STEAMPlay 3K and Pre-K Activity Guide: Building Pre-Engineering Skills

New York Hall of Science 2024 – 2025

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Introduction to the Activity Guide

INTRODUCTION

The New York Hall of Science (NYSCI) is New York City's interactive science center — a place where everyone can experiment, explore, and expand their curiosity; where teachers can find inspiration and new perspectives on STEM learning; and where students can discover STEM careers they might never have imagined for themselves. Located in Queens, the country's most diverse county, NYSCI is recognized as a pioneering research institution developing equitable approaches to STEM learning, designing award winning exhibits, and innovative educational programs, as well as leading groundbreaking youth development and mentorship programs that empower participants to engage with scientific concepts through playful exploration as they encounter the awe-inspiring complexity underlying everyday experiences.

In September 2021, the New York Hall of Science began its collaboration with the New York City Department of Education's Department of Early Childhood Education and school leaders from the Mosaic Pre-K Centers in District 24, Queens to develop the *STEAM Stories Pre-K Activity Guide,* consisting of literacy-based engineering design challenges to foster and excite early learners in STEAM learning. Included in the second edition of the *STEAM Stories* guide is a set of introductory engineering skill building activities to help children increase their fine-motor skills in order to be more successful and independent throughout the subsequent lessons and engineering design challenges in the guide. The scalability and success of the pre-engineering activities, particularly with three year old children, led to the development of this separate new guide called *STEAMPlay 3K and Pre-K Activity Guide: Building Pre-Engineering Skills*. *STEAMPlay* serves as a centralized resource of the pre-engineering activities that can be implemented with three or four year old students to increase their fine motor skills and excite early learners in engineering through engaging hands on activities.

ABOUT THE GUIDE

This guide was developed with NYSCI's approach to learning called Design, Make, Play where open-ended exploration, imaginative learning, deep engagement and delight are the ingredients that inspire passionate learners, critical thinkers, and active citizens.

Building pre-engineering skills allows students to practice their fine motor skills. The development of fine motor skills in young children is a critical precursor to the development of science, technology, engineering, art, and math (STEAM) skills. It is an important foundation for a young child's overall development and readiness for older grades. Mastery of fine-motor skills is the crucial foundation for academic skills, practical life skills, cognitive development, social-emotional growth, overall health, and safety. Children that can master fine motor skills are more independent, confident, and prepared for future learning. In addition, building these skills can pave the way for future STEM careers skills.

The activity guide consists of 10 pre-engineering activities to help build fine-motor skills. These are activities that can be easily integrated into a Pre-K classroom center, where students can regularly seek out and practice these skills. For example, they can be easily integrated into classroom centers. We recommend introducing these activities at the beginning of the school year so that children have an opportunity to build and practice their fine motor skills throughout the school year.

For each activity below, you will see the following format. The format for the activity section below will include:

- Name of the activity.
- Photos — images of the materials and activity in action.
- Objective — the fine motor skill goals.
- Materials — list of what items are needed.
- Instructions — how to implement the activity.
- Facilitation Questions — questions that can help engage the students and check for understanding, in both English and Spanish.
- STEM Career Skills — connections to the STEM field.
- Standards Connections — potential alignment areas for Pre-K Learning Standards.

The *STEAMPlay Guide* addresses the following standards across all activities:

PRE-KINDERGARTEN LEARNING STANDARDS

PK.AL.1 Actively engages in play as a means of exploration and learning.
PK.AL.3. Approaches tasks and problems with creativity, imagination and/or willingness to try new experiences.
PK.AL.4. Exhibits curiosity, interest, and willingness to learn new things and have new experiences.
PK.AL.5. Demonstrates persistence.
PK.PDH.5. Demonstrates eye-hand coordination and fine motor skills.
PK.CKW.2 Responds and reacts to visual arts created by themselves and others.

