



EDUCATION @ MESA ARTS CENTER



MESA ARTS CENTER PRESENTS
NATIONAL GEOGRAPHIC LIVE!
ANAND VARMA: BEAUTY AND THE BIZARRE

Ikeda Theater | November 16 | 10:15 AM | Grades: 5 - 8

2017/2018 EDUCATOR RESOURCE GUIDE



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ABOUT ANAND VARMA, PHOTOGRAPHER...

National Geographic Live! brings you Anand Varma, a biologist turned scientist who captures amazing images of the miniature world around us. From a young age Anand was fascinated by nature, so when he went to college he naturally wanted to research biology. When he was hired on assignment for National Geographic, Anand found the ultimate way to explore natural history by researching, exploring, and photographing nature for National Geographic magazine. Anand has photographed all types of nature subjects including parasitic insects, hummingbirds, frogs, and all manner of wetland and rainforest creatures.

One study Anand is well known for is his photography of the life cycle of the honeybee. Through the creative use of an incubator, Anand was able to photograph the complete life cycle and transformation of an egg to an adult bee as it occurs in the hive. He then compiled all these amazing images into a timelapse video of the honeybee's life cycle. You will no doubt enjoy seeing Anand Varma's incredible photographs as well as hearing his fascinating stories about life as a natural history photographer in this presentation by National Geographic Live!



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WELCOME!

Dear Educator,

Thank you for selecting a **National Geographic Live!** field trip with the Mesa Arts Center. We have a dynamic season planned and we look forward to connecting you to our many speakers and presentations. With National Geographic Live, students are able to experience dynamic presentations and make educational connections well beyond the classroom.

We also recognize and appreciate the energy and time spent on your part in coordinating field trips. In this guide we have provided information to help make this the best experience possible.

In addition, the Mesa Arts Center has many open and inviting spaces that make good places to hold a brown bag lunch. Prior arrangements for lunch accommodations need to be made by either calling (480) 644-6540 or emailing outreach@mesaartscenter.com.

Please contact our offices should you have any additional questions (contact info on last pg.).

Enjoy the show!

TEACHER AND CHAPERONE INFORMATION

Chaperones

- ◆ Assign each chaperone a designated group of students and provide him/her with a written list of the students in that group.
- ◆ Ask chaperones to stay with their assigned group throughout the field trip. Adult chaperones are responsible for the students' conduct and behavior throughout their visit to the Center.
- ◆ Please review theater etiquette rules and responsibilities with all chaperones.
- ◆ Have the phone numbers of every chaperone in your group to quickly access each other in case of emergency.

Theater Etiquette

- ◆ No Food or Drink inside the theatre (besides bottled water).
- ◆ Students must be accompanied by chaperones at all times.
- ◆ Cameras and recording devices may not be used during the performance.
- ◆ Please silence cell phones and resist the urge to text message.
- ◆ Listening and following the House Managers and Ushers will help the seating and dismissal process.
- ◆ Feel free to laugh, clap and enjoy the show but also to be respectful of those around you.



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CURRICULUM CONNECTIONS

National Geographic Live: Anand Varma: Beauty and the Bizarre

Arizona's College and Career Ready Standards

These standards can be achieved by using the discussion questions included in this guide.

Speaking and Listening

Grades 5-8.SL.1 — Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

Grades 5-8.SL.2 — Ask and answer questions about key details in a text read aloud or information presented orally or through other media.

Science

Grades 7 & 8: SC-S2C1-04 — Evaluate career opportunities related to life and physical sciences.

SC08-S4C4-01 — Explain how an organism's behavior allows it to survive in an environment.

SC07-S4C3-03 — Analyze the interactions of living organisms with their ecosystems.

SC07-S3C1-01 — Analyze environmental risks caused by human interaction with biological or geological systems.

Arizona's College and Career Ready Standards

These standards can be achieved by using the STEAM lesson included in this study guide.

Math

5.MD.A.1 — Convert among different-sized standard measurement units within a given measurement system, and use these conversions in solving multi-step, real-world problems.

6.RP.A.3 — Use ratio and rate reasoning to solve mathematical problems and problems in real-world context.

