

Community Based Solar Eclipse Outreach in Rural Appalachia

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Abstract. To take advantage of the ~90% coverage partial eclipse in West Virginia, the West Virginia University (WVU) Physics & Astronomy Department and Extension Service developed a statewide outreach program that utilized multiple avenues to engage learners. In rural areas, access to science can be particularly limited, so we took a unique approach to eclipse outreach by leveraging the tight-knit culture of Appalachian communities. Through online training and youth 4-H camps throughout the state, we worked to prepare educators during the summer before the eclipse so they were empowered to teach and host their own local viewing events on the day of the eclipse. Here we describe how this distributed outreach model allowed us to bring “The Great American Eclipse” to over 50,000 West Virginians. Our results and lessons learned will be helpful for others planning community engagement for upcoming eclipses in South America, Asia, and Africa in the next few years as well as in North America in 2024.

1. Background

The North American solar eclipse on August 21, 2017 provided an excellent opportunity to engage the public in an understanding of astronomy. It also presented educational and logistical challenges for ensuring that as many people as possible were well-prepared, as the public’s interest in such phenomena often occurs at the last minute. Focusing on the rural, Appalachian, communities of West Virginia (pop. 1.8 million), the West Virginia University (WVU) Department of Physics and Astronomy and Extension Service partnered to develop a multi-tiered solar eclipse public outreach program for the ~90% partial eclipse experienced in the state. Here we discuss our “Bringing the Great American Eclipse to West Virginia” project to provide a model for others preparing widespread science outreach in the future.

West Virginia ranks lowest out of all 50 U.S. states in percentage of inhabitants with a bachelor’s degree or higher (19.2%, US Census). However, in recent years there has been a significant effort to enhance STEM education to combat this statistic and bring prosperity to the state. For rural Appalachian students in particular, the impact of STEM experiences can be enhanced when they are integrated into their community, as rural students often place a high value on community and family relationships (Wright, 2012; Howley & Howley, 2015). Therefore, our eclipse project took a community-based approach, which will likely be important for the 2024 eclipse for Arkansas, Alabama, and Mississippi (in addition to West Virginia), as they are also in the ~90% eclipse coverage path, rank in the bottom 10 states of 8th graders earning proficient on their standardized science exam, and have a population where >50% of residents are considered rural (US Census). Middle school grades are a particularly critical audience, as it is during this time that long-term STEM interests develop, with 8th grade career

expectations predicting students' probability of completing a science or engineering degree, regardless of demographics (Tai, et al., 2006).

Taking a distributed, community-based approach to "Bringing the Great American Eclipse to West Virginia" meant leveraging the existing programs and networks in the state. For example: (1) the WVU Extension Service reaches youth in all 55 WV counties through 4-H, Energy Express Summer Reading and Nutrition programs, and the WV State Afterschool Network; (2) the Green Bank Observatory houses a Science Center with an exhibit hall and hosts tours of its radio telescopes; (3) the NASA Independent Verification and Validation (IV&V) office hosts an Educator Resource Center that provides educator workshops, loans out a variety of STEM tools, and maintains a listserv of STEM educators in the region; (4) the WV Science Public Outreach Team (SPOT) trains students from seven WV colleges and universities to deliver science presentations to K-12 schools (Williamson et al., 2014), and (5) the WV Science Teachers Association maintains a listserv of members. Through these mechanisms, we were able to collaborate with K-12 teachers and informal educators to distribute over 30,000 eclipse glasses and reach over 50,000 West Virginians, with a primary focus on middle-school-aged youth.

2. Eclipse Outreach Program Highlights

Our distributed, community-based eclipse outreach program included four primary components: 1) a Summer Science Experiment, 2) online teacher professional development, 3) a pre-eclipse Open House for the public, and 4) an eclipse viewing event. Each of these components incorporated distribution of eclipse glasses.

The annual Summer Science Experiment for 4-H camps and Energy Express sites was focused on the eclipse for the 2017 summer program. Accommodating a variety of age groups, kits included activities such as constructing a pinhole projector to measure the size of the Sun, the "Pocket Solar System" activity from the Astronomical Society of the Pacific, and an eclipse model-building activity. College STEM Ambassadors were trained to assist 4-H leaders in leading the activities throughout the summer.

Educator professional development videos and supporting materials were created and posted on a "one-stop-shop" website, including basic eclipse information and activities, eclipse viewing safety, support for educators in planning eclipse events of their own, and information about related ongoing research at WVU. The videos were supplemented by online live video sessions enabling educators to ask faculty questions. Additionally, we created a closed "Eclipse 2017 WV" Facebook group to provide continued communication with interested people and build a networked community of West Virginians who were prepared to engage others in the eclipse.

Teachers who watched our professional development videos and hosted their own observing event could report back to earn a professional development certificate. Further, after receiving training and materials to conduct the Summer Science Experiment, WVU Extension faculty members who live and work in each of West Virginia's 55 counties organized viewing events within their counties. These agents also served an important role as community leaders educating the public when school boards or local media had questions regarding the safety of eclipse events.

