



VAST's Vision:
Excellence in Science Education
Through Innovation

ISSN 1945-7405

VAST.Org

Check the web for news, conference updates, registration, and forms.

The Science Educator

Winter 2022

A Publication of the Virginia Association of Science Teachers

Vol. 70, No.3

VAST Welcomes 2022 ROCKIN' PD



COFFEE TALK
@ 10:00 AM



VAST is pleased to announce a partnership with VTCA and FMVA. Would you like to visit a quarry, collect rock samples, walk in the footprints of dinosaurs and experience modern mining in Virginia? These unique experiences are free of charge to VAST Members and open to educators of all grade levels. Earn professional development hours, if approved by your school evaluators!

Tentative dates for tours of operating quarries:

Salem Stone - Holtson River Quarry- Dublin VA - June 17

Come Take a Dip in Ordovician Seas at Holston River Quarry!

Boxley - Buckingham Slate - Arvonnia, VA - June 24

Come Visit Buckingham Slate! One of the oldest continuous operation mines in the country.

Luck Stone - Culpeper Quarry- Culpeper VA - July 22

Come walk with the dinosaurs at Luck Stone, Culpeper.

Branscome - Charles City Plant - Charles City, VA - July 29

Check out some of the youngest sediments in Virginia!

For more information, registration and a photo of each site click on the link(s) for each site. Attend one or all four drive-in field trips at four unique Virginia locations.

[Holston River Quarry](#)

[Culpeper Dinosaurs](#)

[Buckingham Slate](#)

[Sand and Gravel/Branscombe](#)

Last year, Coffee Talks were held online using Zoom. They were opportunities for teachers to connect with others and discuss topics of interest with VAST content leaders. Teachers who are the only ones in their schools who teach a subject and are feeling isolated found colleagues. Ideas were shared and concerns discussed. Teachers asked what other teachers do in their classes. They made connections with others in their area or across the commonwealth.

It worked so well, more Coffee Talks are planned for this spring. What topics or issues would you like to discuss? Please send your ideas to Stephanie Harry, VAST President-elect at president.elect@vast.org. Your ideas and concerns are needed.

Watch for dates, times and registration information coming soon. Typically, Coffee Talks are held on Saturdays and there is no cost to register.

Don't take this opportunity for granite, it is going to be gneiss!

Come Celebrate VAST's 70th Anniversary PDI!

DoubleTree by Hilton Hotel, Williamsburg, November 10-12, 2022

Reconnecting to Virginia's Space, Place, and Contributions to Science

Our expedition to Williamsburg to celebrate 70 years of advocating for quality science education will include local field experiences, Virginia-based keynote speakers, celebrations of all that Virginia provides us from indigenous culture, sea to summit geographic marvels, natural resources, pioneering scientific discoveries, and more! Come celebrate and learn in Williamsburg this November!

Get your room early!

PDI registration opens March 1



From the Executive Director

It takes More Than We Have

It takes more than we have sometimes... I'm looking at this new year so differently. I am looking at where I have been and where I am going. I can honestly say, it is hard to say. Who would think we would be still contemplating our every move? As a science teacher, I learned about viruses but never in my lifetime would I think that something else was controlling my existence. I had been raised that I made the choices that impacted me not the other way around. So, you do what you can and create a balancing act that still enables you to be in control of your choices. I hope you take each day to give yourself credit for still being in the job of making a difference in lives of others like students and fellow teachers. If you feel the need to reach out and want to give more or if you feel you need more than please realize that your VAST family is here for you.

**Susan Booth, Ed.S., Executive Director
Fellow, Virginia Academy of Science**

MENU

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Greetings to VAST 2022



Greetings Virginia Association of Science Teachers Community! I hope that your winter break has been filled with rest and renewal in the midst of yet another challenging year. Our recent Professional Development Institute was another success combining live online sessions and pre-recorded sessions all of which are available on VAST website within the membership portal. While we had hoped this year would be in person, the pandemic had other plans. Along with the ever-evolving situation, we too, evolved our professional development offerings in order to provide the same high-quality content in slightly different ways to keep all of us within this community simultaneously safe while continuing our own professional growth together.

As we embark on a new calendar year, new opportunities to grow and learn, as well as a plethora of new unknowns, I implore you to seek experiences that ignite and kindle your own personal passions. I believe that personal passions are often an untapped resource within the world of education and seek to expand the influence they can have on our young scientists whether within our own homes, learning spaces, or a combination of those. Whether you are a formal or informal educator, elementary, secondary, or higher education, a trained or citizen scientist, these lived experiences fuel our own personal passions and in turn, those with whom we share time each day, especially within our learning spaces. Weaving your own personal passions into your work as an educator is not only a dynamic form of self-care, but brings about a stronger connection for yourself and your learners within your content area expertise; it is quite literally, a piece of you. It's true, science can be taught exclusively indoors, via textbooks, and online simulations, but what a difference it makes to bring outdoor opportunities, field studies, and experiential learning to my young scientists. As an elementary educator, author, and field scientist myself, I know that the experience of being outdoors, exploring, sketching, and doing fieldwork are all personal passions that are woven into the experiences I provide my learners. Intentional use of personal passions to empower learners to be scientists rather than passive participants, is a dynamic teaching strategy.

Learning happens all of the time and everywhere, often dependent upon the place and space you find yourself in

at any given moment, as well as the people within these shared spaces and places. We lead daily expeditions with our learners rooted in discovery, exploration, and questions begging to be answered; oftentimes uncovering even more questions to fuel our curiosity and learning. There is great power and beauty in our own individual and collective spaces and places throughout the Commonwealth, which is what inspired the 2022 Professional Development Institute theme: Reconnecting to Virginia's Place, Space, and Contributions to Science.

Virginia has incredible opportunities for exploration and learning with our unique sea to summit geography, rich history beginning with indigenous communities spanning to present day wildlife rehabilitation and restoration efforts, continued commitment to space exploration, and ever evolving knowledge of the world around us.

As we in the Commonwealth grapple to understand and learn from our own history in shared spaces and places, science also continues to call us to new understandings, questions, and investigative opportunities with our own developing scientists. In preparing for our professional development offerings this year, VAST seeks to offer innovative approaches to professional development, increasing place and space-based experiences for educators to gain relevant, timely, and authentic practice. Topics and pedagogical practices such as outdoor education, field science, geoinquiry, story mapping, and citizen science projects provide a platform for great science experiences for educators and young scientists alike, which will permeate especially through our PDI in November.

How will you grow in your own practice of science, delivery of experiences for your learners, and personal passions? VAST is here to support you in these efforts and allow you the platform to share your own journey as well. Will you join me on this exciting expedition in 2022 to explore Virginia's place, space, and continuing contributions to science? This is no ordinary expedition, it is our 70th anniversary as an organization advocating for exceptional science experiences for learners throughout Virginia; another extraordinary year bringing with it incredible opportunity. I hope you will join the expedition.

Becky Schnekser,
2022 VAST President

[Menu](#)

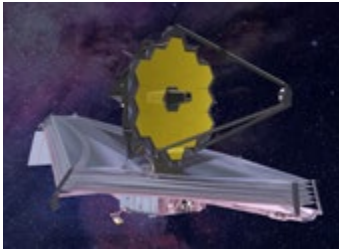
**Work in
Progress!**

VERSE Update!

**Work in
Progress!**

VAST Members will need neither the James Webb nor the Hubble Telescope to discover the contents of the *Virginia Enrichment Repository for Science Educators*. Simply log in to the [VAST.org](https://vast.org) webpage and choose the VERSE tab to access content created by VAST members and presenters for your professional learning and development.

James Webb Telescope Image
courtesy of [NASA.gov](https://www.nasa.gov/sites/default/files/thumbnails/image/euro-pa13-jwst-1920x1080-160919.png)
<https://www.nasa.gov/sites/default/files/thumbnails/image/euro-pa13-jwst-1920x1080-160919.png>



View PDI session recordings
from the 2021 and 2022
VAST PDI Archive - now.

Hubble Telescope Image courtesy
of [NASA.gov](https://www.nasa.gov/sites/default/files/thumbnails/image/hubble3b.jpg)
<https://www.nasa.gov/sites/default/files/thumbnails/image/hubble3b.jpg>



Visit VERSE frequently to
watch it grow.



Content articles from VAST's *The Science Educator*, the *Journal of Virginia Science*, and sessions from the Professional Development Institutes are being 'tagged' with content and grade level identifiers to help target both your interest and learning.

As you collaborate with your school PLC team(s) or work to accumulate professional development points for your next Virginia teaching license renewal, consider the quality VAST materials to inspire, innovate, and enhance your teaching and student learning.

Remember that the VERSE is expanding in 2022, check back frequently and consider how you can add your unique talent and educator insight! It is a work in progress. Newsletter articles from 2012-2021 are accessible currently and require members to log in. The main tab takes you to the links page. At the links page you can select icon specific pages to access specific pdf's. Please note that many articles contain elements of multiple tags and are represented the on multiple icon page list.

Need help navigating, contributing to the VERSE, or suggestions on how to seek PD points? Please contact Mike Pratte VERSE Chair at vice.president@vast.org.

Also remember: VERSE is only available to VAST members! Not a member? Visit [VAST.org](https://vast.org), and click on the "Join" button. Membership is only \$25 a year for all of these resources!



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VAST in 2021: A Reflection by Outgoing President Russell Kohrs

VAST Past-President 2022

In a recent PBS NewsHour segment, David Brooks referred to 2021 as a “shapeless” year. I’ve been thinking a lot about what he meant by that and how I might apply that adjective in my own approach to the past year.