TEACHING STRATEGIES OBJECTIVES FOR DEVELOPMENT & LEARNING

Social Emotional

1. Regulates own emotions and behaviors

2. Establishes and sustains positive relationships

3. Participates cooperatively and constructively in group situations

Physical

6. Demonstrates gross-motor manipulative skills

7. Demonstrates fine-motor strength and coordination

Language

8. Listens to and understands increasingly complex language

9. Uses language to express thoughts and needs

Cognitive

11. Demonstrates positive approaches to learning

12. Remembers and connects experiences

13. Uses classification skills

Literacy

17. Demonstrates knowledge of print and its uses

18. Comprehends and responds to books and other texts

Mathematics

21. Explores and describes spatial relationships and shapes

22. Compares and measures

Science & Technology

24. Uses scientific inquiry skills

26. Demonstrates knowledge of the physical properties of objects and materials

28. Uses tools and other technology to perform tasks

Social Studies

29. Demonstrates knowledge about self

30. Shows basic understanding of people and how they live

31. Explores change related to familiar people or places

The Arts

33. Explores the visual arts

36. Explores drama through actions and language

English Language Acquisition

37. Demonstrates progress in listening to and understanding English

38. Demonstrates progress in speaking English


Sound Capsules
Touch & Feel Capsules

Pre-Engineering Activities

Fuzzy Fishing

Objective

Children will develop fine motor skills associated with twisting and untwisting pipe cleaners. Additionally, they will develop fine motor skills and hand-eye coordination by holding skewers or tweezers and using them to collect the twisted pipe cleaner "fish".

Materials

- Pipe cleaners cut into 2 to 4 inch lengths
- Bowl
- Chopsticks
- Plastic tweezers (with googly eyes)

Instructions

Twisting pipe cleaners into the shape of fish makes for a fun activity to practice twisting motions. Invite children to take short segments of pipe cleaners, fold them in half, and twist the edges to make a simple fish shape, and place them into a bowl. If a sufficient number of them have been made, then they can use a small skewer to go fishing!

The skewer can be speared through the fish's loop, and lifted up to catch the fish. Alternatively, children may use a plastic tweezer to lift up the fish out of the bowl. After every fish is caught, the fish can be put back in the bowl or pond, and the process can be repeated.

At the end of the project, encourage the children to untwist the fish to return them to pipe cleaners. This will give them multiple opportunities to practice twisting and untwisting.

If you want to extend this activity, instead of fish, the children can make links in a chain. Children can work together to make a class chain with contributions from everyone.

Facilitating Questions

- *What happens if you twist 2 colors of pipe cleaner together?*
- *Is it easier to grab many fish, or one at a time?*
- *What animals do the tweezers remind you of?*

¿Qué sucede si unes 2 colores de limpiapipas?
¿Es más fácil agarrar muchos peces, o uno a la vez?
¿A qué animales te recuerdan las pinzas?

STEM Career Skills

- *Twisting:* As sound engineers use their fingers to twist wires together, children use their fingers to twist pipe cleaners together.
- *Tweezers:* As roboticists use tweezers to handle delicate robotics, children use tweezers to collect “fish”.
- *Skewering:* As botanists use skewers to carefully scrape pollen from plants, children use skewers to carefully collect “fish".

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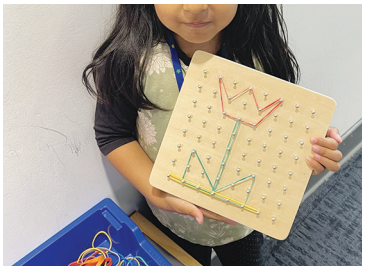
Stretchy Shapes



Objective

Children will develop gross and fine motor skills associated with rubber banding as they stretch out, twist, and place rubber bands on a grid to create shapes and designs. They will replicate shapes on a geoboard, based on teacher examples or card driven challenges, or children can create their own patterns and shapes on their board as they see fit.