In the weeks leading up to the eclipse, several faculty members and SPOT ambassadors spoke at various schools, camps, and summer learning facilities describing how eclipses occur and discussing some of the solar research currently being investi-

gated at WVU. On the Saturday prior to the eclipse, we held a Pre-Eclipse Open House for the public at WVU. Faculty and students volunteered to host eclipse stations. Attendees were given a “passport” to collect stamps at activity stations and turn in for eclipse glasses. Stations included mini-lectures, planetarium shows, solar observing with telescopes, eclipse art, and size and scale activities.

On the day of the eclipse, over 200 WVU students enrolled in the introductory astronomy course were given a pair of eclipse glasses to share with at least 10 people each, and additional physics/astronomy volunteers were stationed with SolarScopes, SunSpotters, and pinhole projectors outside of the student union building. We found this practice to be very useful for building a shared community experience.



Figure 1. The WVU Mountaineer (school mascot) and a student at the eclipse viewing event.

3. Evaluation and Impact

We determined the reach of our efforts through numbers of eclipse glasses distributed, numbers of people involved in our events, and estimates based on reporting provided by participants. Glasses were distributed to almost 300 schools or educational organizations throughout West Virginia, as shown in Figure 2. We received reports about eclipse events from 130 teachers. The categorized number of participants from these reported events are shown in Figure 3, demonstrating the focus on middle school. Given the additional impact from informal educators in Extension Service and 4-H, we estimate that as many as 50,000 West Virginians were reached in 53 out of our 55 counties.

In their survey responses, teachers (N=130) agreed on 5-point Likert scales that having the provided glasses enhanced the value of their event watching (4.79), the provided eclipse videos helped them learn about eclipse science and safety (4.38), partici-

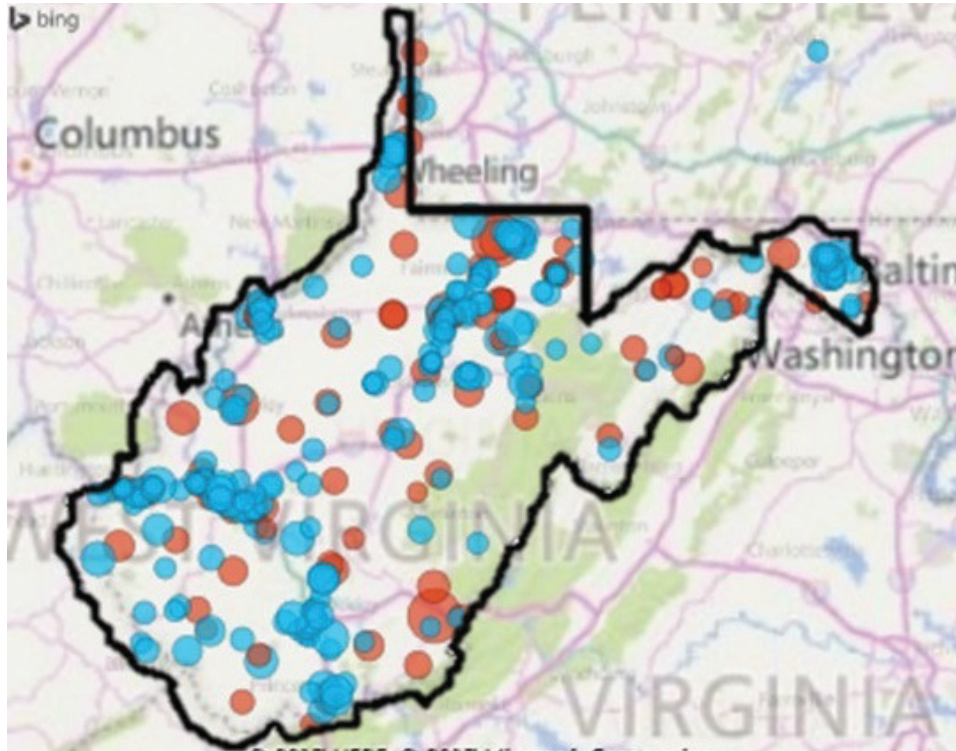


Figure 2. Locations of schools (blue) and other educational organizations (red) where glasses were distributed. Dot size is proportional to the number of glasses.

pants at their events enjoyed themselves (4.65), learned the science behind eclipses and the Sun, Moon, Earth connection (4.26), and viewed the eclipse as a positive way to bring the community together (4.08).

Most informative were the written comments provided by educators and students, which underscore the importance of our community-based approach. Typical comments from teachers who used our one-stop-shop website of resources include: “Thank you—for the easily accessible background information, engaging lesson resources, the chance to call in and ask, and the incredible gift of eclipse glasses,” “THANK YOU for hosting this! I would have never thought to host an event for local home-school and neighborhood without your support.” Comments from the pre-eclipse Open House indicate that participants felt encouraged to act out the eclipse as a family, look up more eclipse resources online, and purchase a telescope. Finally, this quote from an introductory college astronomy student captures many similar sentiments from other students: “The experience that I had sharing my glasses with all of those people was like no other. It was so nice to see the student body coming together to recognize this event and realize just how special it was. I was able to share my glasses with way more than just the ten we were assigned. I enjoyed the looks on people’s faces when they found the sun in the sky and were amazed by what was happening. . . I will never forget this amazing experience and I’m glad I got to witness it here.”