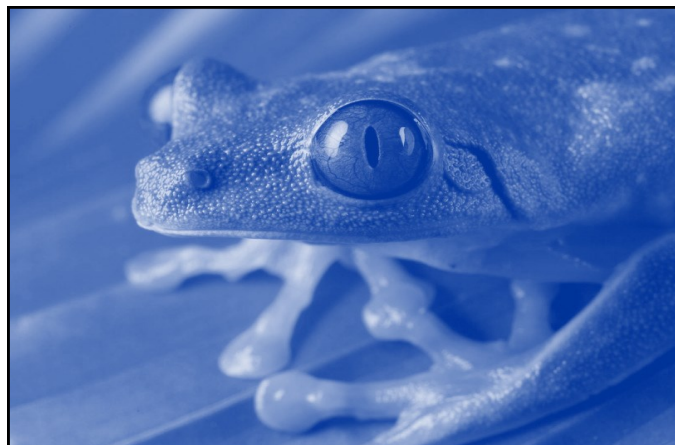
7.RP.A — Analyze proportional relationships and use them to solve mathematical problems and problems in real-world context.

7.G.A.1 — Solve problems involving scale drawings of geometric figures, such as computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

Mathematical Practice 1 — Make sense of problems and persevere in solving them.

Mathematical Practice 2 — Reason abstractly and quantitatively

Mathematical Practice 6 — Attend to precision.





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CURRICULUM CONNECTIONS CONTINUED

National Geographic Live: Anand Varma: Beauty and the Bizarre

Arizona's College and Career Ready Standards

These standards can be achieved by using the STEAM lesson included in this study guide.

Science

Strand 1 of the Science standards lays out the Inquiry process for students in grades 5-8. Performance objective details vary by grade but the general goals of each Concept are below:

SC-S1C1 – Observe, ask questions, and make predictions.

SC-S1C2 – Participate in planning and conducting investigations, and recording data.

SC-S1C3 – Organize and analyze data; compare to predictions.

SC-S1C4 – Communicate results of investigations.

Additionally these standards support the Engineering Design Process:

Grade 5:

SC05-S3C1-02 – Propose a solution, resource, or product that addresses a specific human, animal, or habitat need.

SC05-S3C1-03 – Evaluate the possible strengths and weaknesses of a proposed solution to a specific problem relevant to human, animal, or habitat needs.

SC05-S3C2-03 – Design and construct a technological solution to a common problem or need using common materials.

Grades 6-8:

SC-S3C2-01 – Propose viable methods of responding to an identified need or problem.

SC-S3C2-02 – Compare possible solutions to best address an identified need or problem.

SC-S3C2-03 – Design and construct a solution to an identified need or problem using simple classroom materials.

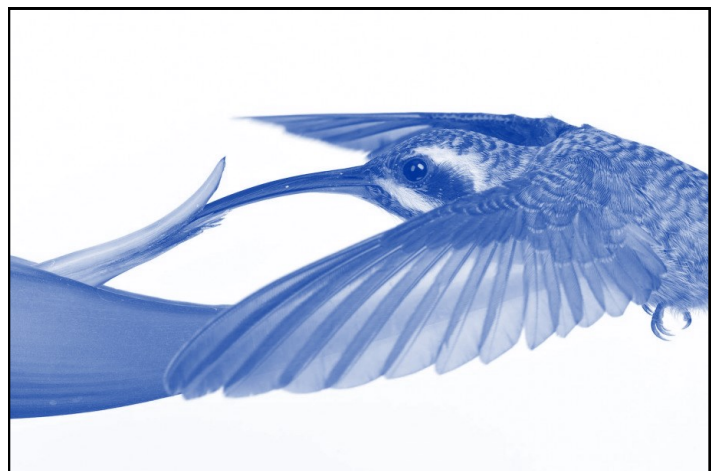
Speaking and Listening

Grades 5-8.SL.4 – Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.

21st Century Learning Skills

By using the STEAM lesson included in this guide, students can become more proficient in the following Competencies:

- Critical Thinking
- Creativity
- Communication
- Collaboration





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DISCUSSION QUESTIONS

Pre-Performance Discussion Questions

What do you know about biodiversity? Why is biodiversity important?

Anand Varma had a fascination with biology, especially marine biology, as a child. He ultimately became a natural history photographer which allows him to explore biology and his passion for photography together. What are you fascinated by? What would your dream job be?

Anand Varma has studied the biology of bees as part of his field work. Why is it important to understand more about bees? What can we learn about observing their first 21 days? You can watch Anand Varma's TED talk on bees at: https://www.ted.com/talks/anand_varma_a_thrilling_look_at_the_first_21_days_of_a_bee_s_life

Post Performance Discussion Questions

What was something surprising or interesting you learned from Anand Varma's presentation on biology and biodiversity?