When I think of something that is “shapeless”, I think of there being little recognizable form. I have been trying to think of the usual signposts that provide “shape” to the year as a place to start and then considering how my work as an educator (home and family life also) fit between those signposts as compared to what normal might look like. These signposts...things like spring breaks, graduations, holidays, the start to a new year, etc. are very much like the dots in the connect the dot puzzles I so enjoyed as a kid. As you connect those dots, a shape emerges. Truly, we usually connect those dots with rather straight lines, which then provides clues to the emerging form before it fully bursts out at us in a final “ah ha!” moment on the page.

2021 wasn’t really like that for me as VAST President. Nor was it like that for me as an educator. It certainly wasn’t like that for me as a parent at home. Those lines between dots seemed to meander in and out of the void between the signposts, often in random ways. When I look back on the last year, I find it very hard to make sense of the final picture of 2021. Thus, I find myself agreeing with David Brooks. 2021 was a shapeless year.

But, that doesn’t mean that good things didn’t happen or that progress wasn’t made in our classrooms or by VAST!

The picture of 2021 may end up looking like an amoeba, but as scientists, we know that such an organism is full of wonder and interest. Amoeboid cells occur throughout the panoply of eukaryotic life.

They can alter their shape by extending and retracting their pseudopods, which they use for feeding and movement. In truth, most educators this year likely feel as if their classrooms in 2021 were very much like this. We have had to be agile in the moment, feeding off data and happenings that could change unexpectedly at any time. Certainly, this has had an effect on our mental health. Certainly, also, this paradigm-shifting work will lead to a new and hopefully better situation for science education into the future. Teachers have had to learn to be adaptable, innovate, collaborate in new ways, and exercise creativity. It’s been exhausting. But, fabulous outcomes, I am certain, are on the horizon.

VAST as an organization has similarly experienced an amoeboid year. Originally, we planned to host a fully in person PDI in November. By March, that was down to a hybrid PDI with virtual sessions and onsite lab experiences at JMU and field experiences in the Shenandoah Valley. It ended up being fully virtual for three days, just like the prior year. It’s been exhausting and straining for all of us on the VAST board, but the challenges of 2021 have forced innovation just as they did in 2020 with the introduction of the VAST VERSE. The lessons VAST has learned through all of these challenges will be reflected in bylaw changes written in 2022, the shape of our PDI in 2022, and the addition of exciting new opportunities soon to be announced as regional events in 2022. VAST’s pseudopods are busy. Be on the lookout for new ways that VAST is serving you!

The Virginia Association of Science Teachers is headed into 2022 strong, financially and with vision. Join us, flex your pseudopods with us, and let VAST continue to serve and support you in the challenges you face! Let’s work together for a 2022 that has a shape to it, a shape that is new and exciting!

Russ Kohrs

Benefits of VAST Membership

Mini-grants • Social Media • Professional Development • Awards • E-notes • Networking

Welcome to 2022, VAST members. Your VAST membership gives you many benefits and we want to make sure that you know what they are and take full advantage of them.

The Virginia Enrichment Repository for Science Educators, VERSE, is available to all members. It is being updated and 'tagged' with content and grade level identifiers to help target both your interest and learning. It is still a work in progress. It includes content from VAST's *The Science Educator Newsletter*, the *Journal of Virginia Science Education*, and sessions from the VAST last several Professional Development Institutes. [See more information on page 4.](#)

Journal of Virginia Science Education, JVSE, is a peer-reviewed professional journal produced by VAST. The principal criterion for the acceptance of a manuscript is that it contributes to strengthening the teaching and learning of science. Teachers-to-be, educators of all levels, school administrators, and informal science educators are invited to submit papers to be considered for publication in *Journal of Virginia Science Education*.

The Science Educator is full of information on national science education news; Virginia Department of Education happenings; announcements from partnering organizations; news from VAST regions; innovative science teaching strategies; grant information; professional development opportunities, workshops, and courses; and award information and applications. It is published five times each year. All members receive a link to the current issue in January, March, May, July, and October by email.

The VAST website, VAST.org contains the most recent news and updates. When VAST members login to the website they have

access to **VERSE** and journal and newsletter issues. There you may renew your VAST membership; check your membership status; and update your membership information.



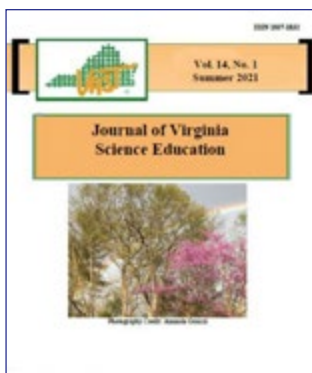
[Recognition In Science Education \(RISE\) Awards](#) are presented to spotlight the excellent work done by science educators across the Commonwealth. They recognize service to science education in the individual's school, school system, and the VAST district in which they work. The awards are grouped in to twelve distinct categories.

[Donna Sterling Exemplary Science Teaching Award](#) - Donna Sterling was a visionary science educator with a passion for working with science teachers and developing habits of inquiry-based teaching. Most recently, her leadership in the **[Virginia Initiative for Science Teaching and Achievement \(VISTA\)](#)** focused on teacher professional development. In 2022, the award will be given to both an exemplary elementary teacher and exemplary secondary teacher. See more information on the Sterling Award and other awards on [page 7](#) and on the [vast web](#).

[VAST Mini-grant program](#) provides seed money for innovative curriculum activities which expand learning opportunities for science students. Team or individual applications are welcome.

Your membership in VAST is your portal to resources, discounted conference rates, and connections to other science teachers in Virginia. Be sure to renew your membership so that you do not miss out on all the resources that VAST has to offer. YOU are important to the VAST education community! Encourage your colleagues to join. Why not gift a new colleague or your student teacher?

[Memberships](#)



Peer Reviewed Journal



Newsletter



VAST.org Website

Elementary (K-6) & Secondary (6-12) Teachers: Apply for the Donna Sterling Exemplary Science Teaching Award 2022



The Donna Sterling Grant is excited to offer two awards this year! One for elementary and one for secondary.

Donna Sterling was a visionary science educator with a passion for working with science teachers and developing habits of inquiry-based teaching. Her leadership in the Virginia Initiative for Science Teaching and Achievement (VISTA) focused on elementary and secondary teacher professional development. This award recognizes that exemplary teachers engage in continuous improvement and is designed to support a professional development plan for the improvement of science teaching. In 2022, the award will be given to an exemplary elementary teacher and an exemplary secondary teacher. For the elementary award the 6th grade teacher must be teaching in an elementary setting. For the secondary award the 6th grade teacher must be teaching in a secondary setting such as middle or high school.

Each awardee will receive a total of \$4000. In addition, registration and travel costs will be reimbursed to attend the 2022 VAST PDI to receive the award and to the 2023 VAST PDI to present a session on the professional development experience and outcomes. Each awardee will receive \$3000 at the VAST PDI in 2022, held at Williamsburg November 10-12, 2022. The remainder will be awarded after the awardee presents at the next VAST PDI and submits an article to the newsletter *The Science Educator* or the *Journal of Virginia Science Education*.

Deadline for Applications: August 15, 2022

To Apply:

1. In your cover letter, include information on yourself, including your preferred name, your home and school addresses, and phone numbers and email address(es) where you can be reached. Tell us how many years you have taught, where, and what subjects and grade levels.
2. In no more than two pages, single-spaced, describe an inquiry-based science unit that you taught. Describe how your unit is student-centered and includes community engagement. Give evidence that the unit was effective. Evidence documents such as student work can be submitted separately and will not count toward the two-page limit.
3. In no more than two pages, single-spaced, describe your plan for professional development, using the funds received through the Sterling award. These plans may include summer courses, attendance at workshops, study abroad opportunities, instructional materials development under the guidance of experts on-site, etc. Feel free to be creative in your plan. Submit the professional development description with anticipated outcomes, including plans for a presentation at the 2023 VAST PDI. Tell how this award will help you become a better teacher of science and will support the development of leadership skills. Tell about your plans for writing an article about your experiences.
4. Submit three letters of recommendation based on direct observations of teaching. One letter must be from the science supervisor or someone serving in that capacity, a second letter must be from the principal, assistant principal, or instructional leader, and a third letter must be from a fellow teacher or a parent. Letters should address the following: Why is this teacher a good candidate for this award? What qualities do they exhibit as teachers that make the recommender think they will use the funds from the award to improve their practice as teachers of science?

All materials must be submitted by 5 pm on August 15, 2022.

Submit applications and letters of recommendation to Dr. Juanita Jo Matkins, jjmatk@wm.edu .



