Bill Blagg's
Magic Science Lab

Presented By
Doceo Arts

ARTS ENGAGEMENT TITLE
Making Magic with the Scientific Method

Suggested for
Grades 2-5

Total length
32:28

Bill Blagg's
magic
SCIENCE LAB

MAKING MAGIC
with the Scientific Method

DESCRIPTION

Students join Bill Blagg inside *The Magic Science Lab* where they will explore how magicians use science to create the impossible! In this residency, students will learn the "secret" 5 step process (The Scientific Method) magicians use to develop the illusions they perform! Together with Bill, they will use the "secret" 5 steps to make a person magically float mid-air! As a bonus, Bill teaches a science-based magic trick students can do at home or in class - how to make a pencil float in the palm of their hand!

LEARNING CONNECTIONS

- **Science** (The 5-step Scientific Method)
- **21st Century Skills** (Critical Thinking; Creativity; Collaboration; Communication)
- **Drama / Theatre** (Character development; Technical elements; Audience role)
- **English Language Arts** (Speaking and Listening; presentation of knowledge and ideas, vocabulary acquisition and use.)

THINGS TO KNOW

- This Arts Engagement is sequential and cumulative.
- All videos are closed captioned.

SUPPLIES

- For Video 4, each student will need two pencils and one wide flat rubber band.

VIDEO 1 – Meet the Magic Man/The Secret Process	**Length: 7:22**
Bill Blagg welcomes you to his Magic Science Lab where you will discover the "Secret" 5 Step Process Magicians Use to Make Magic!	
VIDEO 2 – The Hook	**Length: 6:25**
Explore the Scientific Principle that is the Key to Making a Person Float!	
VIDEO 3 – The Amazing Experiment	**Length: 9:43**
The Moment of Truth - Can Science Make a Person Float?!	
VIDEO 4 – How to Make a Pencil Float	**Length: 8:32**
Bill Teaches Students How to Make a Pencil Float in Mid-Air!	

GLOSSARY

Bill Blagg's Magic Science Lab – *Making Magic with the Scientific Method*

Terms from Videos and Lesson Plans for this Arts Engagement Experience

The Scientific Method	1. Ask a Question 2. Conduct Research 3. Form a Hypothesis 4. Perform the Experiment 5. Draw a Conclusion
Gravity	An invisible force that pulls objects toward each other. On Earth, gravity pulls objects with mass downward toward the center.
Center of gravity	The point where the effect of gravity on an object is equal.
Balance	Stability produced by even distribution of weight on each side of the vertical axis.
Friction	A force that slows or stops motion between two surfaces that are touching.
Levitate	To float in air.
Optical illusion	Something that produces a false impression of reality.
Problem Solving	The process or act of finding a solution to a problem.
Creativity	The use of the imagination or original ideas.
Showmanship	Skill at entertaining, theatrical presentation, or performance.

Theatrical terms are found on page 2 of this Glossary.

Theatrical terms from Videos and Lesson Plans for this Arts Engagement Experience

Set or Stage Design	The design created for a show that creates the world of the show. This can include scenery, props, drops, etc.
Props	An object used on stage by performers during a performance. Props are usually movable or portable but can also be large in size.
Costume	A set of clothes worn by a performer on stage to relay a certain mood, character, or personality. Some magicians use their clothing or costume to assist them in the execution of their illusions.
Theatrical Sound Design	Is everything the audience hears during a performance such sound effects, music, the performers' voices, etc. which is used to create the world of the show.
Theatrical Lighting Design	Incudes the lighting, special effects, smoke, haze, pyro technics, etc. used to create the world of the show. These can be used to draw attention to specific areas, moments, and to ensure the performers are visible.

Lesson Plan & Guide:

Bill Blagg's Magic Science Lab – Making Magic with the Scientific Method

Things to Know

- Bill Blagg cites world-famous magicians Harry Houdini, David Copperfield and others to make the point that magicians have been using the Scientific Method to create magic for centuries.
- Bill Blagg was already an aspiring magician when his 5th grade teacher amazed him by using magic to teach science concepts. This experience influenced the adult illusionist to use his art form to educate. Teachers and experiential learning can have a life-changing effect on students.
- This Arts Engagement is sequential and cumulative.
- Supplies needed are readily available.

Artist Introduction

Bill Blagg combines his love of magic and science to create and tour highly acclaimed live stage shows – *The Science of Magic* and *Magic in Motion* – that apply mind-bending magic to engage learners' curiosity in the science behind the illusion. If you have not done so already, see the Artist Introduction to learn more about Bill.

Work of Art

Making Magic with the Scientific Method is the first arts engagement in the Magic Science Lab series. The Arts Engagement and series reimagine elements of Bill Blagg's action-packed, interactive live stage performances and the science behind them into a digital format for school classrooms.

Learning Connections

- **Science** (The 5-step Scientific Method)
- **21st Century Skills** (Critical Thinking; Creativity; Collaboration; Communication)
- **Drama / Theatre**
  - Character development - physical and artistic choices;
  - Technical elements – how set, props, sound, & lighting support theme of show;
  - Audience role – willing suspension of disbelief.
- **English Language Arts** (Speaking and Listening; presentation of knowledge and ideas, vocabulary acquisition and use.)

