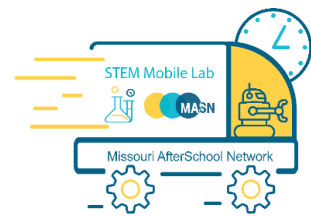


STEM Mobile Lab

Playlist Descriptions



INTRODUCTION

The Missouri AfterSchool Network STEM Mobile Lab transports an afterschool-designed lab of hands-on activities featuring Science, Technology, Engineering, and Mathematics to afterschool programs across the state of Missouri. The following titles, descriptions and learning standards are activities and playlists designed for K-12. Through the registration of the STEM Mobile Lab, a program starts consultant with the MASN team for guidance through the selection process and professional development and mentorship for the program staff.

GRADES K – 2ND

INSTRUMENT CONSTRUCTION

Introductory into vibrations and sound. Students will learn how different materials and forces can cause vibrations and vibrations can create new sounds by creating various instruments. Students will design and create instruments and experiment with what sounds are created from the materials used. (45-60 min)

Grades K & up- MLS 1.PS4.A.1, 2.PS4.A.2

BALLOON POWERED CARS Explore the concept of thrust with this fun balloon car. Students will decorate a car cutout and attach a balloon engine to their model. Students will test their cars, and design and make modifications to their balloon-powered cars.

Grades K & up – MLS K.PS2.A.1, K.PS3.B.1, K.ETS1.A.1

SKELETAL SYSTEM

Learn about how our bones provide support for our bodies and protect our organs by constructing a straw skeletal system. Students will learn different bones and build a skeletal system using straws or from paper and brass fasteners. (45-60 min)

Grades K & up- MLS K.LS1.C.1

YOUR LUNGS

Students will learn how their lungs function. What happens when air moves in and out? Students will learn what it is like to have trouble breathing because of asthma, tissue damage, or other reasons. Students will build replica lungs and put them to the test. (45 min)

Grades K & up- MLS K.LS1.C.1

GETTING TO KNOW SPHERO

Sphero is a programmable educational-based robot that is easy to interact with and works well with all grades. Students will get to learn just what a robot is and gain an introduction to Sphero. Students will construct an obstacle course and play several games to test just how far they can take Sphero. (45 min)

Grades K & up- MLS K.CS.D.01, 1.CS.D.01, 2.CS.D.01, K.AP.A.01, 1.AP.A.01, 2.AP.A.01

RIGAMAJIG

Just what is a Rigamajig? What can you do with a Rigamajig? Exploring Rigamajig activity will help answer those questions. Rigamajig is a hands-on kit that helps students explore, build, and engineer using the power of play. Students will learn about the various parts of a Rigamajig and find out what they can build with it. (45-60 min)

Grades K & up- MLS K.RA.A, 1.RA.A, K.GM.A, 1.GM.A, 2.GM.A, 1.GM.B, 2.GM.B

Rigamajig Topic Areas:

Explore & Create: Introduction to Rigamajig materials and how they work. Children explore the properties of all the Rigamajig pieces and connectors, plus time to put the pieces together to build anything they want.

MLS K.PS2.A.2, K.ETS1.A.1, 2.ETS1.A.1

My Invention DOES: Children use imagination about building something that can be used to achieve a real-world task. Youth discuss, and decide on an “invention” and can make to DO something. The session includes planning and collaboration prior to building it!

MLS K.PS2.A.2, K.ETS1.A.1, 2.ETS1.A.1

Preparative Actions: Through exploration, naming and play youth will build collaboration and problem-solving skills. (20 – 25 min)

MLS K.PS2.A.2, K.ETS1.A.1, 2.ETS1.A.1, 2.ETS1.A.1

Sirens, Bells, and Great Big Yells! Through introduction to Rigamajig materials and how they work, youth will explore the properties of pieces and connections to build something that makes sound or noise!

MLS K.PS2.A.2, K.ETS1.A.1, 1.PS4.A.1, 1.PS4.C.1, 2.ETS1.A.1

Up and Down! Youth construct something that will move up and down. They will need to use their imaginations to get ideas about what elements can be put together, in what configurations, in order to get the resulting contraction to move both up and down.