K-12 OUTREACH AND STEM EDUCATION

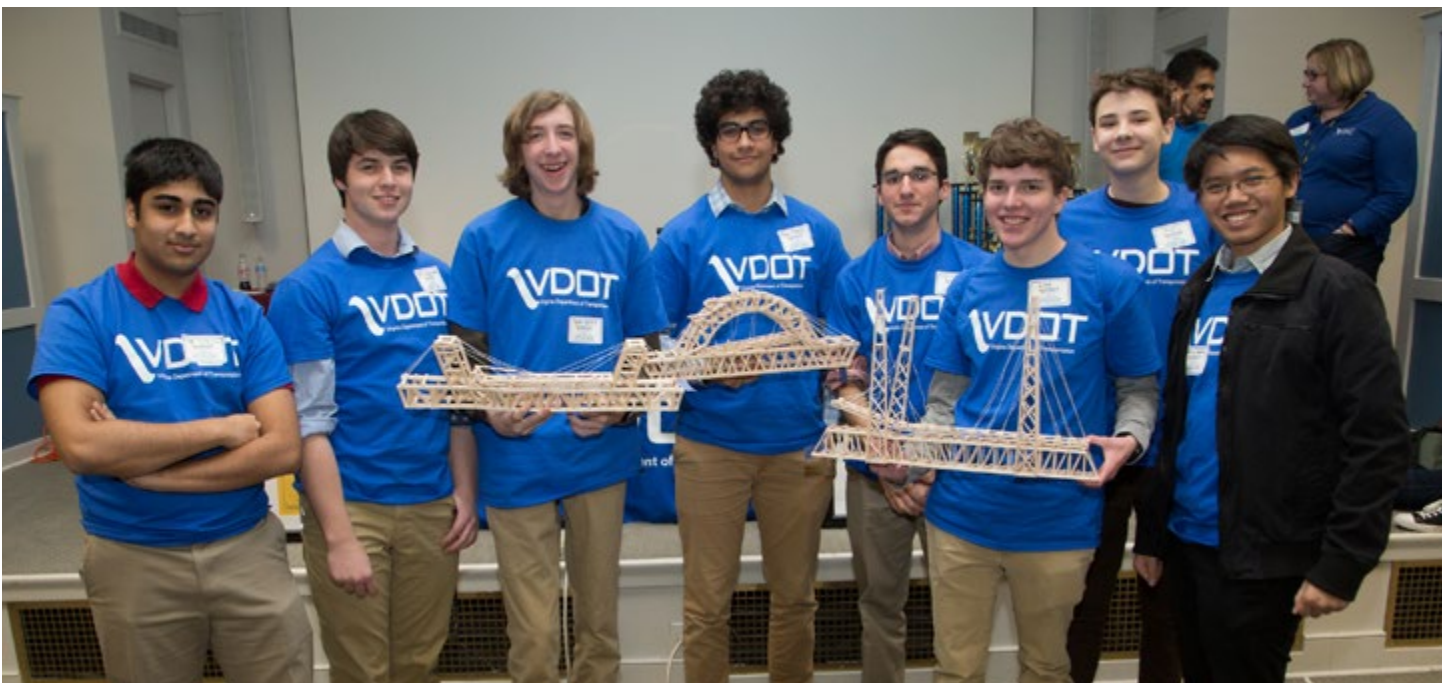
Visit our website at

<http://www.virginiadot.org/info/stem.asp>

to learn about:

- Our student bridge building competition
- Teacher resources and professional development opportunities
- Careers at VDOT
- STEM lessons related to transportation

Follow VDOT on social media



Thank you!

2021 PDI Sponsors

\$5000 Donor



\$2500 Donors

Discovery Education

Science Museum of Virginia

Virginia Department of Aviation



\$1000 Donors

American College of Education

hand2mind

Legends of Learning

Virginia Lottery

Virginia Space Grant Consortium



Virginia Transportation Construction Alliance





The Results of the 2021 Election

New VAST Officers for 2022

Becky Schnekser - President

Becky Schnekser has been a member of VAST for the past ten years and a PDI presenter for nine years. She has served as Region 2 Director and has been the past recipient of the Donna Sterling Exemplary Teacher Award, and RISE award for elementary education twice. She has been published in *the Science Educator* and the *Journal of Virginia Science Education* and in 2021, published her first book titled *Expedition Science: Empowering Learners through Exploration*. Becky is currently a grade 3-5 Lead Teacher for YELLOWHAB in Norfolk, VA, a National Geographic Grantee, outdoor education advocate, and field scientist.

Stephanie Harry - President-elect

Stephanie Harry served on the VAST board as the Chemistry Content Chair. She created the Chemistry content page on the VAST website. Stephanie worked to launch the content chair “Coffee Talks” this past year and presented at the VAST PDI for the past six years. She continues to serve on several VAST board committees, participates in Board of Directors meetings, volunteers at Region II events, and has submitted articles and pictures for the VAST journal and the newsletter. Stephanie is also an active member in several science related professional organizations such as AACT, NSTA, ACS and NOBCCHE.

Michael Pratte - Vice President

Michael Pratte is a K-12 Facilitator of Science with Stafford County Public Schools. Michael has presented a wide variety of topics at both VAST PDI and regional conferences. Michael served as VAST President during the 2019-2020 term when VAST held its first full virtual PDI. He is a member of both NSTA and an officer in VSELA and has collaborated with VDOE to support science standards and curriculum development. Past awards include the VAST Earth Science Award for outstanding science teacher in 2013.

New Regional Directors

Margaret Green - Region III Director

Margaret Greene has served as Region III Director and as the Earth Science/VESTA representative on the VAST Board over the past several years. She is an active member of VESTA and served as both Vice-President and President. She is a member of NSTA, VIP, and NAGT.

Robbie Higdon - Region V Director

Dr. Robbie Higdon teaches undergraduate courses in general instructional methods for grades 6-12 and coordinates a field placement experience within the AVID programs in Harrisonburg City Schools. She currently serves as VAST Director of Region V and serves as the Co-advisor for the JMU chapter of the NSTA. Currently, Dr. Higdon co-directs the College of Education Northern Ireland Cross-cultural Field Experience.

Donna Rowlett - Region VII Director

Dinna Rowlett coordinated regional workshops including Project WILD, WILD about Elk, and Project Learning Tree. She developed a working relationship with Virginia Tech Southwest Virginia Center and the Natural Tunnel State Park. A VAST member for ten years, Donna served as Region VII Director for the past four years and is active member of Virginia Science Education Leadership Association (VSELA).

The full list of Regional Directors and their contact information is listed on [page 28](#).

VAST Needs YOU! Nominations for 2022 Positions



Come and serve your profession and your fellow educator with distinction and honor. Nominate someone, or yourself, for one of our open positions. A few are elected prior to the Fall 2022 PDI while others are open now!

Nominations also includes grants and awards. Do you know of a deserving fellow educator who would benefit from the resume building prestige of being a VAST RISE Award winner? In a few months time, you can nominate them!

Do you have an idea that needs a little cash to get off the ground? Soon, you'll be able to apply for mini-grants through VAST to help make it happen!

Annually, VAST elects a group of individuals according to our current bylaw requirements. Consider nominating someone who you think would serve well in 2023 as:

President-elect: The President-elect shall serve as the co-Chairperson of the standing Professional Development Institute (PDI) of the year in which they will serve as President.

Secretary: The Secretary shall keep a permanent record of all business transacted by VAST; keep the minutes of meetings for the general membership, Executive Committee, and Board of Directors; distribute copies of the minutes to members of each group in a timely manner; and perform such duties as are usually incidental to the office. The Secretary shall be elected for a term of three years.

Regional Director (Regions 2, 4, 6, and 8 are up for 2023!): Regional Director shall be elected from each of the eight (8) Department of Education regions. Directors shall be elected by the membership to serve a two-year term and may serve more than one term. Directors from even-numbered regions will be elected on even years, and those from odd-numbered regions will be elected on odd years. Directors will, within their region, promote VAST membership, regional professional development activities, and the VAST Professional Development Institute (PDI). Directors will serve as the coordinator of science leaders within their region and encourage an active and viable network within their region. Directors are expected to attend VAST Board meetings and provide a report on activities within their region. Directors shall actively participate as VAST leaders including contributing to publications, awards nominations, and the solicitation of presenters for the VAST conference.

You can nominate someone below! Or, you can use the form attached to this newsletter to fill out and send in to Russell Kohrs at kohrsrh@gmail.com.

[CLICK to download a VAST Nomination Form. Nominate someone today.](#)



2021 Virginia Association of Science Teachers Awardees



VAST recognizes exemplary contributions to science education through its annual awards program. Awards are presented to outstanding educators at all levels. In addition, school administrators, and businesses are eligible to be recognized for their support of, and contributions to, quality science education.

The recognition consists of an attractive engraved plaque. The presentations were made as part of the annual PDI in November. VAST is pleased to recognize the following recipients for 2021. Please both congratulate and thank them for their outstanding contributions to quality science education in Virginia.

Recognition in Science Education (RISE) Awards

Outstanding Middle School Teacher Award

Louise Benton Middle School, Prince William County Public Schools

Debra Peterman

Outstanding Biology Teacher Award

Harrisonburg High School, Harrisonburg City Schools

Megan Cullip

Outstanding Physics Teacher Award

Colgan High School, Prince William County Public Schools

LoriAnn Pawlik

Outstanding Elementary Teacher

Greer Elementary, Albemarle County Public Schools

Jessica Campbell

Outstanding Elementary Remote Teaching

Pocahontas Elementary School, Powhatan County Public Schools

Lisa Brown

Outstanding University Teacher

James Madison University

Dr. Kerry Cresawn

Outstanding Science Supervisor

Stafford County Public Schools

Michael Pratte

Outstanding Community Partner

Dr. Michael Bentley

Mini-grants:

Barbara Adcock	Powhatan County Public Schools	\$495 Community waterways (MWEE)
LaNika Barnes	Albemarle HS	\$464 Cultural Relevance & Reflection
Tonya Bates	Chesapeake Public Schools	\$500 Energizing the Periodic Table

My Ancestral Puebloan Adventure

Russ Kohrs

Donna Sterling Grant Project



Photo by Russ Kohrs

Supernova - Petroglyph

One of the early panels visible along the Petroglyph Trail at Chaco Culture NHS. The crescent moon sits near a starburst which is usually interpreted as representing the supernova of 1054 that created the Crab Nebula and was viewed all over the world.

