A collection of practical experiments in the field of mathematics and robotics

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Created fro KA2 project “Through experimentation we discover the world around us”

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Where we are going in this seminar

- Introduction to Early STEM
- Science
- Mathematics
- Engineering and Technology

  Practical tools for teachers

  Toys and tools to use

What is Early STEAM All About?

Science is a way of thinking

Experimenting
Making predictions

Science is a way of thinking

Sharing discoveries

Asking questions

Science is a way of thinking

Wondering how things works

Technology is a way of doing

-Using tools

-Making things work

Technology is a way of doing

Being innovative
Identifying problems

Engineering is a way of doing

Solving problems

Using variety of materials

Engineering is a way of doing

-designing

-creating

Engineering is a way of doing

-Creating things that work

Math is a way of measuring

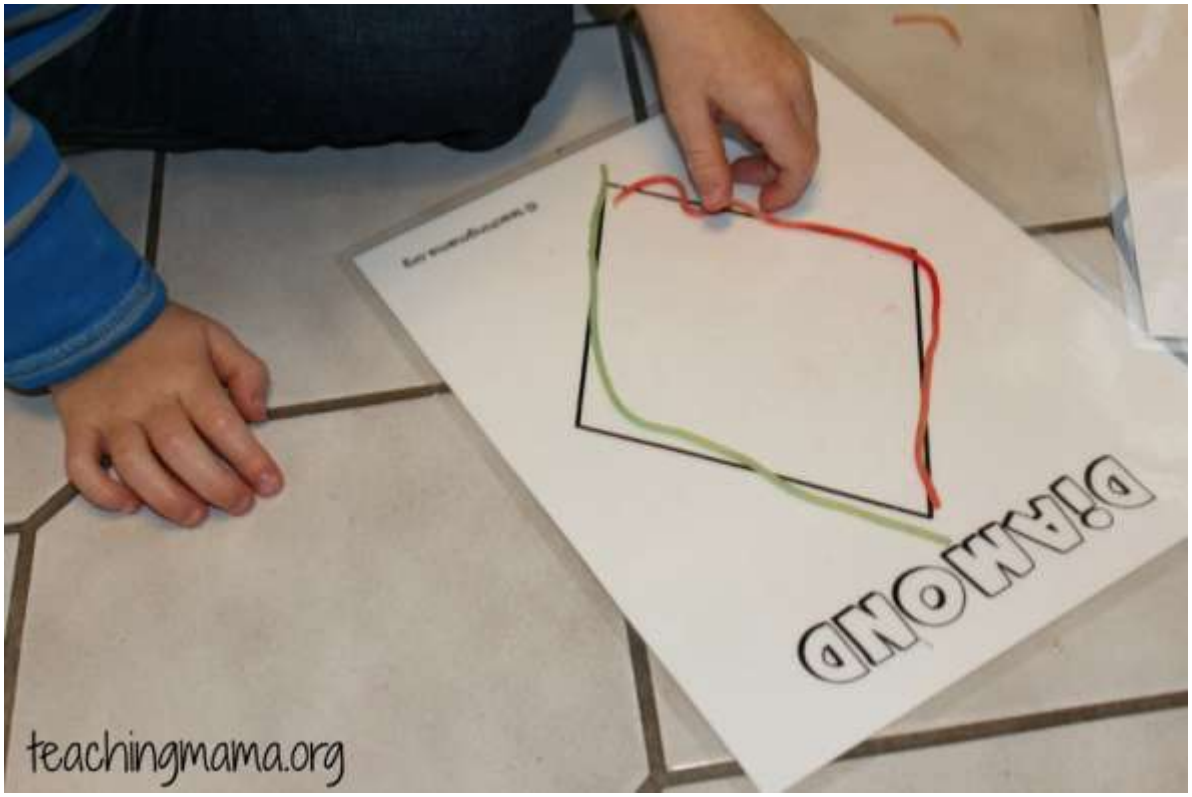
Sequencing (1,2,3,4,…)

Math is a way of measuring

Patterning (2,4,6,8,....)

Math is a way of measuring

Exploring shapes



Math is a way of measuring

Exploring volume (holds more or less)

Math is a way of measuring

Exploring size (bigger, less than…)

How do Infants and Toddlers develop science skills and knowledge?

Natural curiosity (such as intently watching an adult's expressions and actions)

How do Infants and Toddlers develop science skills and knowledge?

Readiness to repeat actions that have an interesting effect

How do Infants and Toddlers develop science skills and knowledge?

Need to explore and make sense of the world

Why DO we need to start Science Early?