MLS K.PS2.A.2, K.ETS1.A.1, 2.ETS1.A.1

SCAT AND TRACKS PT.1 (SCAT)

When you go for a hike it's there. When you go walking around town it's there. Even in your backyard, it's there. What is it? Scat is the answer, but what is scat and what can we learn from it? Scat has many telling signs that can let you know what can be found around you. Students will dive into learning about what Scat can tell us about the animals in their area. (45 min)

Grades K & up- MLS K.PS1.A.1, 2. PS1.A.1, K.LS1.C.1, 2.LS2.A.2

SCAT AND TRACKS PT.2 (TRACKS)

When you go for a hike it's there. When you go walking around town it's there. Even in your backyard it's there. What is it? Tracks is the answer. Tracks can be found everywhere; they are evidence that something was there and some can even be a message left for others to interpret from. Students will learn about tracks and their meanings and play a game of who broke into the trash can using what they have learned from part 1 & 2 of SCATS AND TRACKS. (45 min)

Grades K & up- MLS 1.LS3.A.1

YOUR MUSCLES

Learn about your muscles and how they function and how they interact with the skeletal system. Students will learn about how muscles contract to perform movement as they build their own muscle-powered Elbow. Students will test the strength of their built elbow by lifting various objects. (45 min)

Grades K & up- K.PS2.A.1

States of Matter

Students learn how to identify the states of matter and their properties. The student will also learn how different matters can be changed to a different state. Students will learn that some reactions of change can happen so quick it will skip a state of matter phase.

- States of Matter scavenger hunt (30min)
 - K.PS1.A
- Cheerios Atoms (30 min)
 - 6.PS1.A.1, 5.PS1.A.1
- Oobleck (30-45min)
 - 9-12.PS1.A.3, 9-12.PS1.A.4, K.PS1.A.1, 2.PS1.A.1, 5.PS1.A.1, 3.GM.B
- Magic Balloon (15min)
 - K.PS1.A.1, 2.PS1.A.1, 3.GM.B
- Root Beer floats (15min)
 - K.PS1.A.1, 2.PS1.A.1, 3.GM.B

Grades K & up- math, science, language arts

Science: K.PS1.A, 2.PS1.A.1, 5.PS1.A.1, 6.PS1.A.1, 9-12.PS1.A, **Math:** 3.GM.B

Creating Your Own Amusement Park

Students will take on the roles of architects, engineers, sales engineers, and artists as they create their own amusement parks using different materials. Students will be able to brainstorm, draw, research, and build their amusement park as a collaborative project.

Grades K & up:

ELA- K-5.1.A, K-5.1.C, K-5.3.A, K-5.3-4.A

Fine Arts- VA:Cr2A-C.K-5, MA:Pr5A.3, TH:Cr1A.K-5

Science- K-5.ETS.1.A.1,

Math- 3-5.GM.C

GRADES 3RD – 5TH

DISSECTION (OWL PELLETS)

Introductory dissection activity that helps students understand predator-prey relationships and the food cycle. Identify an owl pellet's content, record, and analyze data. (45 min) *4 weeks advanced booking required.

Grades 4 & up – MLS Science Standards: 6-8.LS1.3

FORENSICS

Work as forensic investigators and use techniques of forensic science to analyze evidence left behind at a crime scene. Use deductive reasoning to evaluate fingerprints, chromatography, fibers, smells, liquids, and powders to determine the criminal's identity. (60 min)

Grades 4 & up – MLS 5.PS1.B.1, 4.ETS1.C.1

MARBLE ZIPLINE

Fight gravity in this STEM workshop designed to challenge your best engineers. Can you work as a group to build a safe yet fast zip line for a marble passenger? Use your math and engineering skills to safely deliver your marble to the landing zone. (60 min)

Grades 3 & up – 2.PS2.A.1, 4.PS2.A.2

YOUR MUSCLES

Learn about your muscles and how they function and how they interact with the skeletal system. Students will learn about how muscles contract to perform the movement as they build their own muscle-powered Elbow. Students will test the strength of their built elbow by lifting various objects. (45 min)

Grades 3 & up- MLS 4.LS1.A.1, 4.PS2.A.1

GETTING TO KNOW SPHERO

Sphero is a programmable educational-based robot that is easy to interact with and works well with all grades. Students will get to learn just what a robot is and gain an introduction to Sphero. Students will construct an obstacle course and play several games to test just how far they can take Sphero.