Introduction

Thanks to the Donna Sterling Award for Exemplary Science Teaching, I was able to undertake a late spring expedition to the American southwest. My goal was to explore the archaeological and cultural connections between human societies and the environment over time with a particular focus on the late 13th century megadrought. The trip took me to a wide variety of places in the four corners region, but began in that enigmatic and powerful [Chaco Canyon](#) (Chaco Culture NHS), a center of Ancestral Puebloan culture, history, and reverence that still matters a great deal to Puebloan descendants today. Ultimately, I was driven by a single question. Was the 13th century megadrought really the main cause of the depopulation of Puebloan great houses in Chaco Canyon and the region? In my archaeological field school, we excavated a Pueblo III period, colonial period, dwelling and in the process of doing that, explored this question then. At that time, this was the prevailing idea. Chaco is a really dry place anyway, but the megadrought made it impossible to live there any longer, so the story went, so

people fled Chaco and made their homes in the cliff dwellings to the north. Over twenty years later and in three short weeks of expedition, I would learn that the late 13th century situation was actually much more complicated and multifaceted than I knew.

Preparation for the Expedition

I was notified of my award status during the fall of 2020. However, preparation really began during that summer. I had submitted my application and had no idea of the status, but I nevertheless moved forward with the purchase of a cheap trailer I would use for cargo. I would be taking my family, who would be loath to see me go without them on such an endeavor of course, so whatever happened with the grant I planned on preparing for any travels the next summer by doing something that would make it easier to conduct a long trip that would require lots of cargo. So, I built my silver bullet - a small teardrop trailer kit with a homemade solar generator that would make such a journey with camera equipment and other small electronics possible.

Chaco Canyon

Russ, his helmet, and his GoPro stick looking through a window through Pueblo Bonito's back wall.



Photo by Russ Kohrs

Then, there was the need to plan for the logistics of fuel, food, and lodging. I did not begin this until the fall when I was notified and the grant would help immensely in making these things possible. We would camp (in often very remote places!), most of the time. My family is all about camping. Four of us are scouts (myself and my three boys) and my wife, Sarah, loves tenting in the wilderness. So, the budget for the grant made this situation ideal. We would need to plan on our own, however, all of the campground stays and any hotel stays ourselves, as paying an agent was not going to be possible. But, what fun! The biggest challenge was the need to reserve all of this, or nearly all of it, ahead of time. The summer of 2021 would end up being massively busy for people traveling during the pandemic, so we had to be sure we had places to stay.

Always at the center of this preparation was the focus on visiting Ancestral Puebloan ruins in the four corners. I spent hours of research time exploring which ones would provide the most information toward addressing my questions as possible (like Chaco Culture NHS). In the process, I kept learning about other sites, many that were really off the beaten path (like [Yucca House NHS](#), a farlung unexcavated unit of Mesa Verde) but that proved to be adventures entirely on their own. I began learning about the differences between “great houses” and “cliff dwellings” and, after spending a great deal of time in peer-reviewed study, began at this early stage to gain a more updated vision of site chronologies in the region. One important discovery - great houses, like Pueblo Bonito in Chaco Canyon, and Cliff Dwellings, like Step House in Mesa Verde, often were occupied at the same time. But, how was that possible? It didn't fit with the story I had learned all those years ago. Already, just through some minor basic research, I was beginning to ask many more questions.

Then, it came to me that one other piece of the puzzle I was missing was the story of this time as it is told by the modern Puebloans themselves. Most of this story is contained in their oral histories. I would find that, for “white” visitors, these cultural narratives are very tightly controlled. So, if I was going to combine any of my archaeological explorations with ethnography, I would need to incorporate ways to do that. Thus, I added in several locations for that purpose. One was a tour of cliff dwellings through [Ute Mountain Tribal Park](#), southwestern CO. Another was spending time at the Indian Pueblo Cultural Center in Albuquerque, NM. These cultural narratives would help bring to life important aspects of Pueblo culture that would allow me to see my experiences through a different set of eyes than my “white” western scientist eyes...and very powerfully, indeed!

Ancestral Puebloan Timelines

Ancestral Puebloan is the term that modern descendant Puebloan peoples use for their ancestors. Another term is likely more relatable for most of us, “Anasazi”. But, that term is Diné (Navajo) and means “ancient enemy”. This term thus refers to the Pueblo through the minds of the nearby inhabitants of [Navajo Nation](#), a massive indigenous nation that contains a great many of the Ancestral Puebloan sites I would be visiting. Of course, the Pueblo today do not see their own ancestors as ancient enemies, so a different and more appropriate term is used. In truth, the Navajo are immigrants to this area, as are nearby Apache and

Ute groups, who came during the time of Spanish colonization beginning in the 1500s. I visited many Pueblo sites of that period. It was a period of Encomienda, which is a term that confers the right to demand forced tribute and labor from conquered peoples in Spanish colonial America. Much of this was demanded not so much by conquistadors, but by the Roman Catholic Church through their missions at places like [Pecos National Monument](#) and [Salinas Pueblo Missions NM](#) sites like Abo, Quarai, and Gran Quivira. It was at Gran Quivira over twenty years ago that I cut my archaeological teeth in the region. In truth, this period was not really too relevant to my question, but the documentation from this period provided deep and powerful insights into Pueblo culture that helped me trace backward key ideas in their culture. Post 1300, the Pueblo world changed a great deal in a short period of time and Spanish colonialism had significant effects.

The Pueblo timeline in the region begins prior to 8000 BCE and runs through about 1550 CE from the “basketmaker” through to the “Pueblo” periods. During the intervening thousands of years here, the archaeological record reflects major progressive development in maize agriculture, basket making from reeds, and pit house dwellings. Baskets do survive from these periods, particularly from Basketmaker III (400-700CE), because the dry climate is very good at preservation and many sites are very remote, leaving them untouched in many cases for hundreds of years. The official “Pueblo” periods (Pueblo I to Pueblo III) are stratified by a variety of other cultural developments. One of these is the development of ceramics. The other are typologies based upon pueblo masonry style. Less important, I would find, are the locations of dwellings (great houses versus cliff dwellings). The narrative I was taught years ago suggested that great houses gave way to cliff dwellings, mostly after the 13th century diaspora. The reality is much more complex, of course. During much of this time, Ancestral Puebloan peoples would develop very large great house complexes in valleys and on mesas, many of which form a system of “outlier pueblos” ([Aztec NM](#), Salmon Ruins, etc.) centered on Chaco Canyon, NM. It is true that cliff dwellings are a later development, but they did not completely supplant the great house complexes, though major centers like Chaco were, by that time, largely abandoned. Other Puebloan cultural elements used for dating are due to trade and exchange. Ultimately, some of these cultural elements are thought to have come from further south, such as out of Mexico. Certainly, later Chacoan sites contain vessels with residual cacao, indicating trade with Central American cultures. Even farflung sites, such as near [Edge of the Cedars State Park](#) in Utah, contained evidence of a robust and distant set of trade relationships through items such as the famous Macaw feather garment on display at that museum. Certainly, cultural ideas were exchanged in addition to these physical items.

Chaco Canyon, along with its outlier locations like Pueblo Pintado, [Aztec](#), Salmon Ruins, and others would see an important period of powerful cultural florescence between 800-1150CE. During this period, more than half a dozen massive great house complexes in close proximity to one another would be built in an environment that today is really desolate. In those days, it is likely that it not only had more moisture, but also more trees. One of the powerful takeaways from this experience

was the reality that no matter how many people may have lived in the canyon full time, the Pueblos there relied heavily on local pinion and juniper resources and the scant intermittent water of the [Chaco arroyo](#) and any that seeped from the cliff walls. The pueblos were also built with massive [Ponderosa Pine timbers](#) harvested over 60km away from forests in places like the Chuska mountains, carried through human power alone, and manipulated into position to form the important structural elements of Pueblo floors and ceilings, “vigas”. This massive outlay of labor to build great houses consisting of up to 900 or more rooms each over several hundred years of time presents a wide array of questions. Most are summed up as “why”? What was it about this location that was so important? Research over the last twenty years has shed some light. There is a system of roads that lead away from Chaco, indicating that it was likely a place of pilgrimage. Modern Pueblo people speak of a “center place” that is a key element of their migration stories. Chaco is a “center place” to modern Puebloan peoples, as it likely was hundreds of years ago. Thus, Chaco Canyon may not have been occupied full time by thousands of people, but perhaps was a location where numerous different Ancestral Puebloan groups built a community great house in an important and perhaps holy site. But, why was it abandoned?

Abandonment at Chaco largely occurred prior to 1300, the time of megadrought. By the late 13th century, most of the Chacoan great houses were already significantly diminished in their importance. This may have happened for a variety of reasons. One is practical, as resource overutilization was certainly a reality, as it is today for Navajo shepherds who use the surrounding region to graze their livestock on ever-decreasing grasses and shrubs. The other is cultural. It appears that there may have been a significant change in religious beliefs around the time of the 12th century, leading to a diminishing importance for Chaco as a site of pilgrimage. Conflict may also have played a role, as it seems to have at later 13th century massacre sites like [Sand Canyon Pueblo](#). Still, the abandonment of Chaco meant that other outlier great houses, like Aztec (no relation to the Aztec people), Salmon, and the Far View complex (Mesa Verde) were elevated in prominence. Concurrently, cliff dwellings sites do become more common, but the reason for these existing at the same time as great house communities is a bit of a mystery, as the clear break between the two ways of living that seemed to exist to me over twenty years ago certainly seemed to break down under more recent scholarship.