Understanding the world around them is one of the strongest predictors of young children's later science learning and reading, and a significant predictor of mathematics

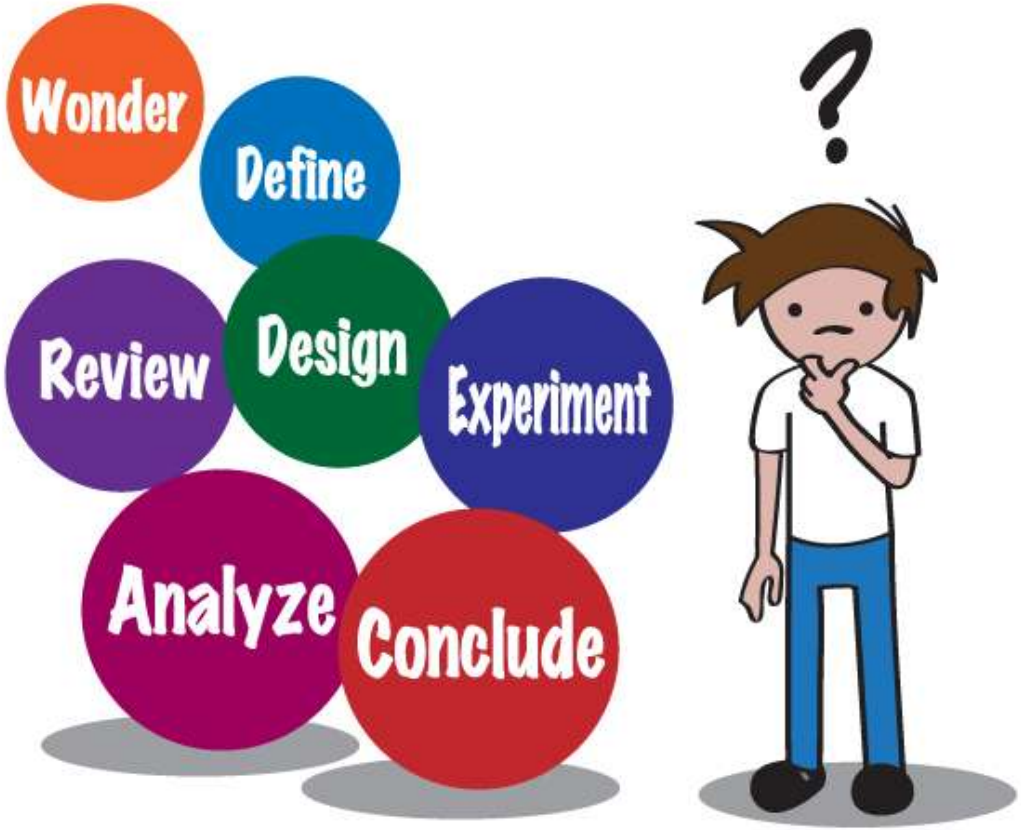
Grissmer et al., 2010



WHAT IS SCIENCE?

WHAT IS SCIENCE?

A way of learning and thinking about the natural world using experimentation to make conclusions