Grades 3 & up- MLS 3.CS.HS.01, 4.CS.HS.01, 5.CS.HS.01, 3.CS.T.01, 4.CS.T.01, 5.CS.T.01, 3.AP.A.01, 4.AP.A.01, 5.AP.A.01

AUTOMATING FISHERIES

While working in groups students will learn about how fisheries help supply food and keep it sustainable. Students will build a mock fishery and build robots to run the fisheries. What goes in running a fishery and are there ways we can improve on the system and can we apply it to other fields?

Grades 3 & up MLS- 4.PS2.A.2, 4.ESS3.A.1, 5. ESS3.C.1, 3-5.ETS1.C.1

SCAT AND TRACKS PT.1 (SCAT)

When you go for a hike it's there. When you go walking around town it's there. Even in your backyard it's there. What is it? Scat is the answer, but what is scat and what can we learn from it? Scat has many telling signs that can let you know what can be found around you. Students will dive into learning about what Scat can tell us about the animals in their area.

Grades 3 & up- MLS 4.LS1.D.1, 5. LS2.B.1, 3.LS3.A.1, 3.LS3.C.1

SCAT AND TRACKS PT.2 (TRACKS)

When you go for a hike it's there. When you go walking around town it's there. Even in your backyard it's there. What is it? Tracks is the answer. Tracks can be found everywhere, they are evidence that something was there and some can even be a message left for others to interpret from. Students will learn about tracks and their meanings and play a game of who broke into the trash can using what they have learned from part 1 & 2 of SCATS AND TRACKS.

Grades 3 & up- MLS 4.LS1.D.1, 3.LS3.A.1, 3.LS3.C.1

SQUISHY CIRCUITS: ELECTRICITY

Playing and learning with conductive and insulating modeling dough to teach the basics of electrical circuits in a fun, hands-on way! Through trial and error, critical thinking, and problem-solving youth will be engaged in engineering thought and process.

MSL: 4.PS3.B.2

YOUR DIGESTIVE SYSTEM (A BALL'S TALE)

Just what all happens to the food we eat or the liquid we drink? Where does it all go? That is what a little ball is about to find out. Students will build their own Marble maze using cardboard and other materials. Students will learn about the roles of each organ in the digestive system as they put the maze together. Where does it start and where does it end?

Grades 3 & up- MLS 4.PS3.B.1, 4.PS3.B.2, 4.LS1.A.1, 5.LS1.A.1

YOUR LUNGS

Students will learn how their lungs function. What happens when air moves in and out. Students will learn what it is like to have trouble breathing because of asthma, tissue damage, or other reasons. Students will build their own lungs and put them to the test. (45 Min)

Grades 3 & up- MLS 4. LS1.A.1, 5. LS1.A.1

DNA EXTRACTION (FROM STRAWBERRIES)

Learn about DNA as you smash and mash strawberries. Students will get a chance to learn about DNA as they extract it from strawberries. After the experiment, students will get a chance to try it on other items as well. What succeeded and what did not?

Grades 3 & up MLS 5. PS1.A.1, 5. PS1.B.1

WATER BOTTLE ROCKETS

What make rockets fly straight? What makes rockets fly far? Students are challenged to design and build rockets from two-liter plastic soda bottles that travel as far and straight as possible or stay aloft as long as possible. With use of the engineering design process students

Grades 4th & up MLS: 4.PS2.B.2, 6-8.ETS1.B.1, 6-8.ETS1.B.2

RIGAMAJIG

Just what is a Rigamajig? What can you do with a Rigamajig? Exploring Rigamajig activity will help answer those questions. Rigamajig is a hands-on kit that helps students explore, build, and engineer using the power of play. Students will learn about the various parts of a Rigamajig and find out what they can build with it. (45-60 min)

Grades K & up- MLS K.RA.A, 1.RA.A, K.GM.A, 1.GM.A, 2.GM.A, 1.GM.B, 2.GM.B, 3.ETS1.A.1

Rigamajig Topic Areas:

A Tidal Wave: A urgent human problem: how to build a structure that will protect people from the ravages of a tidal wave or flood! Children will use imagination and collaborative skills to develop a solution and build a structure into which they all can be saved!