Migration, Water, and Culture

The southwest is quite arid in some places and in others, semi-arid. In any of these situations, water resources are central. In Puebloan culture, as in other indigenous cultures of the area, water plays a very central role in many aspects of life, including in oral histories and mythologies. One of the central themes in Ancestral Puebloan culture, one that is often symbolized in petroglyphs in the form of a spiral, is migration. Migration stories are synonymously linked with creation and especially emergence. Emergence refers to the entrance into the first, second, third, and now fourth Earth. Migration toward a “center place” is a central theme afterward and a way to explain the apparent diaspora of peoples across the continent. From a practical standpoint, why

is migration so central? Could it have something to do with the availability of water and other resources in a very direct way? It is of course easy, as a scientist, to follow evidence of abandonment and rebuilding of Pueblos as support for this hypothesis, though the Puebloan view of this hypothesis is less accepting.

Our guide at Ute Mountain Tribal Park had much to say about emergence and migration. He took us to a [winter solstice marker](#), a combination of petroglyphs (etched in the rock) and pictographs (painted on the rock) that tells a version of these stories while also serving as a way of marking that time around December 21st where fall gives way to winter, by watching the movement of a sliver of sunlight that lines up just right between two nearby rocks and then passes over the panel in just the right way. In this way, the people would know what time of year it was, but also be able to convey these stories and their time-distant connections to their ancestors through associated oral history. Similarly at Chaco, great houses were built with astronomical alignments in mind, especially regarding the seasons, but also lunar events. Each Pueblo had at least one long, straight, wall that was aligned in some way. Other such markers exist in Chacoan locations like Fajada Butte, where a “sun dagger” would appear across a spiral petroglyph carved beneath three specifically-placed stones. Or, there is the very famous [supernova petroglyph](#) site that contains what appears to be a handprint, crescent moon, and an exploding supernova, likely representing the 1054 event commemorated around the world by many cultures that resulted in what we now call the Crab Nebula. Even outlier sites far away from Chaco, such as Chimney Rock in southern Colorado, record important astronomical and, thus, culturally significant moments. In this case, the 18 year “lunar standstill”. Cultural continuity, as it is for all people, is a very important but also practical reality in the Puebloan world.

At different points in our tour there, our guide would talk about the use of kivas for ancestral and modern Pueblo religious observance. The inside of kivas often have a particular set of features, the most basic features being the round shape itself, but also the presence of an entrance through the timber and mud ceiling and a hole, or “sipapu” in the kiva floor. This sipapu is a reminder of the place of emergence, just as the act of entering a kiva is the act of entering into the Earth to commune with the spiritual and the act of coming out of the kiva is an act of emergence, as in the origin story. The rest of what went on in kivas then or even now is held from outsiders as a closely guarded mystery. In Puebloan culture, all built structures (houses) which to us look to be permanent, were and are considered to be temporary within their culture of migration. At some point, a religious leader would emerge from the kiva and announce that it was time to move on. Our guide would explain that the people knew, then, that it was time to grab whatever they could carry and move to the next location, to be determined, thereby abandoning the current structures, perhaps to one day return or forever.

What Really Caused Abandonment?

But, was this a purely cultural migration? Or, was it just a megadrought? Or, were there very real and complex practical reasons for such migrations and abandonment of the homes that were perhaps the only homes these folks had ever known? In our

visit to Chaco, particularly, it was very evident that the canyon itself, even in the best of times, has a very marginal environment that would struggle to support anything close to a large population. Seasonally on the Colorado Plateau, summers are very hot, but winters can also be very cold and come with a great deal of snow. Most locations are above 6,000 ft above sea level. The amount of construction that took place in Chaco Canyon, as in other locations over time, required an immense amount of large and small timber. This would have included an estimated 200,000 plus Ponderosa Pine logs, the vast majority of which have been documented to have been procured over 60km away. It is not known, but is unlikely, that there was ever a large stand of these trees that were local, though certainly one very large log was found in the plaza of Pueblo Bonito and is thought to have been maintained there as a living specimen. Still, just living there throughout the year, even by a relatively moderate year-round population of several hundred people, would have required some consistent availability of water but also large amounts of firewood. Palynological data (pollen) and packrat midden data do suggest that the environment in Chaco was more lush during the period of Ancestral Puebloan occupation prior to the full abandonment around 1300. It does seem likely that human occupation played a significant role in the denudation of that environment, even affecting water resources because of what may have been excessive agricultural usage, which would have made eventual abandonment during a period of major drought not only culturally relevant, but a practical necessity.

Ultimately, what led to abandonment of one site over another seems to be complicated. Certainly, it is today a more nuanced story than the one I was presented with as a part of my field archaeological training twenty years ago. Drought is likely a factor, but is likely a recurring factor in abandonment and migration more often than just during the 13th century. Certainly, the 13th century drought seems to be a much more serious event than others. Still, there is also clear evidence of human degradation of the land through over-utilization of water and vegetation that may have exacerbated the localized effects already experienced by any drought and that would also have created a systems imbalance in such a marginal environment that would have made seasonal recovery of resources take longer or even be impossible. Today, such human impacts are ongoing, as Navajo herders still drive their livestock through the canyon and graze the land. This has led to serious arroyo-cutting during just the last century, making Chaco wash's elevation much lower and significant loss of sediment from the canyon floor and forever altering the environment there in ways that Ancestral Puebloans would probably not recognize.

Bearing Fruit: Results of the Expedition

Because of the Donna Sterling grant, I was able to come home with thousands of powerful and amazing images in various formats. These include blocks of images that I have been able to assemble into gigapixel GigaPan images, which can be annotated, scaled, and zoomed into for exquisite detail. Many of them have been embedded into virtual field experiences which I have assembled ([and linked to here](#)) that use 360 images taken with a GoPro Max as the base storyboard imagery. Also collected

are a wide variety of 360 video segments. All of these are ready to go for inclusion eventually into virtual reality experiences, 3D models, and more. Already, I have been able to present one of my VFE's at the 2021 VAST PDI, which is now a part of the VAST VERSE collection. I have also assembled virtual field experiences for use in my classroom, as we have explored watershed and water balance within watersheds by comparing the [San Juan watershed](#) of the four corners region with the North Fork of the Shenandoah watershed at Mount Jackson, VA. Students have been enjoying the chance to "be there" and, while experiencing a deeper sense of place through local VFE imagery, have gotten much out of experiencing a different sense of place through a very different cultural and environmental lens.

I also came away from this experience with a much deeper sense of the role that culture plays in our environment. Pueblo culture is still strong and prevalent in New Mexico today and in Hopi lands in Arizona. There are still 19 Pueblos in the region that have survived drought, migrations, encomienda slavery by Spanish conquistadors and missionaries, warfare with other indigenous groups, and various pogroms foisted upon them by the American government, such as boarding schools and attempted biological and military genocide, which have further ravaged their cultural continuity. Despite all of this, the Puebloan people retain a strong sense of who they are, which also includes a strong sense of the importance of their environment to them. They feel a kinship with the land. Kinship with it. What is that like, exactly? I mean, in the western world, we own land, but do we feel kinship with it? What does that mean for balance between human needs and environmental needs, exactly?

One key takeaway for me was that the narrative that a fully natural megadrought single-handedly caused Puebloan abandonment appears to be an overly simplistic narrative. No, the reasons for the 13th century cultural upheaval were much, much more complex. Movement, through migration, was a part of their culture. It likely served a practical purpose in preventing some amount of overuse of a local environment also, as a farmer might allow a field to lie fallow for a short period of time. Still other challenges were also seemingly involved that were more human, new religious ideas and apparently also warfare playing their respective roles. In such a way, humans are so similar no matter what their culture!

Despite our very different western culture, where I struggle to find kinship with the land in the same way, I did find a sense of kinship with the Puebloan people. I was able to see them struggle with some of the same very human challenges with which we all struggle. While exploring all of this science in the field, I also was reminded that few human problems have simple solutions, no matter what the culture or time period. In this way, the Ancestral Puebloans and their descendants today have many things yet to teach me and my students.

Conclusions

I can not thank VAST and the Donna Sterling Award committee enough for providing me with the opportunity of a lifetime in helping fund this expedition to the southwest. The chance to explore and be in places that have been important to

me has been wonderful, but the chance to be there and collect imagery that I can assemble into experiences for my students has created powerful new opportunities for my classroom. I also hope that, by providing the link to these above, other teachers will find some of the VFE materials I have created through this grant (and others not through this grant) to be useful in their own instruction. The Google Earth map just contains links and while not all of the VFEs here are narrated and assembled with hotspots for navigation yet, they will be eventually. This award will, thus, continue to bear fruit in coming years as I work diligently to finish all of the many stories there are to tell through these images. Most of all, I am grateful for the chance to explore the confluence between the environment and human culture in a unique way, which has already added a great deal of depth to my instruction. The human/environment story is always a complicated one,

as are all relationships. But, the linkages are so important to maintain. We are a part of our environment. We rely on it for life and for happiness. It gives us a sense of place...and if we look hard enough...perhaps even a sense of kinship. Any way we can get kids to experience it will help us teach toward a better and healthier future for all.

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Mesa Verde State Park



Photo by Russ Kohrs

Middle School Teacher's Opportunity:

National STEM Scholar Program

This Program is seeking middle school science teachers who are interested in professional development that include hands-on activities, connecting with speakers and thought leaders in STEM education; learning with skilled science educators, and developing a creative Challenge Project for classroom implementation. Each Scholar will receive a Chromebook and funding for Challenge Project supplies and materials.

Applications are due February 1.