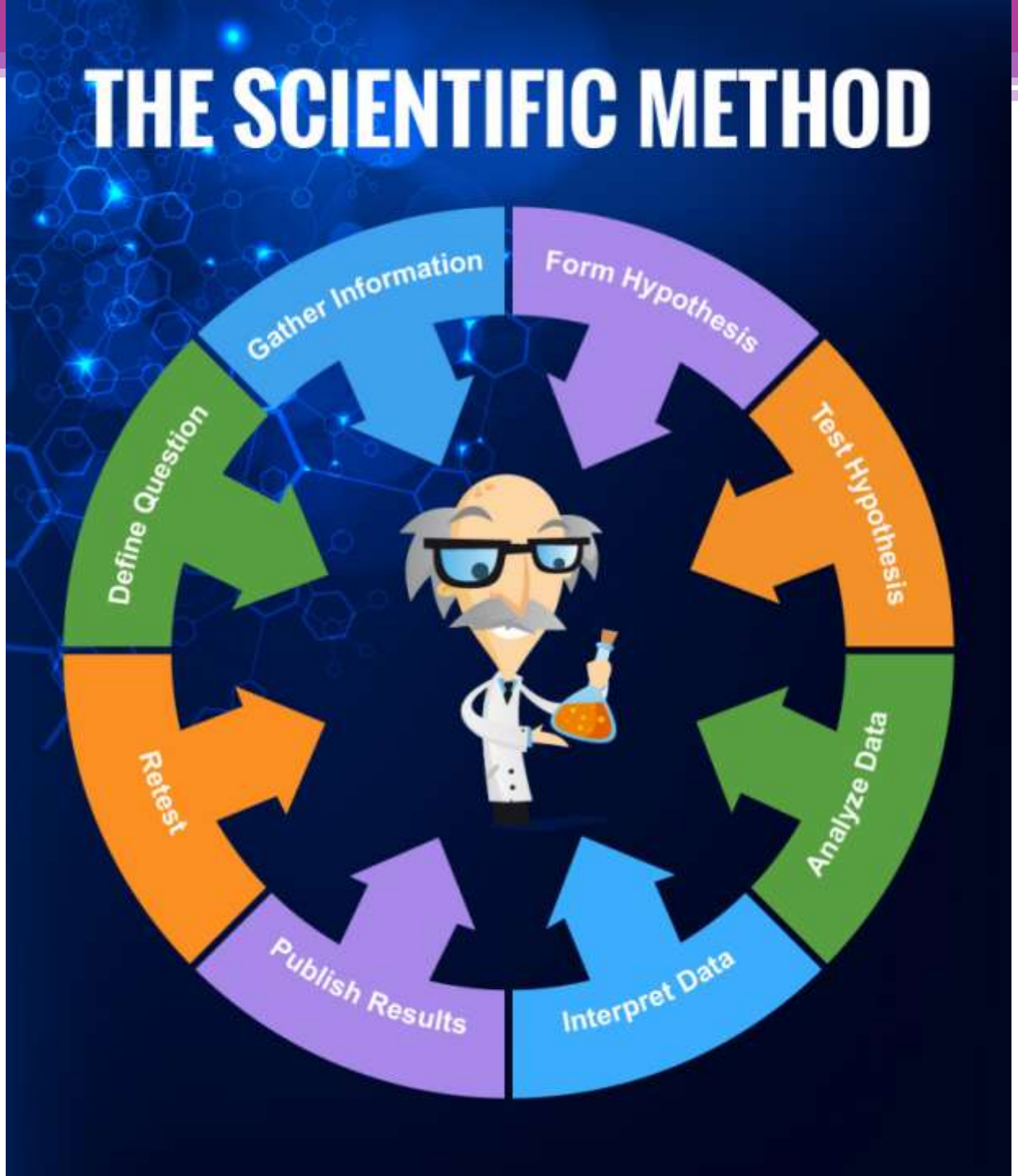


WHAT IS SCIENCE?

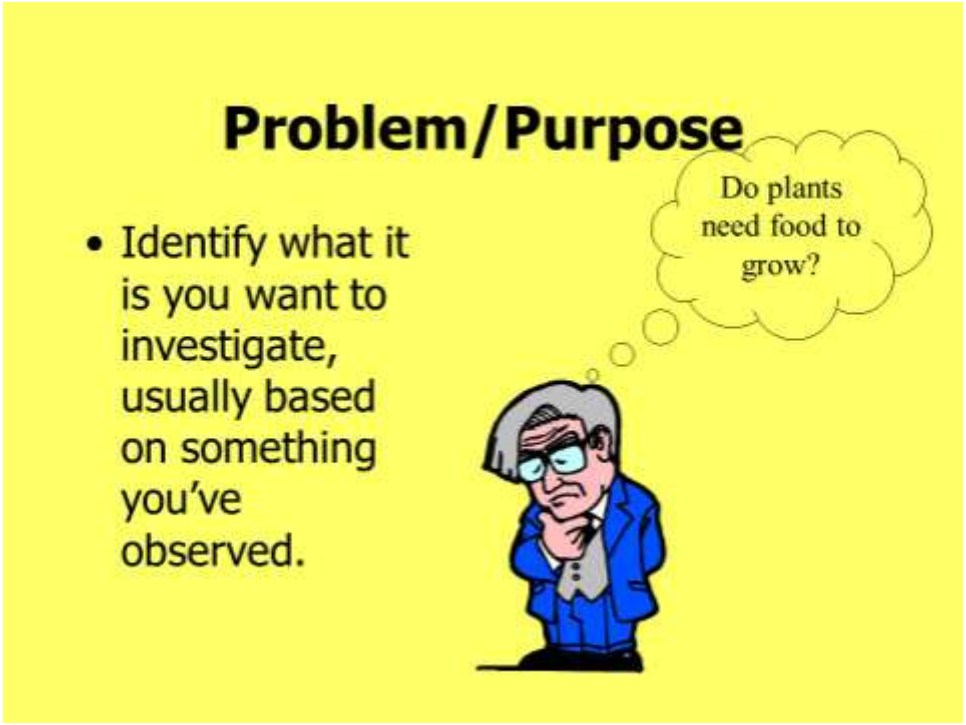
Scientists collect information, look for patterns and connections, and propose explanations