MLS: 3.ETS1.A.1, 3.ETS1.B.1, 3.ETS1.C.1, 3.ESS3.B.1, 4.ESS3.A.1, 4.ETS1.C.1, 5.ETS1.A.1

Driving Teddy Across Over Up Down: Collaborating with a peer group, design and build a contraption that will work to meet several functional needs.

MLS: 3.ETS1.A.1, 4.ETS1.A.1, 4.ETS1B.1, 4.ETS1.C.1, 5.ETS1.A.1

Future Building!: Stretch creative thinking about what people might need or want to have in the future – then design and build a working model of that invention using Rigamajig.

MLS: 3.ETS1.A.1, 4.ETS1.A.1, 4.ETS1B.1, 4.ETS1.C.1, 5.ETS1.A.1

Inclined Plans and Ramps: Challenge to do after investigation and definition of an inclined plane or ramp. Youth are introduced to vocabulary words while completing the experiential learning of the group goal.

MLS: 3.ETS1.A.1, 4.ETS1.A.1, 4.ETS1B.1, 4.ETS1.C.1, 5.ETS1.A.1

Pulleys: Challenge to do after investigation and definition of an inclined plane or ramp. Youth are introduced to vocabulary words while completing the experiential learning of the group goal.

MLS: 3.ETS1.A.1, 4.ETS1.A.1, 4.ETS1B.1, 4.ETS1.C.1, 5.ETS1.A.1

Turtle shells, Bat Wings, and Other Protective Things! stimulate creative thinking, problem-solving, and collaboration within the group. Children will agree upon an idea for an animal to model, including its mode of protection. They will collaborate to construct and evaluate the animal model.

MLS: 3.LS3.A.1, 3.LS3.B.1, 3.ESS3.B.1,

States of Matter

Students learn how to identify the states of matter and their properties. The student will also learn how different matters can be changed to a different state. Students will learn that some reactions of change can happen so quick it will skip a state of matter phase.

- States of Matter scavenger hunt (30min)
 - K.PS1.A
- Cheerios Atoms (30 min)
 - 6.PS1.A.1, 5.PS1.A.1
- Oobleck (30-45min)
 - 9-12.PS1.A.3, 9-12.PS1.A.4, K.PS1.A.1, 2.PS1.A.1, 5.PS1.A.1, 3.GM.B
- Magic Balloon (15min)
 - K.PS1.A.1, 2.PS1.A.1, 3.GM.B
- Sublimation Dry Ice (30-45min)
 - 9-12.PS1.A.3, 3.PS1.A.1, 3.PS1.B.1
- Root Beer floats (15min)
 - K.PS1.A.1, 2.PS1.A.1, 3.GM.B

Grades K & up- math, science, language arts

Science: K.PS1.A, 2.PS1.A.1, 3.PS1.A.1, 3.PS1.B.1, 5.PS1.A.1, 6.PS1.A.1, 9-12.PS1.A, 9-12.PS1.A.4 , **Math:** 3.GM.B

Creating Your Own Amusement Park

Students will take on the roles of architects, engineers, sales engineers, and artists as they create their own amusement parks using different materials. Students will be able to brainstorm, draw, research, and build their amusement park as a collaborative project. (45 minute sessions)

Grades K & up:

ELA- K-5.1.A, K-5.1.C, K-5.3.A, K-5.3-4.A; **Fine Arts-** VA:Cr2A-C.K-5, MA:Pr5A.3, TH:Cr1A.K-5

Science- K-5.ETS.1.A.1; **Math-** 3-5.GM.C

GRADES 6TH – 8TH

MICROSCOPES AND CELLS

We have learned never to trust an atom as they are known to make up everything. For this activity students will learn that they are made up of cells. Students will learn an introduction into microscopes and create their own slide using staining techniques and their own cheek cells. What will they see? What are their cells made up of?

Grades 6 & up- MLS 6-8.PS1.A.1, 6-8.LS1.A.1

MICROSCOPIC LIFE, WHAT'S IN YOUR WATER

Macro vs Micro, we can see what is moving around us with our own eyes, but what about what we can't see with the naked eye? Life comes in all shapes and sizes and can be found anywhere. Students will gather samples of water around their area as well as samples from local water sources and see if they can see life under the microscope.

Grades 6 & up- MLS 6-8.LS1.B.2, 6-8.LS2.A.1

DISSECTION (OWL PELLETS)

Introductory dissection activity that helps students understand predator-prey relationships and the food cycle. Identify an owl pellet's content, record, and analyze data. (45 min) *4 weeks advanced booking required.

