

How We Engaged Audiences in Informal Science Education through the Inaugural Arkansas Science Festival

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Abstract

Science festivals are gaining popularity as informal science education (ISE) events. With support from the Science Festival Alliance and Arkansas State University (A-State), we launched the inaugural Arkansas Science Festival in October 2014. Few science festivals are held in rural areas such as the upper Mississippi Delta, A-State's home, so challenges were expected. Our local and campus communities enthusiastically came together to host events over eight consecutive days. Beginning with school groups attending the opening performance of ArcAttack's singing Tesla coils, through the Science Expo's dozens of hands-on activities, displays and performances, and events in between, we attracted over 2000 participants to our festival. Here we describe the challenges and successes of the first ever Arkansas Science Festival, and how even with a limited budget in a rural setting, we engaged participants in ISE activities.

ISE through the Arkansas Science Festival

Informal science education (ISE) experiences can spark new interest in STEM (science, technology, engineering, and mathematics) fields (National Research Council [NRC] 2009). As advances in the domains of science and technology impact all areas of life, the importance of developing a scientifically engaged public in the 21st century cannot be overstated. One type of ISE experience, the science festival, has become a popular event across the United States and abroad. Though highly varied, science festivals typically focus on a celebration of STEM by engaging the public with scientific content (Bultitude et al. 2011). Science festivals may be offered in a single day or across multiple days, and in a variety of community, university, and museum settings. Each of the 40 science festivals established over the past five years has its own identity, but all rely on STEM practitioners to bring science to participants in an informal, interactive format (Wiehe 2014). The authors of this paper, research scientists at Arkansas State University (A-State) with interests in ISE, implemented the state's and region's first science festival in Fall 2014. At

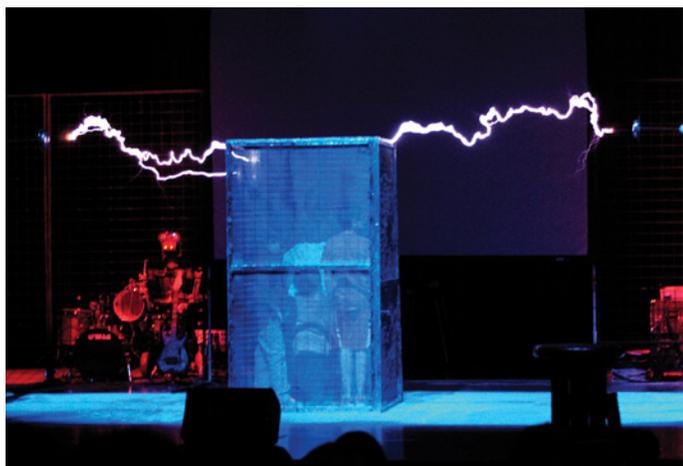


FIGURE 1. ArkSciFest attendees in the Faraday Cage at ArcAttack

the time of planning, approximately 50 science festivals were listed on the Science Festival Alliance website, yet none was listed in the rural South. Scientific literacy is important for all; however, inhabitants of rural communities seldom have opportunities to engage in ISE activities. Our targeted region was the upper Mississippi Delta, which has some of the lowest population densities in the southern U.S. This economically poor region has a historically agricultural focus, little STEM industry, and some of the lowest levels of higher education in the country. The 2014 state data tool of the National Science Board revealed that only 13.8 percent of Arkansans hold bachelor's degrees, while fewer than 9.2 percent of the residents of the Delta region of Arkansas have a bachelor's degree (NSB 2014), one of the lowest rankings in the country. Comparable results are found in other states in our recruitment region. Our immediate region, the Jonesboro, Arkansas area, with almost 72,000 people, has a fairly diverse population, approximately 71 percent Caucasian, 18 percent Black, and 6 percent Hispanic (Cubit Planning 2015). Median household income in 2013 was approximately \$39,000, with more than 25 percent of city residents living in poverty (Cubit Planning 2015).

To build the first Arkansas Science Festival, we sought funding through an initiative from the Alfred P. Sloan Foundation managed through the Science Festival Alliance, a group whose mission is to help create more and better science festivals. On our campus, the Colleges of Education and Behavioral Science, Sciences and Mathematics, and the Arkansas Biosciences Institute provided internal matching funds. Through these generous entities, we had an initial total budget of \$20K. Using a preliminary A-State activity schedule, we

set a date for our festival in collaboration with the performing arts center on our campus and secured a science-themed musical group, ArcAttack, folding their performances into an established family-friendly concert series. Our other activities were planned to span the weekend of that date, and we would use the ArcAttack performances on the first Friday of October 2014 to attract area students and their families back to campus for the Science Expo the following day.

