

# National MagLab

## STEM Lesson Plan:

### Science and the Arts: Ballet (Elementary School)



**Lesson Objectives:** Student will be able to:

- Understand it takes energy to change the motion of objects.
- Identify electric current, magnetic field, and force.
- Conduct research of African Americans, Hispanics, and other minority figures in ballet.
- Organize their findings to present to their classmates using a variety of media formats (PowerPoint, trifold or poster board display, poetry, rap, etc.)
- Produce ballet dancers using homopolar motors.

**Next Generation Science Standard:**

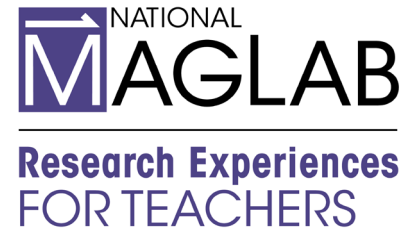
- 3-PS2-3: Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.
- 4-PS3-3: Ask questions and predict outcomes about the changes in energy that occur when objects collide.
- 5-PS2-1: Support an argument that the gravitational force exerted by Earth on objects is directed down.

**STEM RATIONALE FOR LESSON:**

Students will explore how ballet, traditionally seen as a classical art form, is evolving into a more diverse and inclusive space, embracing the talents and perspectives of individuals from various cultures, ethnicities, and genders. They will learn that this shift enriches the art of ballet by fostering a unique and dynamic experience that reflects the beauty of human diversity. Through this understanding, students will recognize the broader importance of inclusivity across all fields, including STEM (Science, Technology, Engineering, and Mathematics).

Moreover, they will come to see how the presence of minorities and people who share their own backgrounds is crucial in shaping the future of STEM. These individuals bring not only their intellect but also innovation, creativity, and diverse viewpoints that drive progress and problem-solving in these disciplines. By highlighting the value of representation in both the arts and sciences, students will appreciate how their unique

# STEM Lesson Plan:



identities and contributions can inspire and influence transformative change in the world around them.

## **Culturally Responsive Connection:**

Students will gain an awareness of the importance of diversifying the arts to include and embrace the talents and uniqueness of all nationalities and genders. They will come to understand the significant impact that representation in the arts has on youth and others, inspiring individuals to see themselves reflected in creative spaces and encouraging broader participation. Additionally, students will comprehend the need for diversity in STEM fields, recognizing and appreciating the valuable knowledge, skills, and perspectives that people from diverse backgrounds contribute to advancing science, technology, engineering, and mathematics.

## **Time:**

- Day: 1-3 Research identify minorities in ballet and create presentations.
- Day: 4 Student Presentations
- Day: 5 STEM Activity
- Each day's activities can take 30-40 minutes.

## **Materials:**

Provided by the teacher:

- Safety goggles
- Battery (AA)
- 18 gage copper wires
- Needle nose pliers
- Colorful crepe paper
- Tape or glue
- Neodymium magnets
- Technology with internet
- Microsoft Office
- Graphic organizers

# STEM Lesson Plan:



Provided by the student:

- Art supplies (Colored pencils, glue, scissors).
- Science Notebook (composition notebook or 1 subject spiral notebook)
- Tri fold or poster board

## Previous Knowledge:

Begin by activating students' prior knowledge with a series of inquiry questions designed to engage them in the topic:

- Have you ever attended a ballet recital? What was it like?
- What do you already know about ballet as an art form?
- What do the terms "minority" and "diverse" mean to you in the context of the arts?
- Can you name a minority ballet dancer? Examples might include Misty Copeland, Janet Collins, Alicia Alonso, or Sarah Gabrielle Ryan.

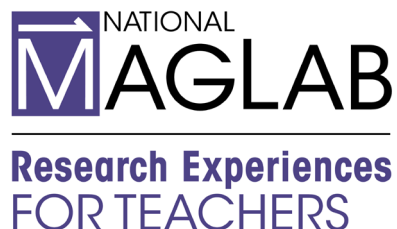
## Day 1: Lesson Introduction

1. Distribute individual KWL (Know, Want to Know, Learned) charts to students, and create a large KWL chart on chart paper for a collective class activity. Begin by filling in the "What I Know" section on the large chart based on students' responses to the inquiry questions. Encourage students to copy this information into the "What I Know" column of their personal KWL charts.
2. Once this is done, transition to the "What I Want to Know" section. Ask students to share what questions they have about ballet, particularly regarding its history, music, outfits, cultural diversity, or famous dancers. Write their questions on the class KWL chart, making sure to capture their curiosity and interests. Students should also record these inquiries in their individual "What I Want to Know" sections. This process will set the foundation for an engaging exploration of ballet and its increasing diversity, helping students connect their prior knowledge to new learning experiences.

