt.

The success of *The Amazing Chemical Circus* catalyzed the formation of the Fusion Science Theater Project, a group of chemical educators, outreach professionals, and theater artists in Madison, WI. The Fusion Science Theater Project has developed and produced three additional mobile shows that can be performed by outreach groups across the country. Reports on the further development of our methods, the outcomes of the resulting shows, and our experience training student groups to perform the shows will follow.

Acknowledgment

This work was funded in part by a grant from the National Science Foundation (DRL #0732142) and Robert and Elizabeth Muller Foundation. This project benefited from the expertise of the chemistry faculty and staff at the Madison Area Technical College. In particular, the authors would like to recognize Amy Payne, Joan Boyce, Bill Hausler, Bill Huntsman, and David Shaw for their indispensable contributions to *The Amazing Chemical Circus*. We would also like to thank Michael Lussenden of Madison Area Technical College Performing Arts and Ray Olderman for their production assistance. Melissa Naud and Stephanie Eastman provided assistance with preliminary assessment of the learning outcomes. Kimberly Yarnall, Ashley Shade, Brittland DeKorver, and three anonymous reviewers provided excellent comments on the manuscript.

Literature Cited

1. LaRiviere, F. J.; Miller, L. M.; Millard, J. T. *J. Chem. Educ.* **2007**, *84*, 1636–1639.
2. Voegel, P. D.; Quashnock, K. A.; Heil, K. M. *J. Chem. Educ.* **2004**, *81*, 681–684.
3. Voegel, P. D.; Quashnock, K. A.; Heil, K. M. *J. Chem. Educ.* **2005**, *82*, 634–636.
4. Hughes, C. *Museum Theatre*; Heinemann: Portsmouth, 1988; 80−84.
5. Koehler, B. G.; Park, L. Y.; Kaplan, L. J. *J. Chem. Educ.* **1999**, *76*, 1505–1508.
6. Lee, N. E.; Schreiber, K. G. *J. Chem. Educ.* **1999**, *76*, 917–918.
7. Louders, L. L.; Huisman, R. D. *J. Chem. Educ.* **1999**, *76*, 196–198.
8. Silberman, R. G.; Trautmann, C.; Merkey, S. M. *J. Chem. Educ.* **2004**, *81*, 51–53.
9. Swim, J. *J. Chem. Educ.* **1999**, *76*, 628–629.
10. Frayn, M. *Copenhagen*; Methusen Books: London, 1998.
11. Palmer, D. *J. Coll. Sci. Teach.* **1999**, *29* (3), 187–190.
12. Worch, E. A.; Scheuermann, A. M.; Haney, J. *J. Sci. Children* **2009**, *47*, 54–59.
13. Sprott, C. *Wonders of Physics* performance; University of Wisconsin−Madison. February 2009.
14. Allen, S. *Finding Significance*; Exploratorium: San Francisco, CA, 2004; pp 47−48.

Supporting Information Available

Outline of the entire show; complete script for *The Amazing Chemical Circus*; questionnaires used for children and their parents to evaluate the show; written comments from children who watched the show. This material is available via the Internet at http://pubs.acs.org.