Issues

Our first setback occurred shortly after finalizing the date for ArcAttack: we could not schedule campus activities the following day, as homecoming, a major athletic event for our university, was now planned for that date. Making "lemonade from lemons," we decided to participate in homecoming by securing a tailgate tent to host activities and promote other science festival events, which would now span eight consecutive days, culminating in the Science Expo the following Saturday. Another issue was that we needed to secure university approval for a logo design and promotional materials through our Office of Marketing and Communications, which we found to be a very busy office. Additionally, there were difficulties in clearing university protocol when soliciting community members for their financial support and inviting outside entities to join in the celebration. This "red tape" caused us to lag behind in both promotion and fundraising for our festival.

Back on Track

With our first two events secured, we sought collaborators within our community and across the state. The county public library offered to sponsor an activity during festival week, and also agreed to participate in the Science Expo. The organizer of a long-running science café in Little Rock (140 miles away) assisted us in hosting the first science café in our region for the festival. We secured an award-winning Arkansas author and radiologic technologist to present a talk on Marie Curie at the Expo, as well as community music groups to present at our homecoming tent. The Arkansas Museum of Discovery (also from Little Rock) arranged to bring their mobile science museum to be enjoyed by student groups on opening day.

Campus Collaborations

We found many enthusiastic campus collaborators and colleagues. The Arkansas State University Museum planned “warm up” activities for visiting regional students prior to the morning ArcAttack performance, as did staff from the Rural and Delta STEM Education Centers on campus. A professor of theatre suggested “Playing with Science,” a national playwriting contest for short science plays. A rock band comprised of faculty and students agreed to perform at the Expo, and several individual faculty, graduate students, and student groups began organizing activities to be presented at the Expo and in the homecoming tailgate tent. Many of the student organizations affiliated with the College of Sciences and Mathematics received guidance from the Student Club Coordinator, who is also currently working on a project of civic engagement sponsored through a SENCER SSI Implementation grant. One of the authors (KY) organized a research methodology course in which undergraduate students designed field studies to be conducted at the various activities. Further, a strategic communications team adopted the science festival as a class project; these undergraduate students organized and planned promotional strategies, and one interned part-time during the summer to help launch our website, Facebook page, and other promotions. Local media, including our campus NPR station, local television station, and newspaper, announced activities, and ran interviews, ads, and articles.

Festival Week

The “Singing Tesla Coils” of ArcAttack kicked off the festival with a daytime school-based show, followed by an evening show for the public. Together, the two programs brought in over 1,100 children and adults. The next day’s Homecoming Science Tailgate Tent presented the launch of weather balloons to the sound of bagpipes, solar-cooked hotdogs, beer-goggle Baggo, juggling, marine touch tanks, and an entomology collection. This event involved more than 250 attendees and volunteers and reached a large cross section of the community, and we had a welcome visit by a mentor from the Science Festival Alliance. Other events included the astronomy-themed science café held at a local restaurant, a tinkering studio in the A-State museum, a unique mindfulness and biofeedback workshop, and a science of music event at the county public library. Another standout program was “Playing with Science”; over seventy-five original short science plays



FIGURE 2. ArkSciFest attendees launch a weather balloon to bagpipes.



FIGURE 3. Checking out the ELF, a solar-powered tricycle.

had been submitted by local, national, and international playwrights (some of them award winners). This fusion of science and the arts was brought to life through readings of the finalists in the playwriting contest by both scientists and actors. The festival closed with the Science Expo which featured over twenty-five activity stations and events and attracted approximately five hundred participants. The total cost of the eight-day festival was under \$10,000, which was used for promotion, supplies, and the paid performances of ArcAttack. All labor was done by volunteers, including faculty, staff, and students from A-State, as well as community members and museum staff. We estimate that approximately 125 volunteers spent a total of 500 hours in planning and carrying out all the events held over the eight days of the Festival.



FIGURE 4. ArkSciFest Playing with Science Short Play Experiment.

Several Goals Attained!

With the financial support of the Alfred P. Sloan Foundation, mentorship from the Science Festival Alliance, and the support of the many volunteers, Expo hosts, event hosts, student and community organizations, speakers, and performers, we reached our goal of bringing science, technology, engineering, math, and health professions to over 2,000 people in our community (from Jonesboro's population of about 72,000) in exciting and educational formats. Due largely to our volunteers' generous assistance, we spent less than half of our initial budget, enabling us to maintain some funding toward the 2015 Arkansas Science Festival.