In what ways did Anand Varma demonstrate curiosity, responsibility, empowerment, and persistence in his work? Why do you think these attitudes are important for explorers?

Did Anand Varma make any call to action to support his work? Are there any changes we can make in our day to day lives to support the Earth or biodiversity? What can we work on together as a group?



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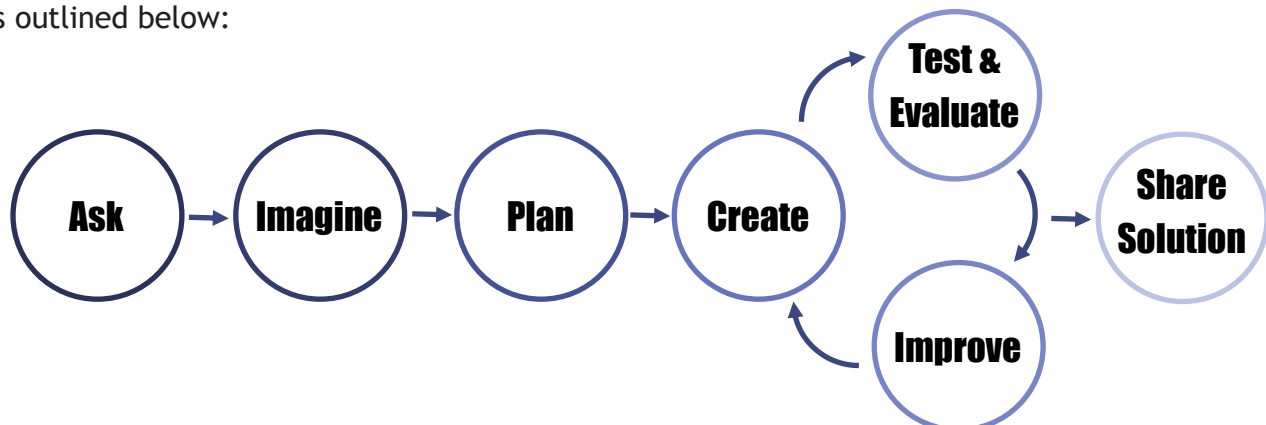
WHAT IS STEM?

STEM is a common buzzword in education these days, so it is important to know what exactly STEM is, and also what it is not. A true STEM lesson not only incorporates different subject areas, but also works to develop students' abilities to think creatively, reason, investigate, and work as a team. Here is a breakdown of what STEM means:

S Science	T Technology	E Engineering	M Math
The study of the natural world.	While traditional digital technology meets this part of STEM, technology is any product made by humans to meet a want or need. Any product created by students to solve a problem can be considered technology.	The design process students use to solve problems.	The study of numbers, equations, functions, and geometric shapes and their relationships.

A science experiment is not necessarily a STEM lesson. The requirements below need to be met as well for a lesson to be STEM based learning:

- The lesson focuses on a real world problem/issue.
- Students are working in productive teams.
- Students are engaging in hands-on inquiry and open-ended exploration. Students should be able to redesign as needed (within time constraints) so there should not be an exact end product/result predetermined by the teacher in mind.
- Students understand that there are multiple right answers to the posed problem and that failure can be used to reevaluate and make changes towards discovering a solution.
- The lesson uses the *engineering design process (EDP)*. EDP is similar to the scientific method and is outlined below:



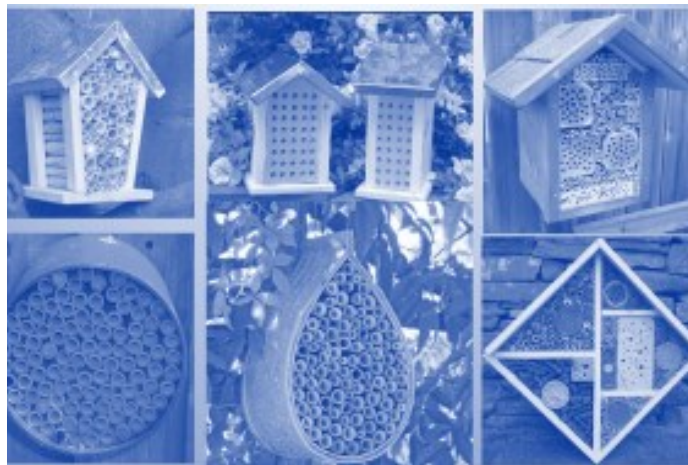
- Adding any type of art component to the lesson changes STEM to STEAM.