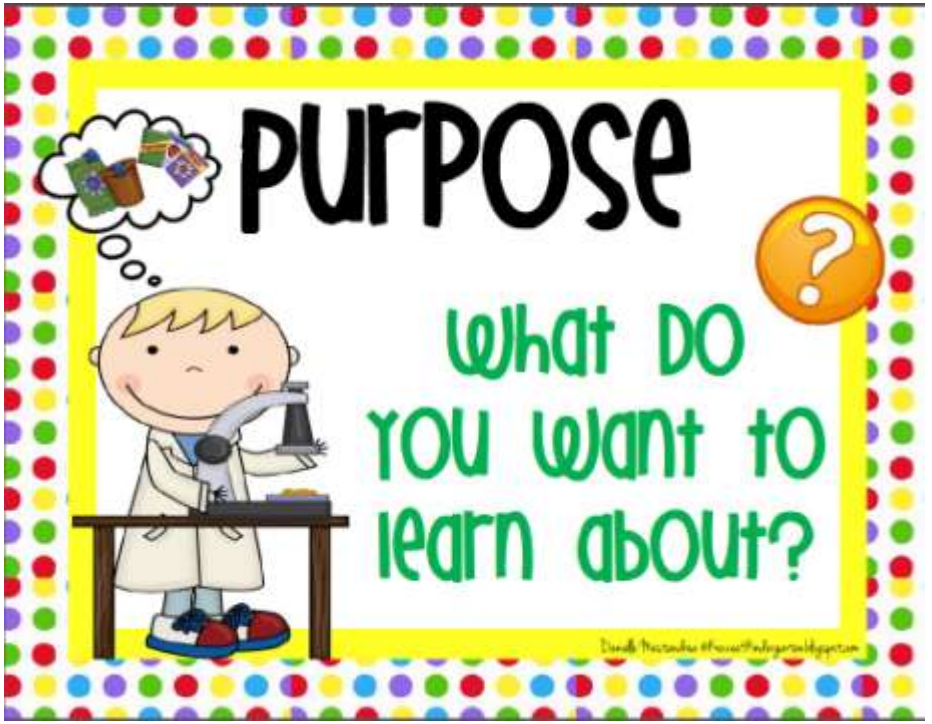
WHAT IS SCIENCE?

Science is always changing with new observations, tests, equipment, viewpoints, and discoveries that lead to new theories and revising old ones

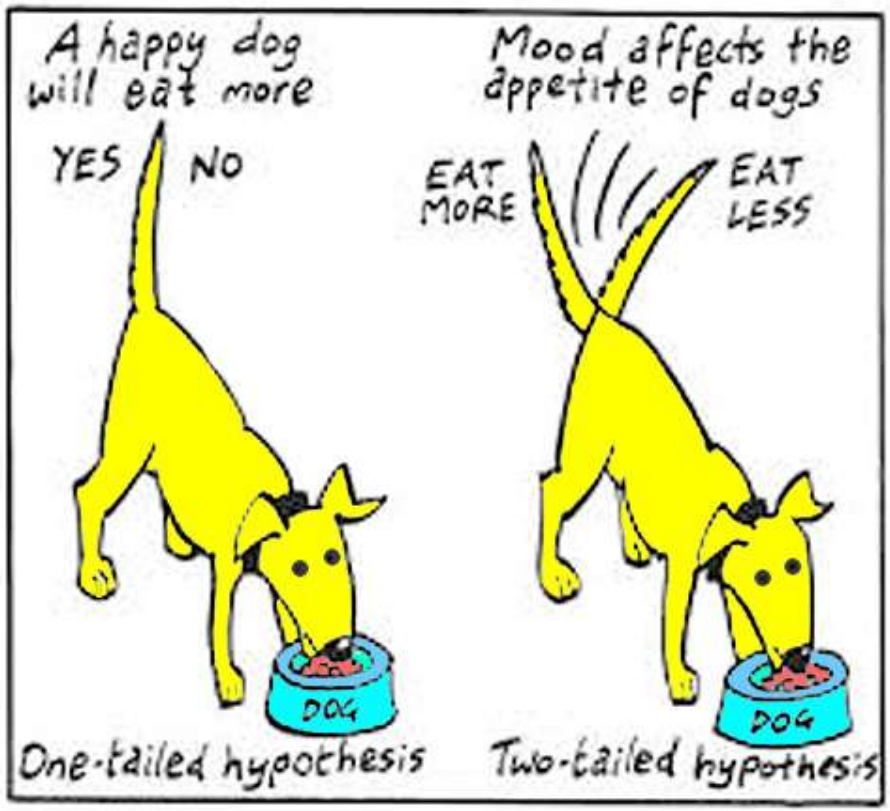

THE SCIENTIFIC METHOD
Gather Information
Form Hypothesis
Test Hypothesis
Analyze Data
Interpret Data
Publish Results
Retest
Define Question