MLS Science Standards: 6-8.LS1.3

AUTOMATING FISHERIES

While working in groups students will learn about how fisheries help supply food and keep it sustainable. Students will build a mock fishery and program robots to run the fisheries. What goes on in running a fishery and are there ways we can improve the system, and can we apply it to other fields?

Grades 6 & up- MLS 6-8.ESS3.C.1, 6-8.ESS3.C.2, 6-8.ETS1.A.1, 6-8.ETS1.B.1-3

WATER BOTTLE ROCKETS:

What make rockets fly straight? What makes rockets fly far? Students are challenged to design and build rockets from two-liter plastic soda bottles that travel as far and straight as possible or stay aloft as long as possible. With use of the engineering design process students

Grades 4th & up MLS: 4.PS2.B.2, 6-8.ETS1.B.1, 6-8.ETS1.B.2

pH BALANCING AND WATER QUALITY

Water is one of the most important resources the world has. We are 60% water ourselves. Even though water seems so abundant since the world is covered in 70% water, only a fraction of a percent is even drinkable for humans. With that knowledge, humans over the years have found ways to protect our water supplies and create more drinkable water. Students will learn about balancing water pH and how we can make seawater drinkable.

Grades 6 & up- MLS 6-8.PS1.A.2, 6-8.PS1.A.4, 6-8.ESS2.C.1

YOUR DIGESTIVE SYSTEM (A BALL'S TALE)

Just what all happens to the food we eat or the liquid we drink? Where does it all go? That is what a little ball is about to find out. Students will build their own Marble maze using cardboard and other materials. Students

will learn about the roles of each organ in the digestive system as they put the maze together. Where does it start and where does it end?

Grades 6 & up- MLS 6-8.LS1.A.4

YOUR LUNGS

Students will learn how their lungs function. What happens when air moves in and out. Students will learn what it is like to have trouble breathing because of asthma, tissue damage, or other reasons. Students will build their own lungs and put them to the test. (45 Min)

Grades 6 & up- MLS 6-8.PS2.A.2, 6-8.LS1.A.4, 6-8.ETS1.B.3

DNA EXTRACTION (FROM STRAWBERRIES)

Learn about DNA as you smash and mash strawberries. Students will get a chance to learn about DNA as they extract it from strawberries. After the experiment students will get a chance to try it on other items as well. What succeeded and what did not?

Grades 6 & up- MLS 6-8.LS4.B.2, 6-8.PS1.A.2

YOUR MUSCLES

Learn about your muscles and how they function and how they interact with the skeletal system. Students will learn about how muscles contract to perform the movement as they build their own muscle-powered Elbow. Students will test the strength of their built elbow by lifting various objects. (45 min)

Grades 6 & up- MLS 6-8.LS1.A.4

States of Matter

Students learn how to identify the states of matter and their properties. The student will also learn how different matters can be changed to a different state. Students will learn that some reactions of change can happen so quick it will skip a state of matter phase.

- States of Matter scavenger hunt (30min)
 - K.PS1.A
- Cheerios Atoms (30 min)
 - 6.PS1.A.1, 5.PS1.A.1
- Oobleck (30-45min)
 - 9-12.PS1.A.3, 9-12.PS1.A.4, K.PS1.A.1, 2.PS1.A.1, 5.PS1.A.1, 3.GM.B
- Magic Balloon (15min)
 - K.PS1.A.1, 2.PS1.A.1, 3.GM.B
- Sublimation Dry Ice (30-45min)
 - 9-12.PS1.A.3, 3.PS1.A.1, 3.PS1.B.1
- Root Beer floats (15min)
 - K.PS1.A.1, 2.PS1.A.1, 3.GM.B

Grades K & up- math, science, language arts

Science: K.PS1.A, 2.PS1.A.1, 3.PS1.A.1, 3.PS1.B.1, 5.PS1.A.1, 6.PS1.A.1, 9-12.PS1.A, 9-12.PS1.A.4, **Math:** 3.GM.B

Creating Your Own Amusement Park

Students will take on the roles of architects, engineers, sales engineers, and artists as they create their own amusement parks using different materials. Students will be able to brainstorm, draw, research, and build their amusement park as a collaborative project.