Advance Preparation

Review Four Videos

This arts engagement is a performance in four short videos (totaling 32:28 minutes) that demonstrate how Bill Blagg applies the five steps of the Scientific Method to create the amazing illusion of a human being floating in the air, seemingly defying the law of gravity. At the conclusion of each video students are given a one-minute challenge as a segue to the next step in the process.

- Video 1 - Meet the Magic Man / The Secret Process (7:22)
- Video 2 - The Hook (6:25)

- Video 3 - The Amazing Experiment (9:43)
- Video 4 - How to Make a Pencil Float (8:32)

Review Lesson Plans

This Arts Engagement includes two (roughly 30 minute) lesson plans that cover all four Arts Engagement videos (two per plan). Since lesson plans are modular and flexible, educators have the option to subdivide these plans into four roughly 20-minute plans - one for each video.

Lesson plan activities help students make meaningful connections between the performance, personal lived experience, and arts and academic standards. They align with Bill Blagg's objective: sparking curiosity and imagination to motivate students to do their own scientific experimentation. For each video, the plan includes:

- Warmup;
- Video Set up;
- Video Viewing;
- Reflection;
- Post-video activity;
- Closure.

Review Glossary of Terms

Review Supplemental Materials

- Guides to live stage performances: *The Science of Magic* and *Magic in Motion*
- Lesson plans (found below)

Once you have reviewed all of the listed resources, decide how you want to present this Arts Engagement for your students. Will you cover all 4 videos in one lesson, or spread them over two lessons?

Making Magic with the Scientific Method Objectives & Outcomes

The Learner will *Know*:

- five steps in the Top-Secret Magic Process;
- five steps in the Scientific Method;
- both are exactly the same.

The Learner will *Understand* that:

- for 100s of years, magicians have used this process to create magic and illusions;
- the five steps must be done in order – every step depends on what came before;
- to begin with the question posed by the performer.

The Learner will *Be Able to*:

- write and explain a hypothesis;
- determine and describe ways to research that hypothesis;
- observe and analyze a levitation experiment and draw a conclusion;
- perform a magic trick - levitating a pencil.

Lesson Plan 1 - Components

Pre-set:

- Chart paper or white board and markers
- 8 Glossary terms:
  - Scientific Method;
  - Step 1: Ask a question;
  - Levitation;
  - Step 2: Research;
  - Engineered piece of plastic;
  - Center of gravity;
  - Balance;
  - Step 3: form a Hypothesis.

Warm Up (5 min)

Ask students to share (and list their responses on whiteboard or paper) what they know about magic. Continue adding to this list as students answer:

- Who has learned how to do a magic trick?
- Who has seen a magic show, live or on TV?
- How do they DO that?

Set up Video: Let's find out! Pay close attention and be ready to discuss the video afterwards.

Main Activity: Watch Video 1 - Meet the Magic Man / The Secret Process (7:22 min)

Reflection (5 min) – Note to teacher - As you facilitate student reflection on the Magic Science Lab video, post or write glossary terms on chart paper or white board.

- What five-step process do magicians use to invent magic tricks or illusions?
  - Answer: Top Secret Magic Process, aka The Scientific Method
- What two steps did Bill Blagg demonstrate today?
  - Ask a Question - what kind of magic trick do I want to do?
    - Answer: Levitation – make a human being float in mid-air.
  - Research – considering tools he could use to create this trick. What did he consider?
    - Answers: – string, magnets, air pressure.

Post Video Activity:

Bill Blagg asked us to think of other tools that could create the illusion of Levitation.

1. Invite volunteers to share their ideas (list ideas on chart paper)
2. Group discussion: What is one idea you think could work? Why do you think so?

Short stretch/water BREAK before next video.

Welcome back. Let's find out what tools Bill Blagg decided on!

Main Activity: Watch Video 2 - The Hook (6:25 min)

Reflection (5 min)

- What tools did Bill Blagg try? Why didn't they work out?
- What tools did he demonstrate? Engineered piece of plastic and ordinary belt.
- What scientific principle helps create the illusion of Levitation? Center of Gravity
- How does it help create the illusion? Balance

Post Video Activity:

Bill Blagg asked us to do step three of The Scientific Method – what is that?

- Answer – Form a Hypothesis – stating what we think will happen when he uses Center of gravity and Balance to create the illusion of a person floating in mid-air.
- Invite volunteers to share their Hypothesis – what they think will happen.
- Group discussion: Are our hypotheses alike or different? Why?

Closing:

- What did you learn about Science today? What about Magic?
- The next lesson will be about the Scientific Method steps 4 & 5. What are they? (Answer: Experiment / Draw Conclusions).

Lesson Plan 2 - Performance

Pre-set:

- Let students know they will need to have a pencil ready for a quiz (wink wink) at the end of the lesson. (Be sure to have an extra pencil and a wide, flat rubber band in reserve for each student.)
- 3 Glossary terms:
  - Friction;
  - Optical illusion;
  - Showmanship.