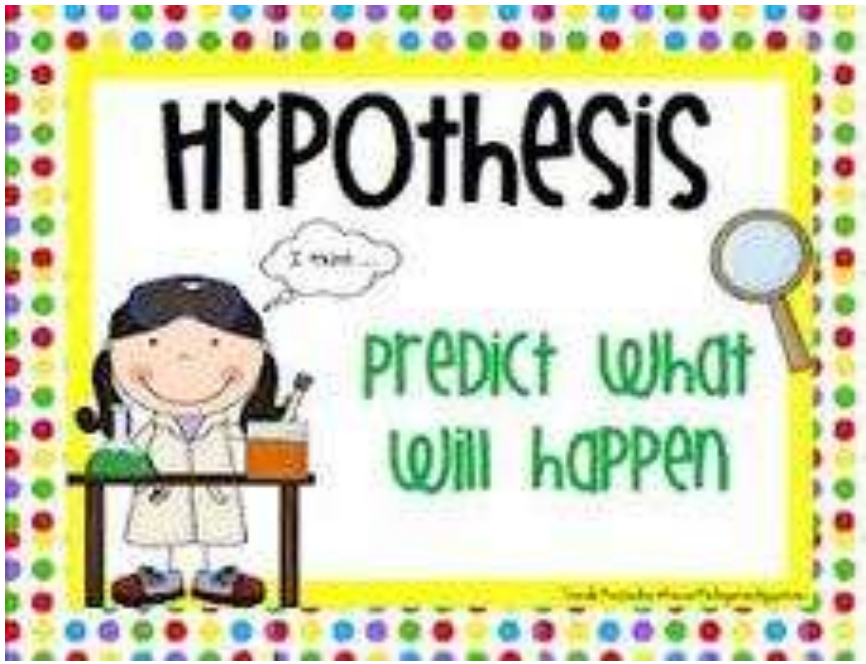
Purpose: *What question are we trying to answer or discover?*





Hypothesis: *What is an educated guess of the answer to our questions?*





Materials: *What are the supplies or equipment we will need for our experiment?*

MATERIALS

A LIST OF MATERIALS NEEDED

What do you need to carry out your experiment?

Make a list of all the chemicals, equipment, and materials needed.

Procedure: *How are we going to conduct our experiment? Step by Step?*

Results: *What happen in our experiment?*

<u>Conclusion:</u> *Was our hypothesis correct?*

Every baby knows the

scientific method!

1 Make an observation.

2 Form a hypothesis.

3 Perform the experiment.

4 Analyze the data.

5 Report your findings.

6 Invite others to reproduce the results.

Science begins with babies!

How Adults support STEM for Infants and Toddlers

Provide materials

How Adults support STEM for Infants and Toddlers

Join infants and toddlers in exploration

How Adults support STEM for Infants and Toddlers

Connect experiences to what children have done or experienced before

Science Skills for Infants and Toddlers

Observing and Describing

Science Skills for Infants and Toddlers

Comparing and Sorting

Science Skills for Infants and Toddlers

Questions and Predictions

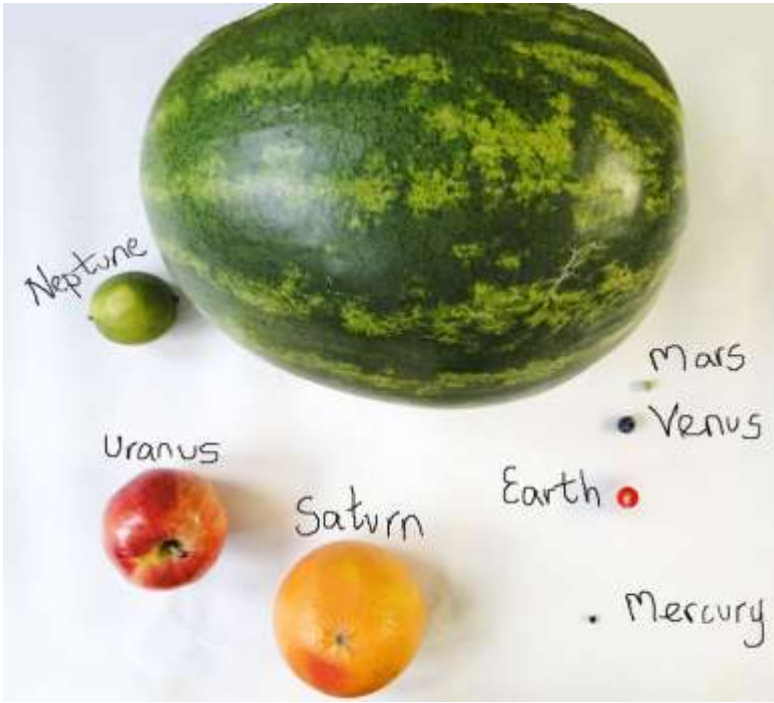
Observing and Describing

Using the senses: Inviting children to use their senses and describe their observations

- *How do they feel?*
- *What do they look like?*
- *How do they smell?*
- *How do they taste?*
- *How does it sound?*

Questions you can ask to help children compare and sort:

- *Do you want the big one or the small one?*
- *This is very small, like your finger.*
- *Let's make a group for you and a group for me*
- *Can we put all the blocks together here? Then we can put the balls together here.*



Questions and Predictions

Invite children to pose questions and model questioning for them

"Which plant is taller?"

"What will happen when we put the color tablet in the water?"

"How can we make this ball roll faster?"