Materials

- Challenge cards (apps.mathlearningcenter.org/geoboard)
- Geoboards
- Variety of rubber bands

Instructions

Stretch the rubber bands across the pegs on a geoboard in order to get them to hook around the pegs. By following the grid, various shapes can be easily made. Squares, triangles, and circles of various sizes can be an appropriate challenge for them to replicate. Successful replication will involve them

practicing math skills as they count spaces, visually measure sizes, and think about basic coordinates.

Layering rubber bands, and exploring the various shapes that can be made on the geoboard will get them to use finger and hand strength as they stretch and manipulate the rubber bands. You can extend this activity by challenging them with more complex, multiple rubber band shapes to replicate.

Facilitating Questions

- *Can you make a simple shape?*
- *Can you make a pattern with lines and/or colors?*
- *What size rubber bands should we use to make a large shape? A small shape?*
- *How many rubber bands will you need to make this design?*

¿Puedes hacer una figura que se vea más simple?
¿Puedes hacer un patrón con líneas y/o colores?
¿Qué tamaño de gomas debemos usar para hacer una figura grande? ¿Una figura pequeña?
¿Cuántas gomas necesitará para hacer este diseño?

STEM Career Skills

- *Rubber band stretching:* As textile engineers use elastic bands to create shapes in fabric-based objects, children use rubber bands to create shapes on the geoboard.
- *Rubber band twisting:* As orthodontists use their fingers to twist rubber bands around some braces, children use their wrist to twist rubber bands.
- *Shape replication:* As geometers study the elements of two dimensional shapes, students study the elements necessary to replicate a shape represented on a card on a geoboard.

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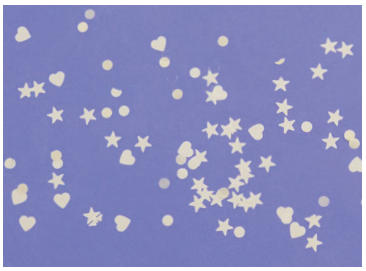
Confetti Crafts



Objective

Children will develop gross and fine motor skills associated with using a hole punch, and practice pincer grip to collect the punch outs. Using a hole punch, children will make confetti to create a unique art project.

Materials

- Self-adhesive lamination paper, cut down to fit
- Colored printer paper (construction paper will not stick)
- Hole punches of various types
- Hole punch assists/aids
- White printer paper, cut into strips.

Instructions

Give children strips of paper and various styles of hole punches, and allow them to explore putting fun shaped holes in the paper. They should collect the punchouts so that they can sprinkle them onto a clear sheet of self adhesive lamination paper in order to use what they made for something fun! Select a background sheet of colored paper, and stick the lamination paper and confetti to the background to finish the project.

Some children will ignore collecting the punch outs, and be more interested in just punching the holes. This is totally fine because we want them to practice the tool use, rather than emphasizing the resulting output. They should become comfortable with the different motions needed to activate different styles of hole punches.

You can extend this learning by having them focus on where the resulting hole is, with something like making a border around a page. This will require practicing control of both the punch, and paper while using it.

If punches require too much strength, consider a thinner paper, such as tissue paper. We also recommend mini hole punch assist devices.

Facilitating Questions

- *What happens to your cut out if your punch is overlapping the edge?*
- *What's the difference between the punchout, and the resulting hole? How do their shapes match up?*
- *Can you tape the punchout back into the hole?*

¿Qué le sucede a su recorte si su punzón se superpone al borde?
¿Cuál es la diferencia entre el punchout y el agujero resultante? ¿Cómo coinciden sus formas?
¿Puedes pegar con cinta adhesiva el punch out en el agujero?

STEM Career Skills

- *Hole punching:* As electrical engineers use hole punches for traces on circuit boards, children use hole punches to create holes in paper.
- *Sample collection:* As entomologists collect many samples of small insects for observation, children collect many small punch outs.
- *Sample preservation:* As microbiologists preserve a specimen under a cover slip on a microscope slide, children preserve their confetti under lamination paper.

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Dazzling Drops

Objective

Children will develop fine motor skills associated with pipette handling. Additionally, they will practice color mixing, and they will observe properties of water in this activity by using a pipette to transfer liquids.