Warm Up – group review

- How many steps are there in the Scientific Method?
- Which steps did we learn about in Lesson 1?
  - Answer: 1. Ask a Question; 2. Research; 3. Form a Hypothesis
- What was our Hypothesis about Bill Blagg's levitation illusion?

Set up Video: Let's see what actually happened...

Main Activity: Watch Video 3 – The Amazing Experiment (9:43 min)

Reflection (5 min) – Note to teacher - As you facilitate student reflection on the Magic Science Lab video, post or write glossary terms on chart paper or white board.

- How did Bill Blagg scale up the tools to plan the onstage performance?
- What was his Hypothesis about the performance?
- What unexpected twist did he add to take the performance one step further?
- What did he ask us to do? Draw a Conclusion.

Post Video Activity: Invite volunteers to share their conclusion – was it magic or science? – and explain why.

Transition to Break: We have one last Making Magic with the Scientific Method video in this Arts Engagement. What do you think it will be about?

Short stretch/water BREAK before next video.

Set up: Welcome back. Ask students to volunteer ideas about what this video will be about, and jot these down on chart paper. Let's find out what Bill Blagg has up his sleeve for us!

Main Activity: Watch Video 4 – How to Make a Pencil Float (8:32 min)

Reflection (5 min)

- Did anyone guess correctly what this video would be about?
- What did you learn in this video?
- What scientific principle was the secret to this trick?
- What secret move made it work?
- What was the twist that took it one step further?
- What do you need to do before performing this trick for friends or family?

Post Video Activity:

- Showmanship
  - How does Bill Blagg make his performance an exciting and engaging way to learn science?
  - Discussion prompts: What does Bill Blagg mean by showmanship? How would you describe his stage persona / character? How does he move around the performance space? Address the audience? Dress? How do you think he "gets into character" for the show? Do you think he loves his job? What makes you say so?

- Technical Theater
  - How does theatrical production enhance the performance?
  - Discussion prompts: What do you notice about the technical aspects of the production? Stage set? Props? Lighting? Sound?

- Partner Work - Pencil
  - Take turns practicing the floating pencil trick as your partner plays the role of audience.
  - Give each other feedback on your performance. What is working? What part do you need to make better?

- Partner Work – Performance – Now add showmanship!
  - Warm up your body and voice – breathe, stretch, vocalize
  - Create your stage magician character! How do you stand, move, speak?
  - Take turns practicing the floating pencil trick again.
  - This time focus feedback on performance / presentation elements.

Closing: Do a showmanship bow for your audience – three steps forward, bend at the waist, three steps back. With attitude!

Lesson Guide and Plans created by: Leigh S. Jones Consulting

RESOURCE GUIDE

This resource guide is designed to be used in conjunction with the live performance of Bill Blagg's *The Science of Magic* show. Utilizing the resources in this guide will help you explore the wonders of magic with students. You will be able to further your students' understanding of the art of magic and the scientific principles/processes displayed in Bill Blagg's *The Science of Magic* show. The goal of this guide is to further promote students to think "outside the box" and spawn their curiosity about how science is used to create the impossible!

The Man Behind the Magic

To say that Bill Blagg has had a magical life would be no exaggeration. From the moment he received his first magic kit in 1985, his world was never the same. Bill professionally launched his magic performing career in 1996, at the ripe age of sixteen. Bill became a stand-out in the magic community, due in part to his off-the-cuff personality and his high-energy performance style.

After graduating college with honors, Bill hit the road to perform magic full-time. Today, Bill has one of the largest touring theatrical magic and illusion shows in the country.

Having a love for both magic and science, Bill combined the two to create his one-of-a-kind, educational show *The Science of Magic.* The show takes students on a rare, exciting, never-before-seen journey behind the scenes of the magic world. Students discover first-hand how magicians utilize science to create the impossible.

Bill lives in Milwaukee, WI, with his wife Kristin. When he's not performing he can be found at his magic workshop, working with his dad to create new illusions to thrill his audiences with.

Magic & Science

Both magic tricks and science experiments can leave people scratching their heads in amazement. Sometimes it seems there's not much difference between magic and science. What are magic tricks anyway? Magic tricks are really just illusions. The magician knows the secret of how to do the trick. However, to the audience the trick looks like magic because they don't understand how the trick was done.

Many magic tricks are really just simple science experiments. The magician adds a few magic words and makes you believe that something supernatural and mysterious is happening. Magicians are master showmen and work very hard to fool audiences by using misdirection and manipulating their senses. In the end, there's a scientific explanation for how the trick works that has nothing to do with magic or magic words.

Examining Magic

The fascination with tricks and illusions is universal and timeless. Before you can examine magic in detail, it is helpful to let children discover the broadness of the topic. As you are introducing magic to the group, brainstorm all the different types of activities that might fall under the category of magic.