<https://www.wku.edu/gifted/nss/>

Awesome Chesapeake: A Kid's Guide to the Bay, 2nd Edition

by David Owen Bell, Marcy Dunn Ramsey (Illustrator)

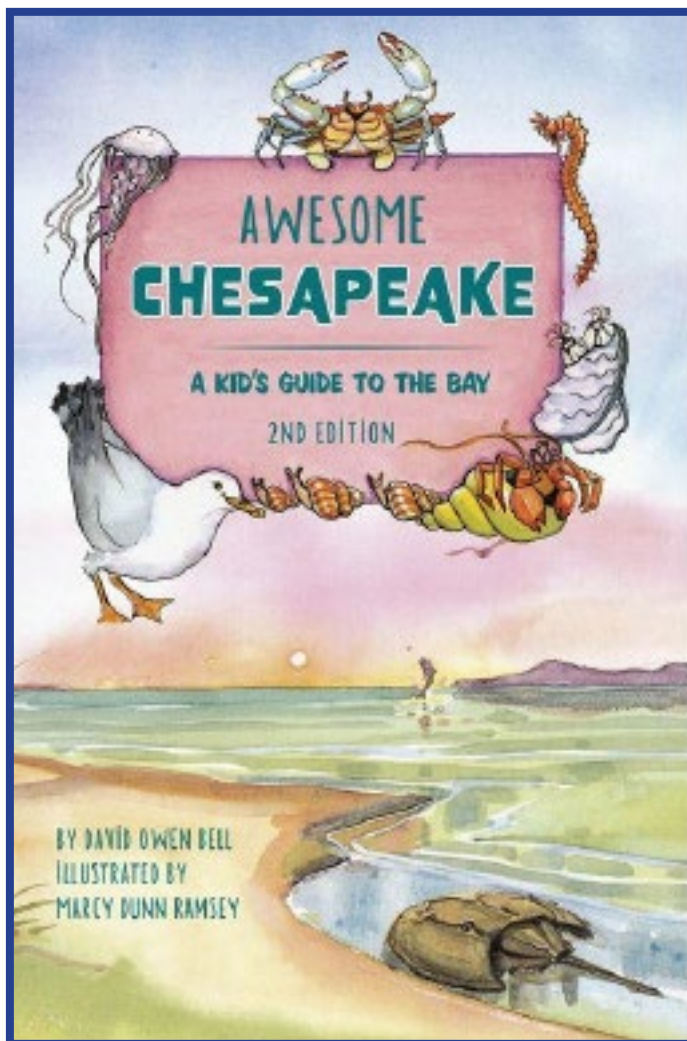
If you teach about the Chesapeake Bay, consider adding this hardback book to your classroom resources. The 64-page book gives you a solid understanding of how the Chesapeake Bay was formed, the abundance of life in and around the Bay, the impact of humans, the importance of watersheds, and how students can get involved in citizen science. The illustrations in the book are student friendly, colorful, and invite students to explore more. A good portion of the book is dedicated to animal and plant life found in the Chesapeake Bay. It tells you in student friendly language about each plant and animal and throws in interesting ecological facts about their habitats. I learned a lot from just reading this book and I liked that the end of the book focuses on watersheds. It invites students to explore their watershed and become citizen scientists. It explains the usual physical and chemical tests associated with water quality and provides a data sheet for students to fill in if they wish to monitor a watershed near them. In addition, there are many resources listed for further exploration of the Chesapeake Bay, and watersheds. Students with no interest in the Chesapeake Bay, would find this book easy to read and become more aware of how this amazing body of 18 trillion gallons of water is an important ecosystem. It could propel them to become more observant in their watersheds and maybe even get them to become a better citizen of their watershed.

In summary, this is an excellent book for elementary and lower middle school teachers to use in their classrooms. There are fun facts that teachers can use, and the best parts are how this book simplifies scientific concepts in student friendly language. If you get a chance add this book to your wish list, you won't be disappointed.

ISBN-13 9780764361203

Schiffer Publishing, Ltd

Publication date 07/13/2021



Reviewed by Anne Mannarino



Virginia Instructors of Physics

Save the DATE for April 23. VIP is a grass-roots, teacher-led organization for teachers and professors of physics and physical science. We meet in the spring to exchange teaching ideas, strategies, labs, and demonstrations. Check out our website at <http://vipphysics.org/> to learn more about our group and follow us on Facebook - Virginia Instructors of Physics (VIP).

The Making of Water's Way: Thinking Like A Watershed, A Bay Journal film by Sandy Cannon Brown, David Harp and Tom Horton,

by Tom Horton



David Harp/ChesapeakePhotos.com

Having written about and taught Chesapeake Bay for half a century, I have come to imagine the estuary's 64,000 square mile watershed as 'the animal that contains all the other animals' (paraphrasing the late Barry Lopez' writing about Arctic landscapes).

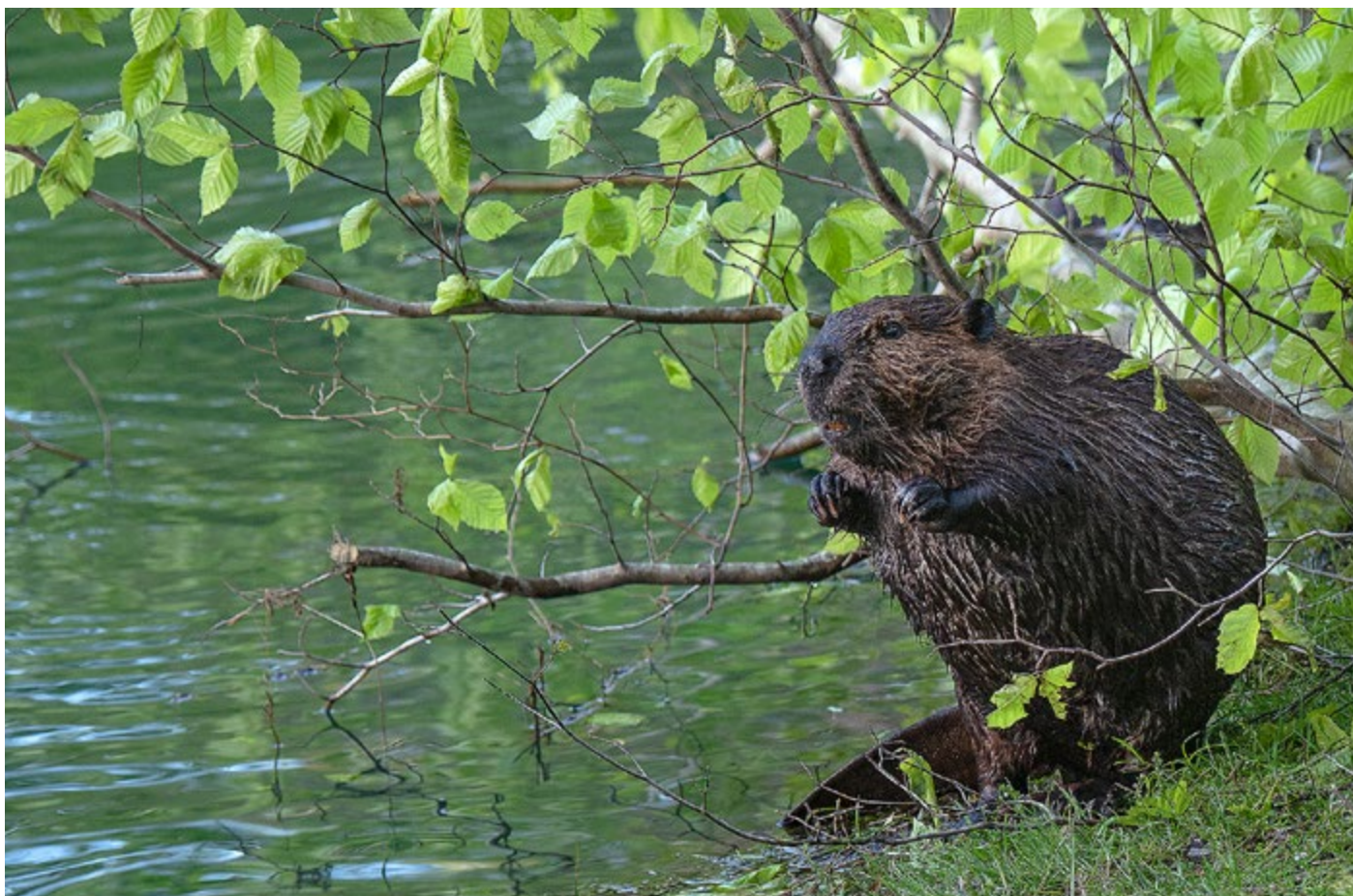
The skin, the hide, the pelt of that uber animal, Chesapeake, was for most of time gloriously green, predominantly forested. But equally important, it was far wetter than today, infested by an estimated four to eight million beavers that controlled the hydrology of the estuary—indeed, of most of North America.

Damming, ponding, slowing the flows of rainwater to the Bay, beavers captured sediment and nutrients, retaining the land's fertility, sponging runoff into the soils, feeding the estuary leanly and cleanly, absorbing the force of floods, recharging waterways through groundwater in droughty times.

Water's way was thus very different until just the last few centuries. European settlers, their numbers in the watershed now grown to some 18 million, preferred whisking water off the landscape rapidly, ditching and channelizing, paving and draining to enable their agriculture and development. The beavers, dominant engineers of the Chesapeake

ecosystem for millions of years, were eliminated for their fur by around 1750. Increasingly, the surface of our great animal Chesapeake turned from lush and green, retentive of its water, to scabbed and crosshatched with paving, dried out by ditching, exacerbating both flood and drought. Key to our thinking that led to Water's Way was the science of Johns Hopkins paleoecologist Grace Brush, who in the 1970's began extracting deep cores of sediment from the Bay's bottom. 'Reading' the seeds and pollens, the skeletons of diatoms and the chemistry all preserved in those cores, Dr. Brush was able to go back in time thousands of years in some cases, relating changes on the Bay's lands to changes in its water quality.