Materials

- Short, clear plastic cups
- Pipettes/ droppers
- Liquid watercolor

- Wax paper
- Trays
- Paper towels

Instructions

Prepare a variety of water color paint inside of small clear plastic cups. We recommend about a 1:6 ratio of paint to water. Cut 6"x 6"squares of wax paper and provide one for each child. Inside a tray to prevent water from escaping, place the child's sheet of wax paper waxy side up. By each station, provide a pipette to each child as well as the small cups of various colored water. Model how to use the pipette, then demonstrate how water beads up on the wax paper. The wax paper is made from substances with oil on them. Water and oil are not attracted to each other. In fact, water molecules are more attracted to each other than the wax, which is why water beads up or the water drops roll right off of the wax paper. Invite children to experiment with the water colors to create their own designs.

When a paper is full, paper towels or another absorbent material can be used to soak up the water to make room for more drops. Water will get under the sheet of wax paper, and cause it to wrinkle. Swap out the wax paper occasionally.

Facilitating Questions

- *Which color(s) are you going to explore?*
- *What happens when you put a drop of colored water onto the wax paper?*
- *How many water beads of color were you able to make?*
- *What happens when you add more than one drop?*
- *How big can you make a water drop?*
- *How can you mix colors?*
- *What shape or design can you make with the water drops?*

¿Qué color(es) vas a explorar?
¿Qué sucede cuando pones una gota de agua coloreada en el papel encerado?
¿Cuántas gotas de agua de colores pudiste hacer?
¿Qué sucede cuando agrega más de una gota?
¿Qué tan grande puedes hacer una gota de agua?
¿Cómo puedes mezclar colores?
¿Qué forma o diseño puedes hacer con las gotas de agua?

STEM Career Skills

- *Pipette handling:* As virologists use pipettes to handle liquid chemical samples, children use pipettes to handle colored water.

- *Material observation:* As nuclear physicists observe the behavior of subatomic particles interacting with one another, children observe the behavior of water droplets interacting with the wax paper.
- *Controlled liquid mixing:* As pharmacists mix different chemicals together to produce a single product, children mix different colored water droplets together to produce a new color.

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Clay Carrots

Objective

Children will develop fine motor skills associated with scissor use by repeatedly cutting playdough. The dough will be soft and pliable to let them do the motion, while also being repairable to allow repetition.

Materials

- Variety of plastic safety scissors (With flip down spring assists)
- Orange playdough
- Optional: clay extruder

Instructions

Invite children to help you cook an imaginary meal, and ask for their help in preparing as many carrot slices as possible. Present them with orange playdough that has been rolled into a carrot, or extruded to make a long tube. Demonstrate with your scissors how to cut our clay carrot into thin slices, then invite them to do the same.

Occasionally gather the sliced carrots, and squish them together to reform more carrots. You can also invite the children to help with the carrot making process. They can roll it out, or operate the extruder. You can extend this learning by giving children access to patterned edge scissors. Patterned scissors can be tougher to operate, but can be rewarding with their novelty.

Facilitating Questions

- *What can we use these carrot slices for?*
- *What other clay foods could we cut? What color would we need?*
- *Which way are the scissors easier to hold?*
- *Where should we hold what we are cutting so it's easy to cut?*

¿Para qué podemos usar estas rodajas de zanahoria?
¿Qué otros alimentos de arcilla podríamos cortar? ¿Qué color necesitaríamos?
¿De qué manera son más fáciles de sostener las tijeras?
¿Dónde debemos sujetar lo que estamos cortando para que sea fácil de cortar?

STEM Career Skills

- *Scissor use:* As orthopedists use scissors to cut material to create, and remove, a cast, children use scissors to cut clay carrot medallions.
- *Rolling:* As materials scientists roll putties to mix polymers, children roll Play-Doh to make model carrots.
- *Lever Use:* As machinists use a lever to operate a drill press, children use a lever to operate the clay extruder.