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STEAM LESSON: BEE HOTELS

Anand Varma spent over 6 months as a beekeeper as he studied the life cycle of the honeybee. Anand Varma was fascinated by the changes the bees went through in the hive. Although bee-keeping is a time consuming and careful process, students can contribute to helping maintain the bee population with this lesson. The art component is in the sketching portion of the project as well as any aesthetics the students add to their final design.



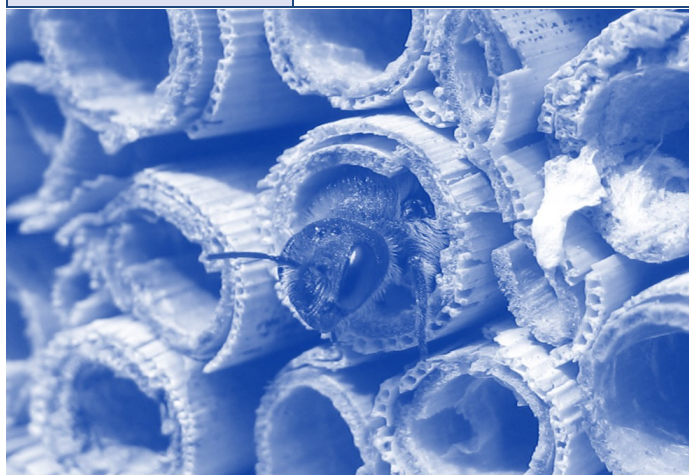
ASK (REAL WORLD PROBLEM)	<p>Since the late 1990's, beekeepers around the world have seen a higher rate of decline in honeybee colonies. Honeybees are key pollinators in our ecosystem because one third of the world's food depends on their pollination. The solution to this problem involves changes to current ecological farming practices, but we can impact bee ecology on a smaller level by encouraging solitary bees who are not part of a hive to lay eggs by creating desirable bee hotels for them. Ask students, "Can you create a desirable bee hotel for solitary bees?"</p>
MATERIAL POSSIBILITIES	<p>Students will need a variety of materials to choose from. By searching "Bee Hotel" online you can see numerous examples of homemade bee hotels. Generally students will need hollow materials for the bees to lay eggs in such as straws, bamboo, or sticks with holes drilled in them. Other bees prefer straw, stems or even a clay/sand mix. Students will also need something to contain the egg laying material such as cardboard, wood, PVC pipe, or a bottle. If you are willing to drill for the students and have the materials to do so, wood blocks with holes of varying sizes drilled in could be a design that students try.</p>
IMAGINE & PLAN	<p>After students have been grouped and presented with the problem, they will need to do a bit of research on solitary bees since each type has a different preference when nesting. Things to consider when creating a bee hotel: How will you make the bee hotel weatherproof from wind and rain? Are you choosing materials that your teacher is able to acquire? Is your bee hotel favoring one type of bee or could several species of bee use the hotel? Will the hotel be attached to something or freestanding? Students should sketch out their bee hotel design to scale before moving on to the create stage.</p>



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STEAM LESSON: BEE HOTELS

CREATE	<p>After presenting their design sketch and explaining the design choices to their teacher, students can create their bee hotel as long as the materials are available to them. If after presenting the design plan, the students are informed that a material is not available to them they will need to reevaluate their plan and revise it to work with available materials. Remind students that they should be measuring materials to match their design so that they are not using more than necessary or being wasteful with materials. If you are incorporating art into this lesson, offer students materials to add their personal aesthetic flair to their bee hotel.</p>
TEST, EVALUATE, & IMPROVE	<p>After the bee hotels are created they will need to be placed or secured outside. If there is a place on campus near vegetation where they would be undisturbed that would be ideal, but also consider letting students take their bee hotels home if they have flowering plants or finding a location in the community where the bee hotels would have a higher potential of bees being nearby. Set a time frame of at least a month before evaluating to see if any bees used the bee hotels. If external factors such as weather affect the bee hotel or no bees are using the hotel, students should discuss improvements.</p>
SHARE SOLUTIONS	<p>Once the bee hotels have been tested, evaluated, and improved if needed, students can present their findings to the class. The class can discuss any factors that may have contributed to the success or failure of each bee hotel. If possible, leave the bee hotels in place so that they can continue to attract pollinators to the area.</p>