Making things disappear, appear and change form is described as magic. Seeming to defy the "natural" order of the world (i.e. defying gravity, walking through walls) is called magic. Moreover, amazing feats that stun or surprise us are deemed "magical." You may soon find your list of magic acts getting quite lengthy!

Next it is helpful to look at some synonyms for magic. Illusions, tricks, stunts, and deceptions are all used to describe magic acts. Discuss with the children why something might be called a stunt, whereas something else is an illusion. Decide how broadly you would like to define the category of magic. Work with the children to create a working definition for the topic of magic.

Pre-Show Discussion Topics

Use the following questions to start classroom discussions prior to attending *The Science of Magic:*

- What is MAGIC?
- Name some famous magicians.
- What is your favorite magic trick?
- Does anyone know how to do a magic trick?
- If you could learn how to do one magic trick, what magic trick would you like to learn? Why?
- Do magicians have magical powers or do they use science to fool us?
- Where do magicians learn how to do magic?

Post-Show Discussion Topics

Use the following questions for classroom discussion after attending *The Science of Magic:*

- **How do magicians create magic tricks?**

  They use the steps of the scientific method. They develop a theory (hypothesis) then they test it. If it fails they change one variable and test it again. They repeat this process over and over until they get their theory to work.

- **Do magic tricks always work?**

  No. Just like scientists, magicians must keep experimenting to find ways to make illusions work. Some ideas NEVER work and others take YEARS to create!

- **How do magicians use mirrors to make magic?**

  They use mirrors to reflect light to make a person think they are seeing something (a mirror image) that is not really there.

- **What type of mirror did Bill use to make things disappear in the magic box?**

  Plane mirror

- **Can a solid pass through a solid?**

  No. When molecules are tightly packed together they form a solid. In a solid the molecules can't move or separate in order to allow another solid to pass through.

- **Since a solid can't scientifically pass through another solid, how did Bill pass the metal hoop over the floating teacher?**

  We can't tell you the secret but here's a tip…misdirection and controlled perspective :-)

- **What can you do with an object when you find its center of gravity?**

  Make it balance

- **After everything Bill taught us during the show do you think (teacher's name) was really floating in mid-air at the end of the show?**

Mention the passing of the metal hoop as proof of no supports, etc. Use this question to spawn creative methods of how the teacher was floating.

Activity: *Create experiments to test the student's hypotheses on how they think the teacher floated. Were their hypotheses correct? Why or why not?*

Terms

Illusion: something that produces a false impression of reality

Misdirection: focusing attention on one thing in order to distract attention from another

Perspective: the way objects appear to the eye

Levitate: to float in air

Center of Gravity: the point where the effect of gravity on an object is equal

Magnetism: the invisible force that causes items to attract or repel each other

Attract: to come together

Repel: to push apart

Mirror: an object with at least one reflective surface

Mirror Image: the image seen when looking into a mirror

Plane Mirror: a mirror with a flat surface. Most common type of mirror

Reflection: the bouncing of light from a surface

Refraction: the change in direction of light as it moves from one transparent substance to another

Matter: anything that has mass and takes up space

Atom: a tiny particle that all matter is made of

Molecule: forms when atoms bond or link together.

Density: a term used to compare two substances that occupy the same amount of space but have different amounts of matter

Solution: mixing two or more substances together (salt water)

Scientific Method: the process used to prove or disprove a hypothesis using experimentation.

Hypothesis: an educated guess about the results of an experiment you are going to perform

Experiment: a procedure used to test a hypothesis or to make a discovery

Magic Lesson 1: The Floating Egg

Sometimes a magician seems to make things float in air. In this project you won't make things float in air, but you will make an egg float in water.

Materials

Quart (liter) jar, tap water, scissors, ruler, masking tape, ½ cup salt, felt-tip pen, uncooked egg, large spoon

The Setup

1. Fill the jar half full of water
2. Cut a 3" piece of tape and stick it to the outside of the salt container. Use the pen to write on the tape, "Magic Swimming Powder."
3. Place the egg and spoon on the table

Magic Science Time!

1. Tell your audience, "I am going to teach an egg how to swim."
2. Begin by showing the audience that the egg doesn't know how to swim by placing the egg in the jar filled with tap water. The egg will sink to the bottom. Remove the egg from the jar with the spoon.

3. Tell the audience that for the egg to swim you need to add magic swimming powder to the water. Pour the salt in the water and stir with the spoon. Say some magic words!

4. Place the egg in the water. The egg will float!

Discussion

- How did the magic powder help the egg float?
- What was created by mixing the powder in the water?
- Why didn't the egg float without the powder?

Explanation

All matter floats or sinks depending on its density. Less dense substances float on more dense substances. The egg floats in salt water because the egg is less dense than the salt water. However, the egg is denser than tap water, so it sinks.

Salt water is a **solution** that contains both salt and water. A solution occurs when a solid is dissolved in a liquid.

Magic Lesson 2: The Broken Pencil

In this trick you'll use water and light to perform an interesting illusion.