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Tape Snakes

Objective

Children will develop fine motor skills associated with ripping and using tape. They will create pictures by using colorful masking tape as their medium. They can make a colorful snake by taping out a line and giving it a googly eye and a tongue. They can alternatively draw a letter if they are inspired, or draw a picture. Have various examples to show them possibilities, especially of what a tape or regular snake should look like.

Materials

- Examples of tape and regular snakes
- Masking tape (optional: different colors)
- Masking tape dispensers
- Washi tape
- Googly eyes
- Markers
- Scissors

Instructions

Before starting this project, teach the class a quick dance to get them primed for the actions they will need to use a tape dispenser. Have the class dance along with you.

"Let's pretend we are going to pull on a piece of giant tape. Grab on to the end!"

Raise both hands above your head, and do a grabbing motion.

"Supongamos que vamos a tirar de un trozo de cinta gigante. ¡Agárrense hasta el final!"

Levanta ambas manos por encima de tu cabeza y haz un movimiento de agarre.

"Pull down! Oh no, it's too strong!"

Slowly bring your hands straight down.

Give a straining motion to emphasize the difficulty.

"¡Jalar hacia abajo! ¡Oh no, es demasiado fuerte!"
Lentamente lleva tus manos hacia abajo. Dé un movimiento de enderezamiento para enfatizar la dificultad.

"Okay, let's try again. Grab a new piece!"
Raise both hands above your head, and do a grabbing motion.

"Está bien, intentémoslo de nuevo. ¡Agarra una nueva pieza!"
Levanta ambas manos por encima de tu cabeza y haz un movimiento de agarre.

"This time, let's do it to the side!
Down and to the side! Much easier"
Lower your hands down halfway, then swing them to the side.

"¡Esta vez, hagámoslo hacia un lado!
¡Abajo y al costado! Más fácil"
Baje las manos hasta la mitad y luego gírelas hacia un lado.

Repeat the motion in order to emphasize and allow them to kinesthetically absorb the difference between the two motions. This will help them internalize the advice and instructions when operating the real tape dispensers.

Part of the challenge is also pulling the tape off of the dispensers. Some children might need help holding the dispenser while they pull, depending on the strength of the tape. There is also the challenge of keeping the tape from sticking to itself. If this is a problem, encourage children to use shorter pieces of tape, and to keep trying. Have a place handy to stick down waste pieces of tape if the child is struggling to remove tape from themselves.

Once they have finished creating their design, they can stick googly eyes to their project, or use a marker to add details. You can extend this lesson by having children use their tape to practice repairing rips or cuts in paper, or by introducing more advanced dispensers, like hand held dispensers with colorful Scotch tape. For more of a challenge, have children

try to rip masking tape without a dispenser at all, or cut masking tape using a scissor once they have practiced this tool as well.

Facilitating Questions

¿Puedes darle a tu serpiente un patrón de color?
¿Cuál es el trozo de cinta más corto que puedes hacer?

- *Can you give your snake a pattern of color?*
- *What's the shortest piece of tape you can make?*

STEM Career Skills

- *Tape ripping:* As building engineers rip pieces of masking tape to hold blueprints to a drawing board, children rip pieces of masking tape to create snake images.
- *Tape laying:* As aerospace engineers use carefully placed speed tape to repair planes, children use carefully placed masking tape to create snake images.
- *Marker usage:* As computer programmers use markers to make diagrams on whiteboards, children use markers to add tongues to their snake.

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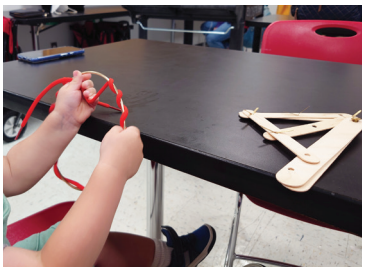
Curly Coils

Objective

Children will develop gross and fine motor skills involved with wrapping as they use a shoelace to cover a metal hoop. This task is meant to help children understand the process of "over and under" involved with wrapping, which are further developed as they learn more advanced skills, like tying. This process is a rewarding activity that can also keep hands busy as they practice, and at the end, the process of pulling the string to remove it can be very satisfying.