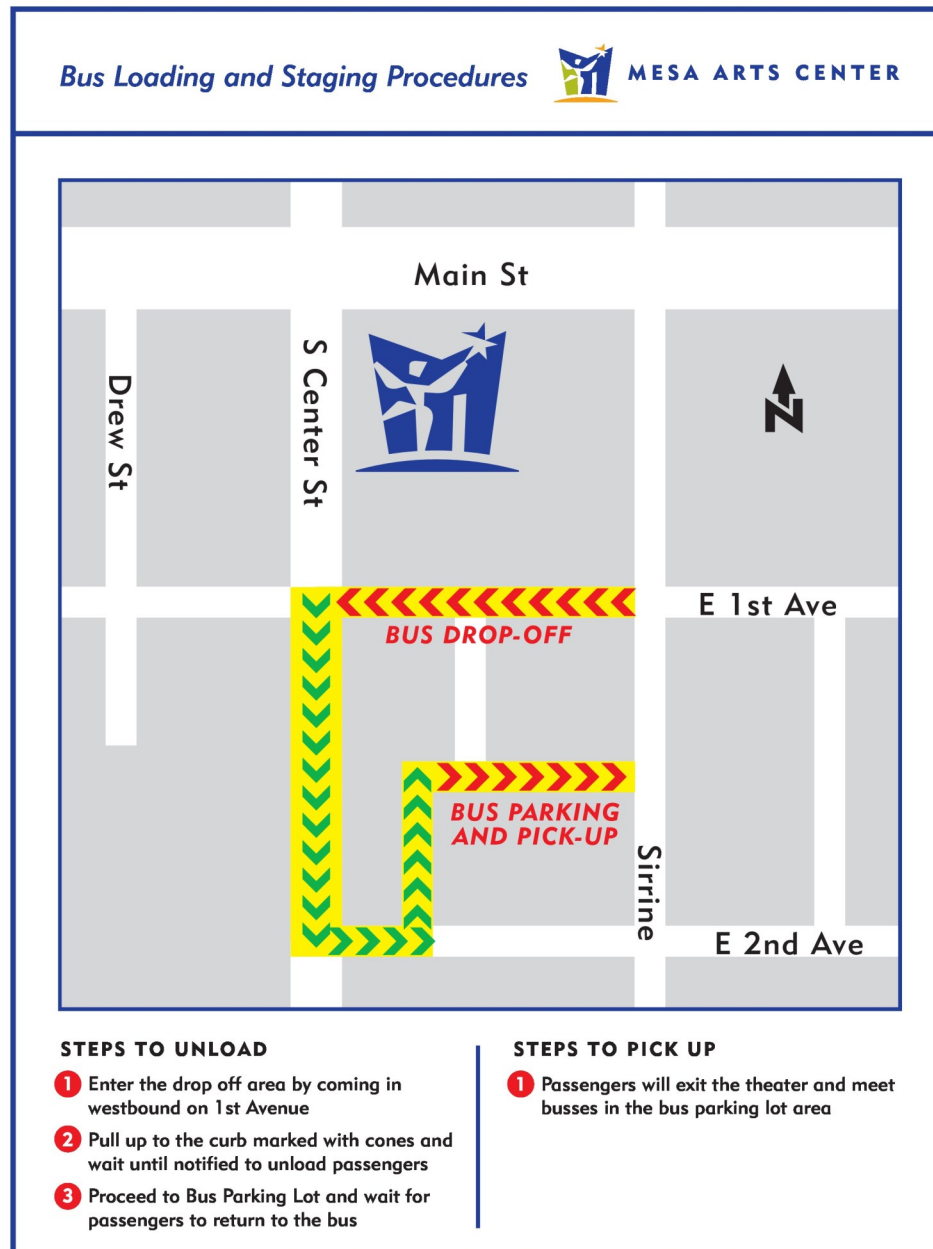
LITERACY CONNECTIONS

- *Students can create an advertisement for their bee hotel. The advertisement should include a diagram and explanation of important features.*
- *Students could also write a research paragraph or paper on a species of solitary bee. Alternatively students could write a persuasive essay about the best way to help grow the dwindling bee population.*



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MESA ARTS CENTER MAP



Mesa Arts Center | One E. Main St. Mesa, AZ 85201 | 480-644-6500 | MesaArtsCenter.com

PLEASE NOTE - We ask that buses arrive approximately 30 minutes before the performance begins to allow ample time to unload and seat students.



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SHARE YOUR EXPERIENCE!

We'd love to hear your students' response to our shows.

We especially appreciate pictures and letters!

THANK YOU!

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