## Day 2 – 3: Research and Project Construction

1. Begin by explaining the purpose and goals of the assignment to the students. Inform them that this week, they will explore the contributions of ballet dancers of

# STEM Lesson Plan:

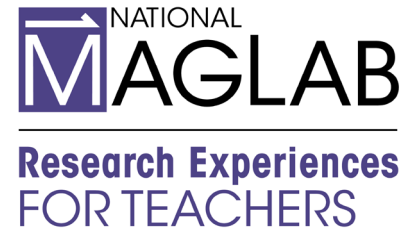


- color to the art of dance. Additionally, they will create their own ballet dancers using homopolar motors, merging artistic exploration with scientific principles.
2. Provide each student with a Biography graphic organizer. Explain that this tool will assist them in staying focused and organizing their research effectively as they gather information about ballet dancers of color.
  3. Instruct students to conduct research on a ballet dancer of color, focusing on their contributions to the art form. As they gather information, they should fill out the Biography graphic organizer with relevant details, such as the dancer's background, achievements, and impact on the dance community.
  4. Once students have completed their graphic organizers, review each one to ensure that they have accurately captured the necessary information and are on the right track. Provide feedback and guidance as needed.
  5. After receiving approval on their graphic organizers, students can begin arranging their information and any related artifacts into their presentations. Encourage them to think creatively about how to present their findings, considering visual elements and engaging storytelling techniques.
  6. As students work on their presentations, introduce the concept of homopolar motors. Guide them in creating their own ballet dancers using this technique, emphasizing the connection between dance and the principles of movement and energy.
  7. Once their presentations are organized and their ballet dancers are created, allow students time to practice their presentations. Encourage them to highlight both their research findings and the creative aspects of their homopolar motor ballet dancers.
  8. Finally, facilitate a presentation session where students can share their findings on ballet dancers of color and showcase their homopolar motor creations. Encourage peer feedback and discussion to enhance the learning experience.

## Day 4: Presentations

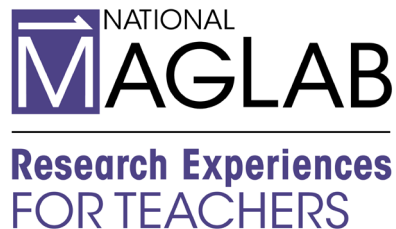
1. Inform students that they will present their projects focused on minorities in ballet and their impact on the arts. Emphasize the importance of sharing their findings and the unique contributions of these dancers.

# STEM Lesson Plan:



2. Provide students with a variety of media formats to choose from for their presentations. Options may include digital slideshows, posters, videos, or live demonstrations. Explain that these choices are designed to accommodate the diverse needs of English Language Learners and Exceptional Learners, allowing all students to engage with the material in a way that best suits their learning styles.
3. Outline the expectations for the presentations, including key components that should be included, such as:
  - a. Brief biography of the dancer
  - b. Discussion of their contributions to ballet
  - c. Impact on the arts and culture
  - d. Personal reflections on what they learned from the research
4. Provide students with adequate time to prepare their presentations. Encourage them to collaborate with peers if working in groups and to seek assistance as needed while organizing their thoughts and materials.
5. Schedule presentation days and facilitate the sharing of projects. Encourage students to engage with their audience by asking questions or inviting discussions after each presentation. Remind them to be respectful and attentive listeners while their peers present.
6. After all presentations are completed, instruct students to reflect on the new knowledge they have gathered from both their research and their classmates' presentations. They should add this information to the "What I Learned" section of their KWL Chart. Encourage students to think critically about how their understanding of diversity in ballet has evolved through this process.
7. Conclude the activity with a class discussion to highlight key takeaways from the presentations. Encourage students to share their insights and any lingering questions they may have about the contributions of minorities in ballet and their impact on the arts. This will help reinforce the learning objectives and foster a deeper appreciation for diversity in the arts.