Materials

A glass, tap water, pencil

The Setup

1. Fill the glass about two-thirds full of tap water.
2. Place the glass of water and pencil on the table.

Magic Science Time!

1. Hold the pencil in front of you. Tell the audience, "I am going to break the pencil by simply sticking it in this glass of water."
2. Hold the pencil upright in the water so that the tip is about halfway between the surface of the water and the bottom of the glass. Make sure the pencil is near the back of the glass, away from the audience.

3. Move the pencil back and forth in the water, keeping it upright. Ask them what they see. It will appear as though the pencil is broken when in the water.
4. Remove the pencil from the water

Discussion

- Did the pencil really break when it was placed in the water?
- If not, then why did it look like the pencil was split in half?

Explanation

This trick works because of **refraction**. Light travels in straight lines, but when it travels from one transparent substance to another the light rays bend. This is refraction. When light travels from a more dense transparent substance, such as water, to a less dense substance, such as air, the light refracts, or bends noticeably. Light travels at different speeds in substances with different densities.

Light reflected from the pencil appears to the audience to be in one place when it travels to their eyes through the air, and in another place when it is refracted through water.

Magic Lesson 3: Disappearing Penny

Here's another effect that uses light and water to produce a mind-boggling effect.

Materials

Quart (liter) jar with lid, tap water, penny, helper

The Setup

1. Fill the jar with tap water. Put the lid on the jar.
2. Place the jar and penny on the table in front of you.

Magic Science Time!

1. Get a helper from the audience to assist you.
2. Have your helper examine the penny and confirm that it's a real penny.
3. Have the helper place the penny on the table. Ask "Can you see it?"

4. Place the jar filled with water on top of the penny.
5. Say a few magic words and wave your hands over top of the jar.
6. Have the helper look through the water from the side of the jar and see if the penny is there or gone. What is the answer?

Discussion

- Where did the penny go?
- Why can't the helper see the penny through the clear water?

Explanation

When light travels from air to water, light bends toward the normal, a line perpendicular to the surface. Traveling from water to air, light bends in the opposite direction, away from the normal.

This trick works because at a certain angle, when light travels from a more dense substance (water), to a less dense substance (air), it no longer refracts but will reflect. **Reflection** is the bouncing back of light from a surface. When the image of the penny comes toward the side surface of the jar at too great an angle, reflection rather than refraction occurs, and the image cannot be seen outside of the jar.

Magic Lesson 4: Keeping Dry

Air can be used in many magic tricks. Try this trick to learn one way air can amaze!

Materials

Paper towel, drinking glass, plastic tub or bucket filled with enough tap water to reach the height of the glass

The Setup

1. Place the materials on the table

Magic Science Time!

1. Crumple the paper towel and place it in the bottom of the glass.

2. Turn the glass over and make sure that the paper will stay in place at the bottom of the glass.

3. Slowly lower the upside-down glass into the tub of water. Keep the glass as straight up and down as possible, until the entire glass is under the water. **Good time for discussion topic #1*

4. Take the glass out of the water and let the water drip off the glass.

5. Turn the glass right side up and remove the paper towel. Let the audience feel the paper towel to determine if it is wet or dry.

Discussion

1. Will the paper towel in the cup get wet? Why or why not?

2. Why didn't the paper towel get wet when it was placed in the water?

Explanation

Air takes up space. The glass is filled with air when it's right side up and when it is upside down. When you turn the glass over and slowly lower it into the water, air remains in the glass.

The water cannot enter the glass because of the air inside the glass. The air creates pressure that is greater than the pressure of the water trying to get in. The towel in the top of the glass stays dry. If you were to tilt the glass on its side in the water, air would exit the glass and form bubbles. Water would then be able to enter the glass and soak the paper towel.

Additional Classroom Activities

Here are some additional ideas to use in the classroom to further explore magic and science!

Activity 1: Make Magic!

- Have students create their own magic tricks. Promote students to develop their own unique magic trick. Guide them through the steps of the Scientific Method to help them in their quest to create their very own illusion.
- If time is of the essence perform this activity as an all class magic trick. Ask students to share ideas of a magic trick they'd like to create. Select one idea and as a class follow the steps of the Scientific Method to make the trick a reality!
- Remember sometimes no matter how many times you try the trick won't work. Be sure to document your experiments and the single variables you change each time. Use those notes to spawn classroom discussion on why the magic didn't work. What else could be tried to make it work? Have students suggest other methods to try. Did they work?

Activity 2: Magic Show!

- Have students select a magic trick from a magic book in the library.

  ***** *If you're school library doesn't have any magic books find some magic tricks online to hand out to the students. See credits/resources at the end of this guide.*

- Discuss with students the importance of showmanship when performing magic. Encourage them to use magic words, hand gestures, etc. when performing.
- Instruct the students to practice the trick at home.
- Plan a day to have the students perform their very own magic show.
- Following each trick explain the science that allows the magic to happen.

Credits / Resources

Many of the tricks in this guide were adapted from the references below.