Try It Out: Color Mixing

- **In pairs, roll play:** one teacher and one kid

- **Purpose**
- **Hypothesis**
- **Materials:** send one person to collect

  3 water glasses, paper towel, and 2 food coloring tubes

  - **Procedure**
- **Conclusion: Come back together to discuss next day**

Early Mathematics

- Math is sequencing (1, 2, 3, 4…), patterning (1, 2, 1, 2, 1, 2…), and exploring shapes (triangle, square, circle), volume (holds more or less), and size (bigger, less than).

Early Math Skills = Later Math AND Literacy Skills

What are the Big Ideas in Mathematics?

- Number and Operations
- Geometry and Spatial Sense
- Measurement and Comparison

How do young children learn math?

- Mathematical ideas are in children's play and everyday experiences.
- Young children develop some math concepts through self-guided discoveries.
- Adult support is essential to move mathematical development along.

Foundations for early Number understanding for Infants

- *Young infants can see differences in small groups*

- *As they grow infants can also tell the difference in larger sets, but only if differences are clear*

Early Number understanding for Toddlers

- Toddlers can typically do tasks in home and natural environments before they demonstrate them in laboratory settings (Mix, 2002)

"Make yours like mine"

- Toddlers move from approximate numerosity matching to more exact ability to match small number sets.

What are Infants and Toddlers learning about Geometry and Spatial Sense?

- Manipulate objects to find out about their properties or attributes
  - How does it feel?
  - What can it do?
  - What can I do with it?
- Use their whole bodies to explore and learn
  - Crawl and walk around their environment
  - Hold and carry toys and other objects

Infants and Toddlers:

- Relate objects in play, for example…
  - Putting smaller objects inside larger objects or stacking two blocks that are the same size
  - Put their hand together or in their mouth
  - Put toys or objects on, in, or next to other objects

Help Children Learn Math through "MATHEMATIZING"

- Emphasize math ideas
- Use mathematical language
- Make comments, ask and answer questions, and pose math-related problems
- Provide a variety of materials and tools for exploration of math ideas

How to support early mathematics: MATHEMATIZE

Definition: to bring out the math in what children are doing (commenting, questioning)

- Example:

Whee! Look how fast the ball rolls down the slide.

You stayed up and the ball went down!

Which slides faster – a ball or a boy? Why does the ball go so fast?

Math Connections

- Shape (geometry)
- Spatial concepts: up, down
- Speed, comparing (measurement)

Try it out: Stacking Cups

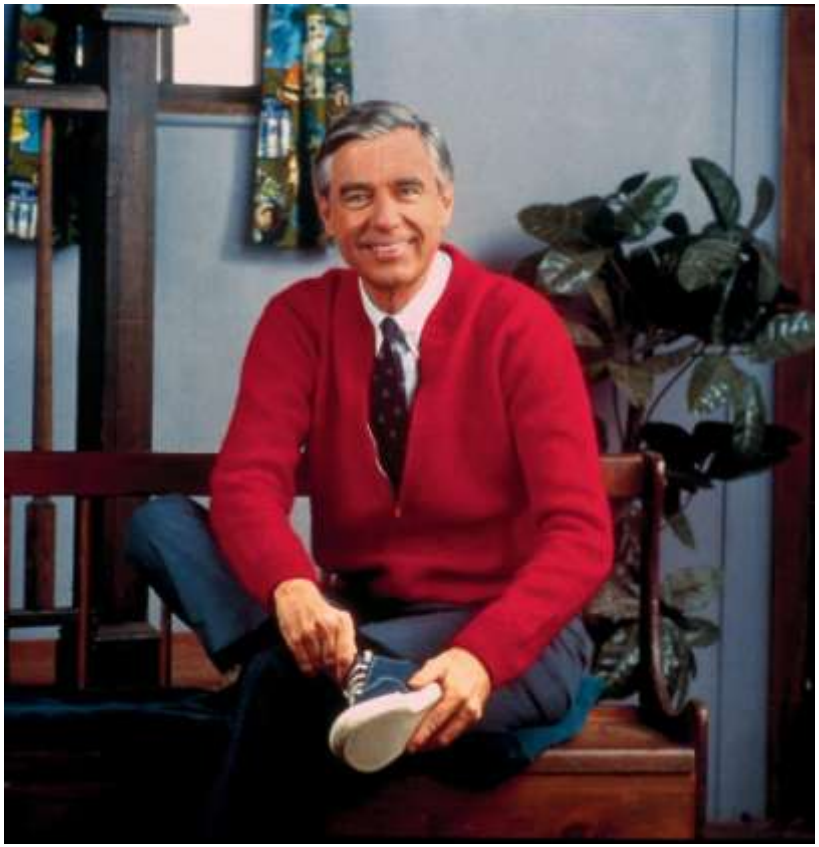
- **In pairs, roll play:** one teacher and one toddler/baby
- **Try It:**
  - Stacking
  - Counting:
    - "Look we have stacked 1, 2, 3 cups"
    - Count as your stacking
  - Preposition words:
    - Inside, Above, Under, Behind, In, Out, Near, Far
- **Share Findings in 5 minutes**

Engineering and Technology

What is Technology?