She charts a dramatic shift—as the land was altered, as its keystone species the beaver was eliminated, as polluted runoff increased—from life that thrived on the bottom, to life that inhabited the surface. In a murkier Chesapeake, light failed the rooted aquatic plants and the benthic algae. Sediment smothered oysters. The ecosystem that had characterized the Bay for millenia literally capsized, flipped, turned bottom up, just in the last several decades. Most of the hardwon, modest progress in Bay restoration since the 1980's has come from applying technology to 'point' sources of pollution, sewage and the airborne



David Harp/ChesapeakePhotos.com

A beaver working on a beech tree

emissions from tailpipes and smokestacks. Increasingly these efforts are pushing limits of technology and expense. Our film argues it is imperative that efforts to restore Chesapeake Bay rethink water's way and build upon fledgling efforts to reconfigure our landscapes to function more like in beaver days—including allowing the beavers themselves to expand wherever possible.

Making this happen will require a massive new educational effort. Suitable habitat will not be what limits the expansion of beavers, who create clean water and splendid ecosystems wherever they go. They are masters of creating their own habitat and they are relentless.

The limit will be 'cultural' carrying capacity; the degree to which humans will tolerate beavers and water's way as it was for most of time. Beavers are fundamentally creatures of the wet and soggy, while we, the other major ecosystem engineer, are only just learning to rethink the drained and the paved.

There are proven and well documented ways humans can learn to live with and control beavers' penchant for chewing down trees and flooding roadways and private property.

These techniques (see beaverinstitute.org for a trove of information) are low tech and cheaper than trapping. Some excellent popular books on beavers have been published in recent years (Eager by Dan Goldfarb; Once They Were Hats by Frances Backhouse; Water, A Natural History by Alice Outwater).

The vast possibilities of beavers in the classroom can be seen from our success with re-educating the public to the ecosystem values of the oyster, filtering pollution and creating reeflike habitats. This has led to robust programs in Virginia and now in Maryland to create shellfish sanctuaries throughout the Bay and its rivers. While oysters even in their heyday merely fringed the edges of several tidewater counties, beavers occurred on virtually every acre of the watershed; and the rodents are charismatic!

Water's Way is available, free, for streaming or for downloading from the Bay Journal's website. We hope it will be widely shown and inspire the development of curriculum, and create an audience of 'beaver believers' throughout the Chesapeake watershed.

Tom Horton covered the environment for *The Baltimore Sun* for 35 years and has written eight books about the Chesapeake Bay. His honors include the John Burroughs Award for the best book of nature writing, the David Brower award from the Sierra Club, and other awards from the Chesapeake Bay Foundation and the Audubon Society. He currently is a Professor of Practice in Environmental Studies at Salisbury University and a contributing writer and columnist for the *Bay Journal*.

Dominion Energy's Project Plant It! Celebrates Trees, Pollinators & More!

Have you heard the buzz about Project Plant It!, the environmental education initiative created by Dominion Energy in 2007? Each spring, the program continues to grow and engage the next generation of environmental stewards.

Teachers, scout leaders and other group leaders registered in the fall to receive free tree seedlings and free packets of wildflower seeds designed to attract pollinators. The planting materials will be shipped to participants in March/April 2022 in time for Arbor Day, April 29, 2022, and National Wildflower Week, May 1-7, 2022.

"We are excited to share that the 16th implementation of Project Plant It! in 2022 coincides with the 150th anniversary of the first occurrence of Arbor Day in 1872 and the 50th anniversary of the Arbor Day Foundation, which was established in 1972," said Shai West, Project Plant It! coordinator and associate community affairs representative at Dominion Energy. "The Arbor Day Foundation has been a longtime partner with Dominion Energy and we're thrilled to celebrate these major milestones with them. Together, we're helping students of all ages understand that trees



celebration on Arbor Day," said Cara Perkins, a third-grade teacher at Randolph Elementary School in Goochland County. "In spring 2021, students planted trees with foresters from Dominion Energy and learned about pollinators in a fun activity conducted by a local expert. They planted their wildflower seeds in a special spot where they can watch the bees that will come to the colorful flowers. Project Plant It! really brings science to life with creative lesson plans and the hands-on planting materials. Our teachers love

this enriching program, and our students know that being in third-grade means getting a tree from Project Plant It!"

The Educator Resources page of the Project Plant It! website, projectplantit.com, includes a variety of hands-on instructional materials about trees and pollinators, including free STEM-based lesson plans, a list of books and online resources, a participant certificate, and more. Many of the materials are available in English and Spanish.

For more information, visit projectplantit.com or "Like" Project Plant It! on Facebook.



improve air quality, provide a home for wildlife, prevent soil erosion and provide many more benefits to the ecology."

West noted that Project Plant It! added the pollinator feature to the program in the 2020-2021 academic year. "Bees, butterflies, hummingbirds and bats are some of the pollinators that play an essential role in supporting our nation's food system and the sustainability of our environment," she added. "Project Plant It! aims to increase bee populations by having students plant pollinator gardens at their homes, on school grounds or in their communities."

Teachers appreciate Dominion Energy's support of environmental education. "For over 10 years, third-graders at Goochland Public Schools have participated in Project Plant It! with a huge

Fast Facts About Arbor Day

- J. Sterling Morton was a journalist and editor of Nebraska's first newspaper.
- In 1872, at a meeting of the State Board of Agriculture, Morton proposed a tree-planting holiday called Arbor Day.
- Support for this new holiday was so great that one million trees were planted in Nebraska on the first Arbor Day.
- Today, Arbor Day is celebrated in every state in the U.S. and in many countries around the world.
- In Morton's words: "Other holidays repose upon the past; Arbor Day proposes for the future."
- The Arbor Day Foundation was founded in 1972 and is headquartered in Lincoln, Nebraska. The nonprofit organization is dedicated to planting trees in neighborhoods, communities, cities and forests throughout the world.

Registration for Project Plant It!'s spring 2022 season has closed, but teachers may download lesson plans and other resources about trees and pollinators at projectplantit.com.

Qubit x Qubit's Intro to Quantum Computing course

Anish Aradhey

Quantum computing is an emerging technology that could change the world, and we want your high school students to learn about it next year. As a leading STEM education nonprofit, Qubit by Qubit offers a free Introduction to Quantum Computing course designed specifically for high school students. The only prerequisite is geometry. The course is online and taught by Qubit by Qubit's instructors from leading universities. Through our partnership with IBM Quantum and 100+ high schools, we have taught 15,000 students quantum computing. You can submit this short interest form to learn more about how to offer this free course at your school.

About Qubit by Qubit: We believe accessible and inclusive quantum education will drive future innovation, shared prosperity, and social mobility for all. Our mission is to create an equitable quantum workforce by equipping the next generation with the quantum computing skills necessary for the future of work.

Gabbie Meis,

Assistant Program Manager, Qubit by Qubit
www.qubitbyqubit.org

I first heard of Qubit x Qubit's Intro to Quantum Computing course when I was offered Qubit's Qubit x Qubit's scholarship from HHS to cover the course's cost if I wanted to enroll. I enrolled because I thought the course would be an interesting way to explore my interest in physics and learn about a topic that I would have the opportunity to learn about in school.

Going into the course, I had a few years of experience with coding, especially in Java. I started writing in Python this past summer, so I was excited when I learned that the coding portion of the course would be Python-based. However, I had no background in physics or quantum. Luckily, the course does not assume students have background knowledge in either.

The course has two main parts. It includes weekly 90-minute lectures by course instructor Akshay Agrawal that focus on quantum computing and quantum physics, as well as how quantum information science and engineering can be applied to other fields including economics and biology. During lecture, students can ask questions only via an online Q&A feature. The course also includes weekly hour-long labs, which focus on coding skills related to the topic that students are learning about during lecture. The labs are led by a Teacher's Assistant (my TA is a PhD student in quantum computing at Duke University). The labs are regular Zoom meetings with about 50 students where students can turn on their cameras and talk directly to TAs. In addition, labs are broken into beginner, intermediate, and advanced levels, so I was able to find a lab that matched my level of background knowledge. Weekly multiple-choice homework assignments focus on concepts that we learn in both lecture and lab.

During the first few weeks of the course, lectures focused on defining quantum computing. We learned about what qubits are, how scientists are able to manipulate them with

quantum gates, and how qubits and gates can be used to create increasingly complex structures, including quantum circuits, algorithms, and applications. The instructor, Akshay Agarwal, made it clear that quantum computers are an active area of development, so they can't yet solve real problems like classical computers do today. However, lectures have made a point to highlight recent accomplishments in the field of quantum science, such as how IBM recently unveiled a 127-qubit quantum processor. Lectures talked about the current shortfalls of and potential benefits of quantum computing. The course has especially emphasized that because quantum computers use the laws of quantum physics to operate, they can solve certain types of problems fundamentally better than classical computers do.

The first few weeks of lab meetings covered basic Python skills such as performing basic math operations and working with different data types including Strings and booleans. I already had covered these concepts in my previous experience with Python.

More recent lecture topics have included the mathematics of qubits. Early on in the course, lectures introduced the idea that qubits can be represented in many different ways, including numerical (ket) representation and visual (bloch sphere) representation. Later, we learned about how we can also represent qubits with vectors. Using quantum gates can be represented by matrices. Hence, we can use linear algebra to calculate how gates manipulate qubits. This was very interesting to me because I had never heard of linear algebra before. Most recently, lectures have focused on Quantum Key Distribution, which is a quantum algorithm that can "detect" eavesdropping. This is because quantum bits can change when someone measures the values they contain; this algorithm has exciting implications for cybersecurity.