Books

Wiess, Jim (1998). *Magic Science: 50 jaw dropping, mind-boggling, head-scratching, activities for kids.* San Francisco: Jossey-Bass

Shalit, Nathan (1981). *Science Magic Tricks.* New York: Holt, Rinehart and Winston

Web Links

Card Trick Central – http://web.superb.net/cardtric

This website has hundreds of card tricks. They are sorted by ability level and make it easy to find an appropriate one to try.

Magical Youth International – http://magicyouth.com

Magical Youth International is the youth program of the International Brotherhood of Magicians (IBM).

Bill Blagg – http://www.billblagg.com

Official website for Bill Blagg that includes tour dates, biography, videos, pictures and an e-mail group sign up form.

Special Thanks

Overture Center for the Performing Arts (Madison, WI) – Educational Series (2010).
**Excerpts from the self-produced Overture Center Guide have been referenced in this resource guide.*

Simon Shaw – Shaw Entertainment Group. Great Barrington, MA

STUDY GUIDE

This study guide is designed to be used in conjunction with the live performance of Bill Blagg's *Magic in Motion* show. Utilizing the resources in this guide will help you explore the experience of magic and live theater with your students. You will also be able to further your students' understanding of the scientific laws that were taught during Bill Blagg's *Magic in Motion* show and how bending those laws created magic! The goal of this guide is to further promote students to think "outside the box" and spawn their curiosity about how magic doesn't exist without science!

MOBB PRODUCTIONS Inc

About Bill Blagg

To say that Bill Blagg has had a magical life would be no exaggeration. He received his first professional magic book from his great-grandfather, which eventually led to building magic props with his dad. These early beginnings paved the way for Bill's successful career in the art of magic.

After graduating from Carthage College (Kenosha, WI) with honors, Bill decided to pursue magic full-time. Today, Bill is one of the nation's top touring magicians and performs close to 200 shows a year! In addition to his educational magic experiences (*Magic in Motion & The Science of Magic)*, Bill also tours theatres across the country with his full-scale magic & illusion show, *The Magic of Bill Blagg LIVE!* which has been featured on ABC, CBS, NBC and FOX TV!

Having a love for both magic and science, Bill has created his one-of-a-kind, educational show *Magic in Motion* to teach students how magic wouldn't exist without science. The show takes students on an exciting journey where they experience magic first-hand as the laws of science are defied right before their very eyes!

Bill lives in Milwaukee, WI with his wife Kristin (and their dog Daisy). When Bill is not performing magic, he can be found at his magic workshop creating new magic & illusions to thrill or educate his audiences!

Find out more about Bill and his magic at www.billblagg.com

About *Magic in Motion*

Bill Blagg's *Magic in Motion* melds the fascination of magic with the wonders of physical science to create an unbelievable educational experience!

In this highly visual, interactive show, students will be on the edge of their seats as they experience how science creates magic right before their very eyes! Their jaws will drop in amazement as ordinary objects come to life, while others defy gravity with a simple clap of the hands!

Students will discover how magic is created from core scientific principles such as force, energy, friction, motion and more. Together with Bill they will explore these principles while bending the laws of science to experience the impossible! Science and magic will collide as students instantly become stronger than their teachers, stop moving objects with their minds and even make a teacher's cell phone invisibly travel through time!

Magic in Motion is a magic filled, educational experience that is designed to inspire students to investigate how physical science is necessary for magic to exist while also playing an important role in their daily lives!

Find out more about Magic in Motion here: www.shawentertainment.com/magic-in-motion/

SCIENCE IN THE SHOW

Motion: a change in position compared to a place or an object that is not moving

Force: push or pull on an object. A force happens when two objects interact – that is, when one object does something to the other object. When the interaction stops, the force stops, too

Unbalanced Force: a force that causes a change in the motion of an object

Push: a force that moves an object away from something

Pull: a force that moves an object toward something

Gravity: a force that pulls objects toward each other

Mass: the amount of material that makes up an object

Energy: the power to make matter move or change

Friction: a force that slows or stops motion between two surfaces that are touching

Speed: rate of motion, or the measure of the distance an object travels in a certain amount of time

Velocity: how fast and in what direction an object is moving. Speed and direction of a moving object

Position: where an object is in relation to the objects around it

Simple Machine: something that uses force to make work easier

Fulcrum: fixed point on which a lever rests

Lever: a simple machine made up of a stiff bar that moves freely around a fixed point

Kinetic Energy: the energy of motion

Potential Energy: stored energy, energy caused by position

Pressure: (as in barometric pressure) the weight of the air

Newton's Laws of Motion: three fundamental laws of classical physics developed by Sir Isaac Newton that describe the relationship between an object and the forces acting upon it

PRE-SHOW ENGAGEMENT

Physical Science Concept Review:

Conveyor Belt Graffiti Write

Review the following science concepts with students. Suggested concepts for each grade level are listed below.