- ***"Technology developed through engineering include the systems that provide our house with water… bridges, tunnels…cellular phones; television and computers…"***
- ***Technologies are the tools created by people through engineering to solve problems. We use technology to help us do certain tasks. Every one uses technology!***

GUIDING PRINCIPLES



"I give an expression of care every day to each child, to help him realize that he *is* unique. I end each program by saying, 'You've made this day a special day by just your being you. There's no person in the whole world like you. And I like you just the way you are.' And I feel that if we in public television can only make it clear that feelings are mentionable and manageable, we will have done a great service."

Fred Rogers' Senate Testimony (1967)

NAEYC / FRED ROGERS CENTER DRAFT POSITION STATEMENT (2011)

"It is the position of NAEYC and the Fred Rogers Center that technology and interactive media are learning tools that, when used in intentional and developmentally appropriate ways and in conjunction with other traditional tools and materials, can support the development and learning of young children."

ERS Tip!

- FCCERS-R “25. Use of TV, video, and/or computer
- Children under 24 months should not be allowed to view television/computer. In addition, media screen time is limited for children 2 years and older to not more than 30 minutes total, once a week. Computer use time should be limited to no more than 15 minutes per day with the exception of school-aged children completing homework assignments, or children with disabilities who require assistive computer technology. No media screen time should be allowed during meals/snacks.”

- ITERS-R “In addition, media screen time is limited for children 2 years and older to not more than 30 minutes total, once a week, with only 15 minutes at a time per day for computer use.”

What is Engineering?

- Engineers want to know how and why things work
- Engineering is solving problems, using a variety of materials, designing and creating, and building things that work.

Engineering and Development

- Engineering – "building things that work" (Boston Children's Museum)
- Block building improves children's spatial skills (Casey et al., 2008)
  - Using stories with block building improves children's block building skills

How can young children engage in engineering and technology?

- Block Building
- “Simple Machines”: Ramps

Block Play Development

(in Casey et al., 2008)

- In the first stage of block play, children may play with one block, and use it to represent an object, such as a dog or car, in their play.

- Next, children begin to combine blocks in a one-dimensional way, by stacking them on each other (and knocking them down!)

Block Play Development continued

- Following this, children might combine blocks in a one-dimensional horizontal construction, often looking much like a “train”
- Next, children begin building two-dimensional structures such as walls or floors (typically at about two or three years of age)

Block Play Development continued

- Children may then create 3-dimensional structures, such as “piles” of blocks that do not have and “inside” (they have no interior space, it is a solid pile of blocks)
- More complex structures follow – including bridges and walls that enclose a space (there is empty space inside the structure). Children typically reach this stage between four and seven years old.

Blocks & The Environmental Rating Scale: ITERS

To reach a level 7 you need a block area that includes:

- 3 different sets of blocks AND each set of blocks needs at least 10 blocks or more
- A variety of accessories including: transportation, people, and animals AND at least 5 of each accessory items

- Sample Kit Idea

Remember there are may other things that need to be happening to et to a level 7 in ITERS besides having materials in the classroom. Please refer to ITERS fro more information.

Simple Machines: Ramps

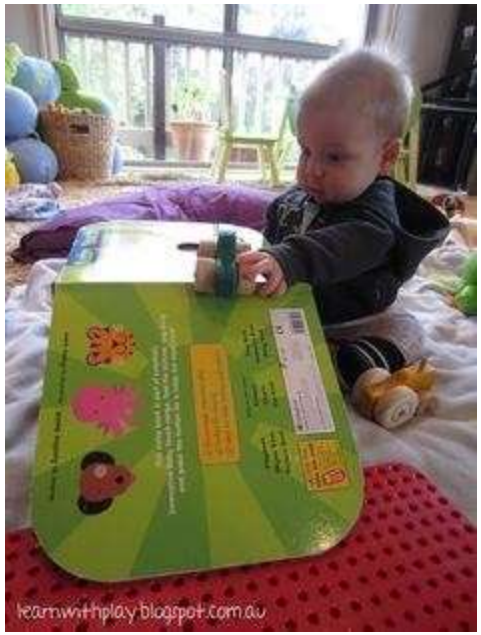
- What infants and Toddlers can learn
  - Natural world
  - Experimenting
  - Observation

Now you Try!
Engineering with Ramps

How many comments can you make to help infants/toddlers think about rolling, up, down, and other STEM ideas?

How many things can you do to make this engaging and interesting for Infants and toddlers? (i.e. adding materials, smiling and clapping, etc.)