Materials

- Metal hoop
- Round shoelaces



Instructions

Have the child hold the hoop and string in one hand, and then use their free hand to wrap the shoelace around the hoop. Encourage children to pick a direction to wrap in, and be consistent. Beginning this activity can be initially tricky, as it requires one hand to hold the shoelace to the hoop, and the other hand to perform the over-under motions. If the shoelace is not held down, it will spin around the hoop, making wrapping fruitless. They may need assistance with holding the string down, so they can focus on wrapping.

The use of a metal hoop is important, as the child is required to let go of the string, and pick it back up on the other side repeatedly in order to wrap successfully. This guides them towards persistence, and more intentional interaction, where they have to pay attention to direction, repetition, and prepares them for weaving and tying.

To help motivate children with a social-emotional connection, try giving them a scenario where they have to pretend to be wrapping wires in scientific equipment. An interesting science field connection is that many tools in science use wraps of wire around a metal core in order to create a magnetic field.

Facilitating Questions

- *How can you hold the hoop so it's easiest to wrap?*
- *What else could we wrap around this hoop?*
- *Is it possible to wrap the shoelace without letting it go?*

¿Cómo se puede sujetar el aro para que sea más fácil de envolver?
¿Qué más podríamos envolver alrededor de este aro?
¿Es posible enrollar el cordón sin soltarlo?

STEM Career Skills

- *Wrapping:* As physicists create electromagnetic coils, children will wrap the shoelace around a metal core.
- *Over/Under:* As computer scientists wire core-memory for software, children will be discerning about over and under to successfully wrap the shoelace.

- *Iteration:* As biomedical researchers use consistent patterns to repeated trials on samples, children will use repetitive steps with consistency to successfully wrap the shoelace.

PK.MATH.9. [NY-PK.OA.2.] Duplicates and extends simple patterns using concrete objects
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PK.PDH.5. Demonstrates eye-hand coordination and fine motor skills.
PK.CKW.2 Responds and reacts to visual arts created by themselves and others.

Soft Sushi

Objective

Children will develop the gross and fine motor skills required to use rubber bands in a way that allows them to bind materials together. This is an extension of the rubber band stretching activity above (Stretchy Shapes), so it should be done after students have developed comfort with those skills. This activity focuses on holding things together by twisting, rather than just the process of stretching rubber bands around things like geoboard pegs. Children will practice how to use big rubber bands on smaller objects, through the use of twisting and doubling up. They will also practice rolling skills in the process to create tight "sushi rolls".

Materials

- White felt cut into 1 inch strips (1 inch wide x 11 inch long)
- Black felt cut into 1 inch strips (1 inch wide x 11 inch long)
- Orange, green, pink felt or string cut into 1 inch long shreds
- Rubber bands 2 or 3 inches in size (size #18 recommended)
- Chopsticks with assists or tweezers

Instructions

Have children curl and roll the white felt ("rice") into a "sushi roll." Then, wrap the white sushi roll in a strip of black felt ("seaweed") to complete the sushi look. Have children then hold the sushi, and use a rubber band that is larger than the roll to keep the roll together. The size of the rubber band should enforce the requirement that they twist the rubber band in order for it to hold tight.

The primary focus of this activity is to get children to understand how to simultaneously hold the rubber band under tension around their target object and twist it in order to double up the banding. If you use soft felt, the roll will not unravel while the child manipulates it. Use rubber bands that are thin enough to be appropriate for the children's strength. You can extend the learning by using large enough rubber bands that allow children to do triple or quadruple twists.