Grades 2 and 3: push, pull, force, motion, gravity, simple machine

Grades 4 and 5: energy, motion, change, force, direction, gravity, mass, pressure

Grades 6 and 7: force, motion, law of gravity, mass, distance, direction, unbalanced force

1. Write each science concept on a piece of chart paper.
2. Break students into small groups. Give each group one of the chart papers. Make sure each student has a marker to write with (you may want each student in each group to have a different color marker for accountability purposes so they have to contribute to the graffiti write).
3. Tell students that when you say go, they will silently write for one minute what they know or questions they have about the concept on the chart paper. Students may add on to other students' thinking as well.
4. After one minute, rotate the chart papers to the next group, hence the "conveyor belt". Again, give one minute for students to jot their thinking, questions, and responses to others' thinking.
5. Continue until all groups have responded on all charts.
6. When the original chart makes it back to the original group, have the group look at it and then report out any interesting thinking or questions that are written on the paper.
7. Have a whole group or small group discussion about how these concepts may be connected to the show *Magic in Motion*. Have students jot some reflections about what they are going to expect from the show.

Nature of Science Review:

3-2-1 Bridge: How do magicians use science to create magic?

PART ONE

For this engagement, you are going to use the first part of a Visible Thinking Routine called 3-2-1 Bridge. You will begin this engagement before the show, and then complete the other half after seeing Magic in Motion.

1. Set up several chart papers with the following organizer:

PART ONE **Initial responses:** **How do magicians use science to create magic?**	**PART TWO** **New responses:** **How do magicians use science to create magic?**
Three thoughts or ideas	**Three thoughts or ideas**
Two questions	**Two questions**
One analogy	**One analogy**
BRIDGE: Explain how your new responses connect to your initial responses.	

2. Break students into small groups.
3. Have groups complete part one only. Students can share their thinking with the rest of the class when finished.
4. Save the charts for after the show. Students will reflect on their new thinking after seeing *Magic in Motion*.

THEATER ETIQUETTE

Review theater etiquette with students before attending the show:
Theater etiquette is an important part of attending a live stage production. So that all patrons have an enjoyable experience at the theater, please share these guidelines with your students prior to attending the performance. Remind students to be respectful of the performers and other audience members by engaging in responsible behavior.

· You agree to be on time. Theater is great! It's live! It happens in the moment. You can't rewind it. You are an important part of the show and you need to be there from the very beginning. The performers are there, so you need to be there, too. Arriving 20 minutes before show time is the standard rule.

· You agree to use the restroom before the show starts to avoid getting up and disrupting the performance while it's happening. Once a class is seated, you may visit the restroom in small groups prior to show time. Young students must be escorted.

· You agree not to talk or whisper during the show. If you whisper to your friends during the show, you disrupt those around you, and quite possibly the performers. And, you might miss something!

· You agree to participate. This includes laughing at appropriate times, clapping in appreciation for the things you like, and doing other things when invited by the performers to do so. It also means paying attention to what's going on by listening and watching closely.

· You agree to turn off all cell phones and other gadgets that may make noise during the show.

· You agree not to take pictures or use recording devices of any kind during the show. The material performed on stage is copyrighted material, and therefore protected under copyright law from reproduction of any kind without written permission.

· Finally, you agree to give the performers a full curtain call. A curtain call is the performers' final bow at the end of the performance. It's your opportunity to show your appreciation for what they've shared with you. Please wait until all the performers have taken their final bow before exiting the theater. The ushers and your teacher will assist you in finding the best route out of theater!

POST-SHOW ENGAGEMENT

Nature of Science:

How did he do that?!?!

Break students into small groups to analyze one of the magic tricks Bill performed.

Have students create a visual that includes their explanations of the following:

- The science concepts represented before the trick.
- The science concept(s) that Bill defied to create the magic.
- The steps Bill may have taken to make the trick work.
- Variables that would cause the magic not to work.

Nature of Science Review:

3-2-1 Bridge: How do magicians use science to create magic?

PART TWO

For this engagement, you are going to use the second part of a Visible Thinking Routine called 3-2-1 Bridge. You will complete this engagement after the show.

1. Pass out the original chart papers to the small groups:

PART ONE **Initial responses:** **How do magicians use science to create magic?**	**PART TWO** **New responses:** **How do magicians use science to create magic?**
Three thoughts or ideas	**Three thoughts or ideas**
Two questions	**Two questions**
One analogy	**One analogy**
BRIDGE: Explain how your new responses connect to your initial responses.	

2. Have students complete part two.
3. Now have students work together to complete the bridge.
4. Present your thinking to the rest of the class.

EXTENSION:

Challenge Reality: Can you create your own magic trick?