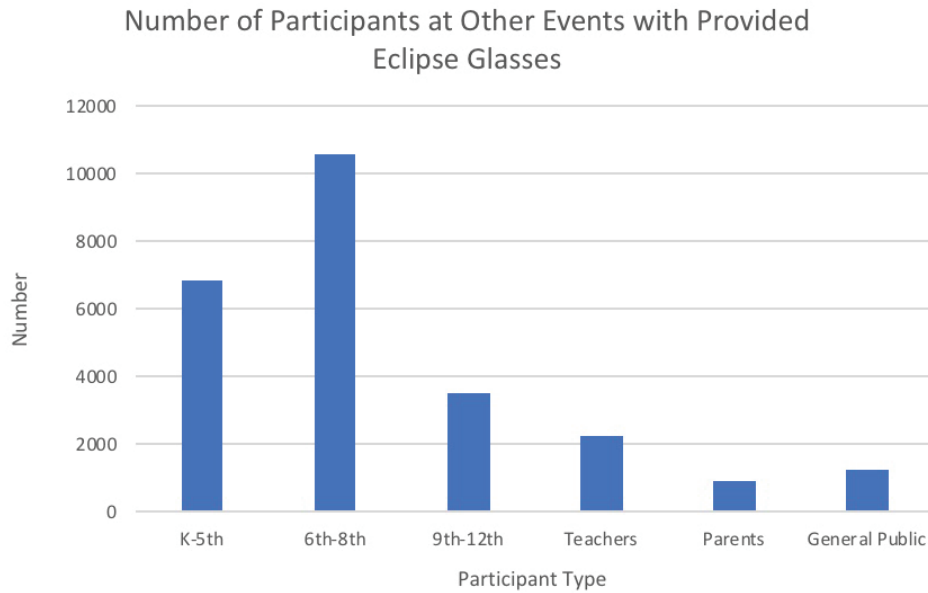


Figure 3. Distribution of participants in events organized by teachers.

4. Lessons Learned

As with any astronomical event, there is no control over the timing. The eclipse occurred prior to or within the first week of the beginning of the school year for many West Virginia schools. The eclipse also occurred in the middle of the afternoon (from about 1-4pm), overlapping with dismissal time for many schools. This made it challenging for the teachers to schedule observation sessions without disrupting the dismissal procedure. Furthermore, within a week of the eclipse, a viral social-media post about eye safety caused a lot of concern among many school administrators. The timing and safety concerns caused over half of the schools (59%) who reported their events to restrict or cancel their eclipse viewing. For example, some schools required permission slips signed by parents, some enacted an early dismissal and gave glasses to students to take home, and some cancelled school and gifted the glasses they received from our project to other organizations. We responded to these concerns as best we could through email, the county Extension Offices, and our Facebook group, but in the future, it would be useful to partner with eye experts to create a stronger message for ensuring eye safety and communicate this to school administrators and teachers early in the process and in an ongoing manner. Because the April 8, 2024 eclipse will occur later in the school year, such planning and communication will be possible.

Another issue was the demand for eclipse glasses. Our request form for educators was completely overloaded, causing us to close the form early and distribute smaller numbers of glasses than were requested. We encouraged teachers to have students share and use the projection method, but some teachers felt strongly they needed an individual pair of glasses for each student. Additionally, some visitors to the pre-eclipse Open House wanted to “grab and go” without participating in the educational efforts, as we had free glasses that, at that point, were selling for exorbitant prices online.

Fortunately, we found that the requirement of a stamped passport proved to be a critical crowd management tool, and we only gave out two per family/group.

Similarly, recipients of glasses at WVU Extension Offices had to actively participate in an experiential astronomy activity before receiving a pair of safe viewing eclipse glasses. A strict rule of one pair per 4-H camp participant also ensured that the glasses were distributed fairly and decreased the likelihood of glasses being discarded without use. To combat the feverish need for eclipse glasses in the future, more details and discussion for use of projection methods would also help administrators and educators understand that they can provide a safe way to observe the eclipse without looking directly at the Sun. During the eclipse, we found that being creative with various projection methods, such as colanders and threading one's fingers, turned out to be some of the most interactive and enjoyed activities, so more emphasis on these activities in the future will be beneficial to both participation and safety aspects.

5. Next Steps

Now that we have a strengthened network of community leaders and educators around the state, we can build on the momentum and excitement of the eclipse to better leverage other STEM resources. For example, in their survey responses, teachers (N=130) indicated that as a result of using the WVU eclipse resources, they were more likely to use WVU resources in the future (4.22/5 Likert scale), participate in a training workshop at the NASA Educator Resource Center (4.08/5), request for a SPOT ambassador to visit their school (3.96/5), and visit the Green Bank Observatory (3.85/5). We have already tapped into this network to advertise other professional development opportunities for teachers, and during other programming we continue to receive words of thanks from educators. We recommend our multi-pronged, community-based, approach to others planning astronomy public outreach, especially to those in rural states who will experience the solar eclipse in 2024. Readers may contact us with questions.

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