Attendees were asked to provide feedback regarding their experiences by completing a brief survey given by student volunteers (Table 1) who were stationed outside the exit doors of the Expo. Sixty-nine adult attendees completed the survey (66 percent female; M age = 37 years, range = 18 to 67 years; 83 percent Caucasian, 3 percent African-American, 3 percent Asian, 2 percent Hispanic; 8 percent selected "other" or multiple categories). We estimate this was approximately 14 percent of all attendees, both children and adults. Since attendance

was measured simply by the number of people entering the hall and was not broken down by age, it is impossible to tell what percentage of the adult attendees completed the survey, a limitation of this research. However, 62 percent of the adults who completed surveys indicated they had brought children with them; thus, we theorize that we have captured a higher proportion than 14 percent of the adult population who attended the Expo.

Items were designed to assess perceptions of different aspects of the event, and three different forms were utilized. All participants were first asked why they attended the event. Then all participants were asked to rate the event on a five point scale (5 = excellent, 1 = poor). A series of statements were then given to all participants to assess impact on interest/learning, such as "Now I'm more interested in STEM than I was before coming today;" affective reactions such as "I enjoyed myself at this event—it was fun," and impact on engagement, such as "I totally got into what I was seeing or doing at the event; I was really engaged in what I was doing." Participants responded to these using a Likert-type scale (5 = strongly agree). The remaining items varied depending on which form participants received. This paper focuses on the items that all participants received.

Participants had a wide variety of reasons for attending the Expo. The most common response (40 percent) focused on attending because of children or grandchildren. Means for all items were significantly higher than the neutral point, $p < .001$. Twenty percent mentioned they enjoyed science or were interested in learning more about science or the exhibits, and 11 percent believed the event would be fun. (Note: participants' responses could fall into more than one category.) Results revealed that participants rated the result quite highly, $M = 4.4$, $SD = 0.6$. A one-sample t -test revealed this was significantly higher than the midpoint of the scale (which was labeled as "good"), $t(68) = 19.5$, $p < .001$. Finally, participants' responses to individual survey items (see Table 1) also reveal that participants reported positive effects in learning STEM content, were engaged in the activities, and had positive affective responses. Again, a one-sample t -test revealed all means significantly higher than the neutral midpoint of the scale, $p < .001$. Perhaps most tellingly, the most highly rated item was agreement that attendees would be interested in attending another science festival. No significant correlation was found between age and any of the items, and no differences were found as a function of gender.

TABLE 1. Adults' Ratings of the ArkSciFest's Science Expo (Mean and Standard Deviation)

Item	M (SD)
I would like to attend another science festival.	4.7 (0.5)
I enjoyed myself at this event—it was fun.	4.6 (0.5)
I enjoyed the booths and displays at the science festival.	4.5 (0.6)

Note: all $p < .001$, compared to the neutral point of the scale

Discussion of Results

Overall, research and evaluation in ISE has lagged behind program development (Bultitude et al. 2011; Hussar et al. 2008). Manning, Lin, King, and Goodman (2013) released one of the first assessments on science festivals. Manning surveyed participants at several major science festivals (all held in urban areas, such as San Diego, San Francisco, and Philadelphia), and results revealed that 78 percent reported that science learning was more fun and enjoyable as a result of attending the events and that 79 percent claimed they would “look for information on something they had learned at the festival.” From our Expo, 66 participants who had attended a science event the prior year reported actually having engaged in behavior to search for more information on a topic, an indication of increased engagement in science. The results from the present study augment the limited research by providing evidence that a more rural population may also derive benefits from these types of informal science activities.

Next Steps

New partnerships were formed between festival organizers and the county library, local museum, and university performance hall, all of which have committed to continue in future years of the festival. Finalists of “Playing with Science” have been selected for publication in an anthology to be disseminated to other festivals and schools. Plans are currently underway for the next Arkansas Science Festival to be hosted in October 2015, and we have partnered with the NSF-sponsored EvalFest team to evaluate it. To continue the growth of the festival we intend to form a steering committee as well as an advisory board, and we welcome the Museum of Discovery, Little Rock, and EcoFest, Conway, Arkansas, which have

committed to being a part of the second Arkansas Science festival, expanding the festival beyond the Northeast Arkansas region.

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