You can also extend this activity by starting with small shreds of colored felt or string first, and then wrap it with white felt in order to add "fillings" to the sushi so that children can engage in imaginative play to add different "flavors" to the sushi. For example, green felt or string could represent cucumber, pink felt or string can be tuna, and orange felt or string can be salmon and carrots. Once the sushi has been made, children can practice tweezer skills by using tweezers or chopsticks with assists in order to pick up the sushi.

Have children also take the sushi apart when they are finished playing with it, in order to help clean up.

Facilitating Questions

- *What happens if we don't wrap it tightly?*
- *How many times do we need to wrap the sushi to keep it together?*
- *Can you show me a good technique to twist the rubber band?*

¿Qué pasa si no lo envolvemos bien?
¿Cuántas veces necesitamos envolver el sushi para mantenerlo unido?
¿Puedes mostrarme una buena técnica para torcer la banda elástica?

STEM Career Skills

- *Curling:* As electrical engineers create capacitors, children will tightly roll felt into a tight cylinder.
- *Twisting:* As lab technicians use their wrists to screw the lids of a sample jar, children will use their wrists to twist a rubber band.
- *Banding:* As archaeologists use elastic bands to attach labels to an artifact, children will use a rubber band around something to keep them securely attached.

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PK.AL.5. Demonstrates persistence.

Fascinating Fasteners

Objective

Children will develop fine motor skills required to operate various clothing fasteners. By practicing with Montessori type boards that have a variety of fasteners on it, children can practice attaching and detaching in different ways. This will look like them zipping zippers and buttoning buttons, in addition to using toggles, snaps, and string for attachments.

Materials

- Montessori style boards of clothing fasteners
- A variety of gloves
- Ice packs
- Hand warmers (example: Hot Hands)

Instructions

To begin, children should experiment with becoming familiar with how to connect and disconnect all of the various fasteners on the board. Some are easier than others,

so challenge children to persist, and master all of the fastener options.

To expand this activity, after children have developed their fastener skills, have them start thinking about the tradeoffs that engineers have to consider. Add the narrative that we are astronauts trying to find the best glove to work in space. This will make the board challenge harder. Invite children to pick a pair of gloves to wear while doing the board. Nitrile gloves, mittens, and oven mitts are some ideal options, but bring in gloves of your own choice, or invite children to bring gloves from home.

Once children are wearing the gloves of their choice, ask them to see which fasteners they can still operate while wearing gloves. This process may be frustrating if their gloves are bulky, and that's okay. Engage them with questions on the gloves' ease of use, which fastener is harder or easier to do with it, etc. If it becomes too frustrating, allow children to swap to different gloves or take a break and try the activity without gloves until they are ready to try again. Have them consider if their gloves were a good choice for astronauts in space.

As an extension, tell the children that not only do astronauts need to consider the function of their gloves, but they have to consider their protection from the elements because outer space has extreme temperatures. Invite the children to think about these tradeoffs just like real astronauts. Once children test their gloves with the Montessori board, have them think about the protection that the gloves offer. Would they wear those gloves out in the winter? Give the children an ice pack, and ask if when they hold it, they can feel the chill through their gloves. Also try a hand warmer.

Once they get a sense for how much their gloves protect them, have them swap to a different pair of gloves to try the same experiment. Does their new glove protect more or less than their previous gloves? Is their glove good at only protection or both protection AND function? Have children compare gloves and come to a conclusion.

Facilitating Questions

- *Which fastener is your favorite? The easiest? The hardest?*
- *Where have you seen these fasteners before?*
- *Which do you have on your clothes today?*
- *If I was wearing this kind of gloves, which fastener would be the easiest to use?*
- *Which glove do you prefer?*
- *Which do you think is best for both heat and doing fasteners?*

¿Qué sujetador es tu favorito? ¿El más fácil? ¿El más difícil?
¿Dónde has visto estos sujetadores antes?
¿Cuál tienes en tu ropa hoy?
Si usaras este tipo de guantes, ¿qué cierre sería el más fácil de usar?
¿Qué guante prefieres? ¿Por qué?
¿Qué guante crees que es mejor tanto para calentar como para confeccionar sujetadores?