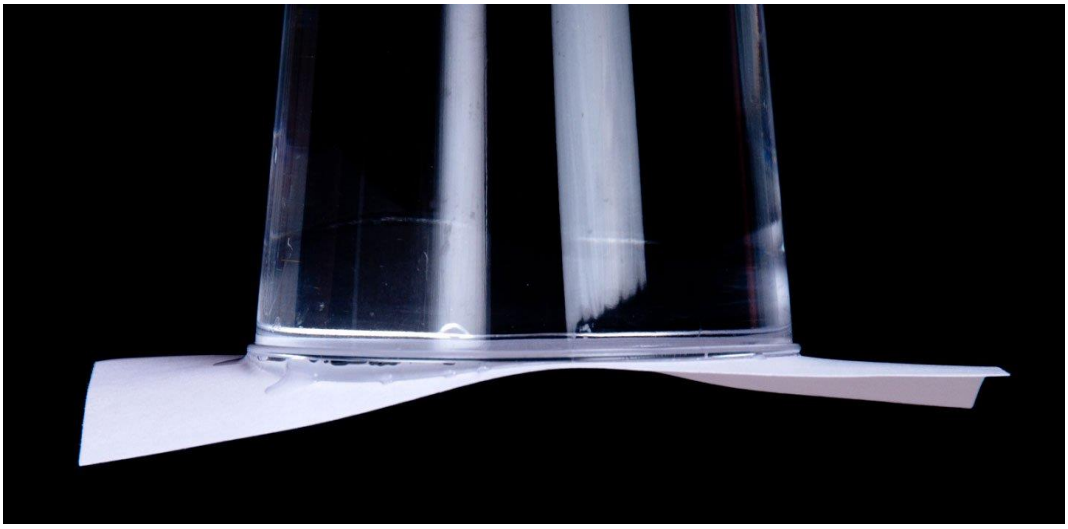
Think you have what it takes to be a magician? Bill says that, "You experience magic when something conflicts with your reality." Take a shot at designing your own magic trick by defying one of the physical science concepts explored in *Magic in Motion*.

Or

Demonstrate how one of the physical science concepts are used in the real world (reality). Be prepared to present your learning!

Physical Science Class STEM Experiment:

Floating Water: Turn the glass over and nothing spills!



Is it scientifically possible to fill a glass with water and turn it upside down without the water spilling out like Bill did during *Magic in Motion*? Here is a popular science stunt that looks like magic and makes a great STEM exercise! Have students break into groups to see if they can make water defy gravity!

Students will explore the following concepts while conducting this experiment: gravity, potential energy, kinetic energy, pressure, friction, balanced forces.

You will need:

- Clear plastic cups
- Water
- Playing cards or index cards
- Bowls (just in case)
- Towels

1

Before you get started, make sure the index card or playing card is large enough to completely cover the mouth of the glass. Fill the glass or plastic cup to the top with water.

2

Cover the cup with an old playing card, making sure that the card completely covers the mouth of the container.

3

Keep your hand on the card and turn the cup upside down. Hold the cup over the bowl just in case you accidentally spill.

4

The final step takes guts. Slowly take your hand away and the card will stay in place . . . and so should the water (keep your fingers crossed).

5

Don’t press your luck too far. Put your hand hand back on the card and return the cup to its upright position.

6

If the temptation is just too great, and you want to do it again. Just make sure the card doesn’t become completely soaked and accidentally fall apart. This could be a huge surprise for everyone in class.

HOW DOES IT WORK

The secret is right in front of your nose—it's the air that we breathe. Air molecules in the atmosphere exert pressure on everything. Scientists know that at sea level air molecules in the atmosphere exert almost 15 pounds of pressure (okay, 14.7 pounds if you want to be exact) per square inch of surface area. Your body is used to feeling this kind of air pressure, so you don't notice it.

When you first turn the cup upside down, the pressure of the air inside the cup and the air pressure outside the cup are equal (balanced force). If you look closely, however, you'll notice that just a little water leaks out between the card and the cup. This happens because the force of gravity naturally pulls down on the water. When some of the water escapes, this causes the volume of air (the space above the water inside the cup) to increase slightly. Even though the amount of air above the water stays the same, the volume occupied by the air is now greater and the air pressure inside the cup decreases. The pressure of the air outside the cup is now greater than the pressure inside the cup and the card stays in place (potential energy). All of this is possible because the water creates an airtight seal (friction) between the rim of the cup and the card.

When the seal is broken (even a *tiny* bit), air enters into the cup, equalizes the pressure, and gravity pushes the water out (kinetic energy). Poking a thumbtack-size hole in the cup allows air to seep into the cup from the outside. The pressure of the air molecules both inside and outside the cup stays the same, gravity takes over, the card falls, and the water spills.

FURTHER EXPLORATION

Repeat the experiment but this time change the amount of water in the cup. Does it make any difference? What about if you switch the container? Will a wider cup hold the card better than a narrower cup? Does the temperature of the water have any effect on the water staying inside the cup?

Try the experiment using a paper cup or plastic cup but this time, using a thumbtack, poke a small hole in the bottom of the cup. What do you predict will happen if air is allowed to sneak into the cup? What if you cover the hole and then perform the trick? Does it work? What happens when you stop covering the hole?

Resources for this guide include:

The Magic of Bill Blagg Live!

Shaw Entertainment Group

Graffiti Writing Strategy https://goalbookapp.com/toolkit/strategy/graffiti-boards

Project Zero: Visible Thinking Routines

Next Generation Science Standards

Brittanica Kids

This guide was created in association with Kim Dennison. Thank you Kim for your research and development that made this study guide possible!