Grades K & up:

ELA- K-5.1.A, K-5.1.C, K-5.3.A, K-5.3-4.A; **Fine Arts-** VA:Cr2A-C.K-5, MA:Pr5A.3, TH:Cr1A.K-5; **Science-** K-5.ETS.1.A.1; **Math-** 3-5.GM.C

HIGH SCHOOL

NERVOUS SYSTEM (WITH CLAY)

Learn about a major part of the nervous system, your brain. Students will learn about the function of each part of the brain, while determining what would happen to the brain if that area was damaged or diseased. Students will group up and create a brain with a potential anomaly and see if others can figure it out.

Grades 9 & up- MLS 9-12.LS1.A.3, 9-12.LS3.B.2

DNA (GEL ELECTROPHORESIS)

Have you ever wondered how DNA comparison is done, and what traits you have that match your parents? Students will learn about DNA sequencing while conducting their own experiments using gel electrophoresis. Can they find which DNA sequence matches another? Who or what is more related?

Grades 9 & up- MLS 9-12.LS1.A.1, 9-12.LS3.B.3, 9-12.LS3.B.4, 9-12.LS4.A.1

MICROSCOPES AND CELLS

We have learned never to trust an atom as they are known to make up everything. For this activity, students will learn that they are made up of cells. Students will learn an introduction to microscopes and create their own slides using staining techniques and their own cheek cells. What will they see? What are their cells made up of?

Grades 9 & up- MLS 9-12.LS1.A.2, 9-12.LS1.B.1

MICROSCOPIC LIFE, WHAT'S IN YOUR WATER

Macro vs Micro, we can see what is moving around us with our own eyes, but what about what we can't see with the naked eye? Life comes in all shapes and sizes and can be found anywhere. Students will gather samples of water around their area as well as samples from local water sources and see if they can see life under a microscope. Students will take samples of surface areas and prepare microscope slides.

Grades 9 & up- MLS 9-12.LS1.A.3, 9-12.LS2.C.1

pH BALANCING AND WATER QUALITY

Water is one of the most important resources the world has. We are 60% water ourselves. Even though water seems so abundant since the world is covered in 70% water, only a fraction of a percent is even drinkable for humans. With that knowledge, humans over the years have found ways to protect our water supplies and

create more drinkable water. Students will learn about balancing water pH and how we can make seawater drinkable.

Grades 9 & up- MLS 9-12.PS1.A.3, 9-12.PS1.B.1, 9-12.ESS2.A.4, 9-12.ESS3.A.1, 9-12.ESS3.C.1

YOUR LUNGS

Students will learn how their lungs function. What happens when air moves in and out. Students will learn what it is like to have trouble breathing because of asthma, tissue damage, or other reasons. Students will build their own lungs and put them to the test. (45 Min)

Grades 9 & up-MLS 9-12.LS1.A.3

States of Matter

Students learn how to identify the states of matter and their properties. The student will also learn how different matters can be changed to a different state. Students will learn that some reactions of change can happen so quick it will skip a state of matter phase.

- Sublimation Dry Ice (30-45min)
 - 9-12.PS1.A.3, 3.PS1.A.1, 3.PS1.B.1
- Root Beer floats (15min)
 - K.PS1.A.1, 2.PS1.A.1, 3.GM.B

Grades K & up- math, science, language arts

Science: K.PS1.A, 2.PS1.A.1, 3.PS1.A.1, 3.PS1.B.1, 5.PS1.A.1, 6.PS1.A.1, 9-12.PS1.A, 9-12.PS1.A.4 **Math:** 3.GM.B,

FAMILY ENGAGEMENT

STEM MOBILE LAB YOUTH SHOWCASE

Include family members in the STEM Mobile Lab as they directly engage alongside students in a culmination STEM Mobile Lab Youth Showcase family event. By design, the showcase provides youth participants the opportunity to demonstrate and engage in the instruction process with families. Dive deeper into the learning experience by highlighting two of the STEM Mobile Lab playlists, per grade level, youth have mastered during the program week. Support youth and families in conversations about individual youth interests and considered career exploration!

For questions please contact:

Beth Rasa Edwards, MASN Enrichment Connections Coordinator at Rasab@missouri.edu.

and/or

Richard Irwin, MASN STEM Educator at riwin@missouri.edu