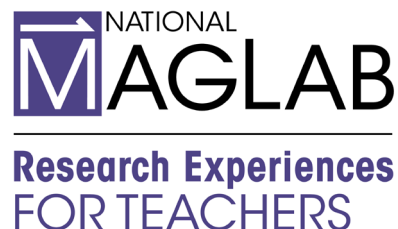
# STEM Lesson Plan:



## Day 5: STEAM Activity

1. Begin by explaining to students that we will extend our lesson by creating ballet dancers using homopolar motors. This hands-on activity will deepen their understanding of the principles of electromagnetism and allow them to explore the intersection of art and science.
2. Instruct students to define the following vocabulary words in their Science Notebook. Encourage students to use their own words and include examples where applicable:
  - a. Electromagnetism
  - b. Homopolar motors
  - c. Lorentz Force
  - d. Direct Force
  - e. Current
3. Conduct a discussion on the vocabulary words, providing definitions and context for each term. Use graphic features such as pictures and diagrams to enhance understanding and retention of the concepts.
4. Show a video demonstrating the process of creating tiny homopolar motors. <https://www.youtube.com/watch?v=CdfVzYRp5c0> After viewing, assess students' comprehension by asking questions about the video. Encourage them to share their thoughts and clarify any points of confusion.
5. Divide students into groups of 3-4. This collaborative setup will promote teamwork and allow for shared problem-solving as they work on their projects.
6. Go over the Lab Safety Rules with the class, emphasizing the importance of safety while working with materials and tools during the activity.
7. Instruct students to lay the template on the table and carefully mold the wire into the designated shape by following the template guidelines. Demonstrate the molding process and assist students as they shape the wire into the form of a ballerina or dancer. Encourage each student to take turns shaping the design. If the ballerina design proves too challenging, instruct them to follow a basic homopolar motor design.
8. Using tape or glue, have students add crepe paper to the waist of their ballerina to mimic a ballerina's leotard, adding a creative touch to their projects.
9. Guide students to balance the battery onto the magnet, ensuring that the positive terminal is facing upward. Instruct them to connect the wire to the positive terminal of the battery, so the ballerina stands upright. Then, connect the bottom

# STEM Lesson Plan:



end of the wire to the magnet and observe the results! Encourage students to refer to their notes and vocabulary to identify the electric current, magnetic field, and force at play.

10. Move around the classroom to observe the students' findings and engage in discussions about their discoveries. Listen to their observations and encourage them to explain their reasoning and processes.
11. After completing the homopolar motor activity, have students revisit their KWL chart to document any additional facts or insights they have learned from the STEM activity. This reflection will help consolidate their learning and encourage them to connect their new knowledge with previous information.

## Vocabulary:

- Electromagnetism: Interaction of electric currents or fields
- Homopolar Motors: The electric current from the battery flows through wire generating a magnetic field.
- Lorentz Force: The combination of electric and magnetic force on a point charge due to electromagnetic fields
- Electromagnetic Fields: Produced by moving electric charges
- Electric Current: A flow of charged particles such as electrons moving through an electric conductor.

## Accommodations:

- Weekly lessons and activities presented in different formats
- Different student presentation formats
- Preferential seating
- Peer partner
- Extended time research and create presentations
- Notes and graphic organizers utilized in whole group instructions and on assessment

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# STEM Lesson Plan:



## Appendix:

### Additional Resources and References

1. Breaking Barriers: Black Dancers at American Ballet Theatre  
(<https://artsandculture.google.com/story/breaking-barriers-black-dancers-at-american-ballet-theatre-american-ballet-theatre/XgWBTwQFdjXcLw?hl=en>)
2. Misty Copeland – Breaking Barriers and Shattering Stereotypes in Ballet  
(<https://www.the-ballet-shop.com/2023/06/breaking-barriers-and-shattering-stereotypes-in-ballet/>)
3. Pointe-ing Towards Change: Inclusive Practices in Ballet  
(<https://womenscenteratumbc.wordpress.com/2019/02/04/pointe-ing-towards-change-inclusive-practices-in-ballet/>)
4. 10 Ways to Deep Dive into Diversity and Inclusion for Ballet?  
(<https://www.clevelandinnercityballet.org/single-post/10-ways-to-deep-dive-into-diversity-and-inclusion-for-ballet>)

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WHAT DO YOU  
KNOW



WHAT DO YOU  
WANT TO KNOW



WHAT HAVE YOU  
LEARNED