STEM Career Skills

- *Zippers:* Used by mechanics to zip up their tool bag.
- *Knots:* Used by nurses to securely tie medical sutures.
- *Cinches*: Used by telecommunications specialists to bundle wires.
- *Buttons:* Used by chemists to button up their lab coats
- *Velcro:* Used by astronauts for quick-release attachments of their tools.

PK.AL.1 Actively engages in play as a means of exploration and learning.
PK.AL.3. Approaches tasks and problems with creativity, imagination and/or willingness to try new experiences.
PK.AL.4. Exhibits curiosity, interest, and willingness to learn new things and have new experiences.
PK.AL.5. Demonstrates persistence.

Linkage Logs

Objective

Children will develop fine motor skills associated with bending brass fasteners. This activity exposes children to two concepts: brads as a fastener and linkages as a mechanical object. Linkages are when two or more objects can pivot around one another, which can be used for leverage, or a change in motion. Children can attach popsicle sticks together to make shapes, or create dynamic objects that allow for imaginative play.

Materials

- Brads
- Popsicle sticks with holes in them
- Optional Carabiners

Instructions

Start by demonstrating how the brad works. Align the holes of two popsicle sticks, and place the brad through them. Then demonstrate that the wings of the brad can be spread, and invite the child to carefully try flattening them down in opposite directions. The tips are a little pointy so have them take their time.

Pre-create a variety of simple shapes and linkages with the children to inspire them with the possibilities. Make a "snake", a triangle, a square, an X, and a shape with 3 or more popsicle sticks in a stack. Have the children make their own versions of these so they can explore their properties.

This activity is fun and easy for them to freely explore independently, once they master the technique of using the brads to connect the pieces. Challenge them to make specific shapes or letters and numbers!

As an extension to this activity, introduce a carabiner to the children. First demonstrate how they work and allow children to freely explore how to open them. Carabiners require very specific interaction to open, and can be challenging for children who mimic the actions with slight variations. Once children are comfortable with how the carabiner opens, encourage them to link the popsicle sticks together using the carabiner. They can also link carabiners with each other to practice.

Facilitating Questions

- *Can the popsicle sticks fall apart when they are attached together with a brad? Why not?*
- *Can you move the brad to a different hole? How do you reuse the brad?*

¿Se pueden desmoronar los palitos de helado cuando se unen con un clavo? ¿Por qué no?

¿Puedes mover el clavo a un agujero diferente? ¿Cómo se reutiliza el brad?

- *What other shapes can you make? What about combining shapes?*
- *Does the triangle move? What shapes can move?*

¿Qué otras formas o figuras puedes hacer? ¿Qué pasa con la combinación de formas/figuras?
¿Se mueve el triángulo? ¿Qué formas/figuras pueden moverse?

STEM Career Skills

- *Bending:* As machinists build structures by bending a single sheet of metal, children will practice bending the wings of a brad out.
- *Attaching:* As inventors combine materials together to make structures, children will attach popsicle sticks together to make new structures.
- *Pivots and Hinges:* As mechanical engineers plan moving parts in machines, children will use brads to explore how shapes can move.

PK.MATH.13 [NY-PK.G.2.] Names shapes regardless of size
PK.MATH.14 [NY-PK.G.3.] Explores two-and three-dimensional objects and uses informal language to describe their similarities, differences, and other attributes
PK.MATH.15 [NY-PK.G.4.] Creates and builds shapes from components
PK.AL.1 Actively engages in play as a means of exploration and learning.
PK.AL.3 Approaches tasks and problems with creativity, imagination and/or willingness to try new experiences.
PK.AL.4 Exhibits curiosity, interest, and willingness to learn new things and have new experiences.
PK.AL.5 Demonstrates persistence.
PK.PDH.5 Demonstrates eye-hand coordination and fine motor skills.
PK.CKW.2 Responds and reacts to visual arts created by themselves and others.

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