Continued on next page.

More recent labs have focused on how to create quantum circuits using Python code. We learned how to “add” qubits into our code using Python’s Qiskit code library, apply gates to them, and measure the values they produce. I have even been able to run my code on one of IBM’s real quantum computers! This was exciting because it reminded me that the course content was tangible and not purely theoretical. Some of the highlights of my time in the course so far have been attending the variety of live sessions that the course offers outside of lectures and labs. During one session, we were given a virtual tour of a quantum computing lab at the Colorado School of Mines. Another session invited several women quantum engineers and scientists to talk about their experiences in the field. Some of the course TAs who are undergrads even gave a presentation about studying quantum computing in college, which was very helpful for me as I approach college applications.

So far, the course has broken down quantum computing into small, simple concepts that easily build on each other. It has made quantum computing understandable, and it has made me confident that I can explain the basics of quantum computing to others. The course has emphasized how anyone can have a future in quantum science and

technology because this field can be connected to so many other disciplines and because there is ongoing research at every level of the “quantum stack”: there are people studying how to make the best qubits and quantum gates all the way up to how to make the best quantum applications.

Overall, the course has helped me realize how science is ever-changing. Before this course, I didn’t even know the field of quantum information science and engineering existed, let alone that I could choose to pursue a career within it. The course has familiarized me with the basics of quantum physics and has made me even more sure that I want to study physics in the future. Much of quantum computing is about storing, measuring, and preparing data, so learning about quantum computing has even helped me code in Java for my school’s robotics team. As a whole, the course has definitely inspired me to learn more about quantum computing and its potential to revolutionize our world. I can’t wait for the next semester of the course!

Anish Aradhey

Governor’s STEM Academy at Harrisonburg, VA., Student

An Intro to Quantum Computing by Qubit by Qubit - A Science Coordinator’s Perspective

As the co-director of the Governor’s STEM Academy at Harrisonburg High School, I have helped to design the plan of studies our students follow in each of the three different pathways we have; Technology and Engineering, Health Care, and Mathematics and Science. We knew we wanted to have our students take at least one computer science course if they were in the T & E or M& S pathways, and we had an increasing number of students who were passionate about computer science being the field in which they were most interested. As our CS classes filled, and then as our CS teachers found other employment, we found ourselves in a difficult position. A piece of our solution has been Qubit x Qubit’s Introduction to Quantum Computing. See Anish’s article for more information and a student’s perspective on

the experience. See Gabbie’s article for more details from the organization, Qubit by Qubit. From my perspective, they have offered instruction we could not in the area of computer science due to increased student interest and staff shortage. They have also integrated the computer science with the quantum physics, achieving the integration of disciplines we strive for in the STEM Academy at Harrisonburg.

Andrew Jackson

Secondary Science Coordinator, Harrisonburg City Public Schools

Co-Director Governor’s STEM Academy at Harrisonburg, VA



Online Vaccine Educational Research Study



What is this study about?



Researchers from Georgetown University Medical Center and Hampden-Sydney College are conducting this study to help young people learn more about vaccines-what they are, what they do, and how they can help prevent diseases.

This research study has been approved by the Hampden-Sydney College Institutional Review Board (IRB) and is designed to find out if 10th grade students will learn new information after watching educational videos about vaccines.

Who can participate?

This study is open to any 10th grade student in the Virginia public school systems with access to a computer or mobile device with internet capability.

What will you need to do if you decide to participate?

It will take about 80-90 minutes to complete the study.

Participants will be asked to:

- Complete a brief survey with 16 multiple choice questions (10 minutes).
- Watch some educational videos. One group will watch some educational videos about vaccines. The other group will watch educational videos about the biology of cells. This will take about 60 minutes.
- Complete another brief survey with 20-25 multiple choice questions (10-15 minutes) after watching the videos.

One of the student's parents will need to give permission first and then the student will also need to sign a form agreeing to be involved in this study.

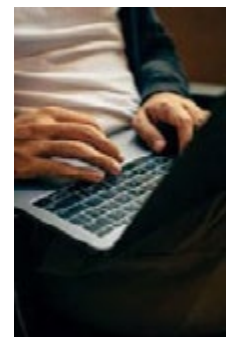
What will you get for participating?

All participants will have the opportunity to view the vaccine videos which contain important information about vaccines.

Participants who successfully complete the study will receive a check for \$40 for contributing their time to this research.

What if you have any questions?

If you are interested in participating or have any questions, please contact Dr. Edward Lewin's research team at mwolyniak@hsc.edu.



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Virginia Junior Academy of Science Virtual Symposium:

May 13-14, 2022

Dr. Julia H. Cothron

VJAS Representative to VAST Board

1. *What Is the Virginia Junior Academy of Science (VJAS)?*

VJAS is a STEM competition and symposium for 7-12 students. Over 600 students participate annually in more than thirty categories such as botany, engineering, environmental and earth science, mathematics and statistics, and medicine and health. Middle and senior high students participate in separate categories. The 2022 VJAS Virtual Symposium will be held May 13-14, 2022.

2. *How Do Students Participate?*

Students complete individual or team projects which are supervised by a teacher, mentor or parent. A school or individual joins the Virginia Junior Academy of Science. The student(s) submit a formal research paper by March 2.

3. *How Are Students Selected?*

STEM Readers review and score projects using criteria which are applicable to all STEM disciplines. Readers recommend projects for the symposium and the projects are ranked in the various categories. Selected students are invited to present at the May 14 Virtual Symposium, held in connection with the College of William & Mary. All students receive feedback from the STEM Readers.

4. *How Are Students Judged at the VJAS Symposium?*

Students make a presentation. STEM Judges score the research paper, presentation and responses to questions. Category winners are selected with first, second, third and honorable mentions awarded. The first place category winners become eligible for over twenty-five honor awards and scholarships. Two students, or teams, are selected to attend the American Junior Academy of Science. The project abstracts and first place papers are published in the VJAS Symposium Proceedings. All presenters receive feedback from the judges.

5. *How Do Students Benefit from VJAS?*

Students have increased understanding of Virginia's Standards of Learning (SOL) for STEM subjects. They use creative and critical thinking skills and develop technical reading, writing and presentation skills. Students obtain an enhanced understanding of careers by interacting with STEM professionals, participating in symposium lectures, and visiting university campus and research laboratories. In addition, students can develop citizenship skills by serving as a VJAS officer and/or volunteering at the symposium. Students can use feedback from STEM Readers and Judges to improve future research.

6. *How Can I Obtain Support for Student Research? Learn More?*

The Virginia Academy of Science (VAS) supports student research by providing mentors for teacher. VJAS Student Officers, or a prior VJAS presenter, can mentor a beginning researcher. Experienced teachers within a division are a valuable resource for teachers beginning to involve students with VJAS.

To learn more, visit the Virginia Junior Academy of Science website (<http://vjas.org>). Be inspired by images from prior symposia, abstracts and papers in the VJAS Symposium Proceedings, and the student publication, The Voice. Learn details by reviewing the VJAS Handbook and by contacting the VJAS Leadership Team. Are you interested in being a reader for judging the symposium? Register at this link: <http://vjas.org/judges.html>

VJAS STEMinar



Learn from experienced students,
teachers, and members of VJAS!

January 29th
3-4 p.m. ET

Form Link:
tinyurl.com/vjas-steminar



#334-21

**Commonwealth of Virginia
Virginia Department of Education
Superintendent's Memo #334-21**

DATE: December 17, 2021
TO: Division Superintendents
FROM: James F. Lane, Ed.D., Superintendent of Public Instruction
SUBJECT: Public Comment Period for the Proposed Data Science Standards of Learning and Curriculum Framework

On November 18, 2021, the Virginia Board of Education received for first review the proposed Data Science Standards of Learning and Data Science Standards of Learning Curriculum Framework. The proposed Data Science Standards of Learning for Virginia Public Schools would be an addition to the current 2016 Mathematics Standards of Learning. The standards provide an introduction to the learning principles associated with analyzing data sets and can be the basis of a locally-developed high school level one-semester or year-long mathematics course. Through the use of open-source technology tools, it is anticipated that students participating in these courses developed from these standards will identify and explore problems that involve the use of relational database concepts and data-intensive computing to find solutions and make generalizations. Students will engage in a data science problem-solving structure to interact with large data sets as a means to formulate problems, collect and clean data, visualize data, model to predict, and communicate effectively about data formulated solutions.

The proposed Data Science Standards of Learning can be accessed at the Virginia Department of Education Data Science Standards of Learning webpage. Public comments regarding the proposed Data Science Standards of Learning will be received at vdoe.mathematics@doe.virginia.gov from December 17, 2021–January 31, 2022.

For more information

For additional information about the proposed Data Science Standards of Learning, please contact Tina Mazzacane, K-12 Mathematics Coordinator, Office of Science, Technology, Engineering, Mathematics, and Innovation, by email at Tina.Mazzacane@doe.virginia.gov or by telephone at (804) 225-4849.

JFL/TLM

FIELD TRIPS ARE BACK!

Nothing is better than the sights and sounds of young minds discovering the awesome science all around them! From dissections to engineering challenges, there is something for curious minds of all ages at the Science Museum of Virginia. If you're looking for a scientific adventure, but are unable to visit us in-person, we also offer a wide variety of Digital Demos.

Learn more at smv.org/groups



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Mission of the Virginia Association of Science Teachers (VAST)



- inspire students,
- provide professional learning opportunities,
- build partnerships,
- advocate for excellence at the school, local, state and national level.

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for inclusion in the next Newsletter.**

**Please consult the website for up-to-date information, VAST forms for awards and mini-grants,
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