Try it out: Ramps & Balls



- **In pairs, roll play:** one teacher and one toddler/baby

- **Purpose** - **Hypothesis**

- **Materials:** send one person to exchanged your stacking cups for:
  - 1 plastic ball, 1 soft ball, 1 piece of cardboard
- **TRY IT OUT:** (switch balls with a group)
- **Conclusion: Come back together to discuss in 5 minutes**
- **Brainstorm: How many comments can you use while exploring Ramps & Balls?**

Example Kits & Mini Color Kit

Examples of how to incorporate STEM materials into your classroom

- Color Kit
- Animal Kit
- Block Kit

Before you leave don't forget your own Mini-Color Kit; including activity cards for all of the activities we did today and a few surprises materials

How Adults support STEM for Infants and Toddlers

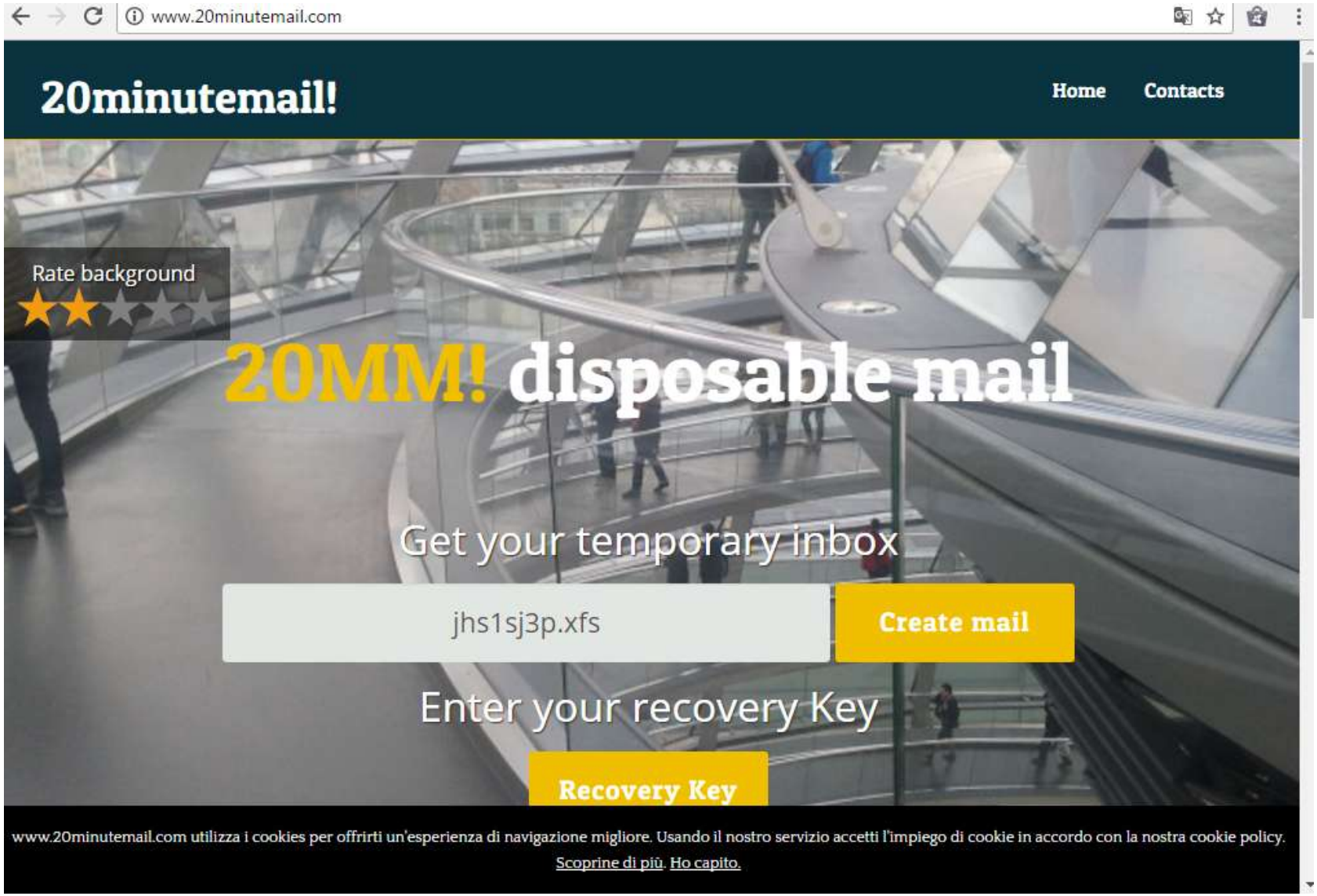
- Plan to provide appropriate materials for exploration.
- Share in the child's curiosity!
- Help the child make sense of the experience in an age-appropriate manner by connecting new information to what

Planning for STEM through out the Day

- STEM Matrix
- Brainstorm with a partner how to bring STEM into daily routines
- Walk around, explore materials for new ideas


COOL TOOLS
For EVERY TEACHER

1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slideshare

https://www.slideshare.net/geopet/best-practices-in-art

http://fliphtml5.com/ruki/mcvt

weebly

padlet

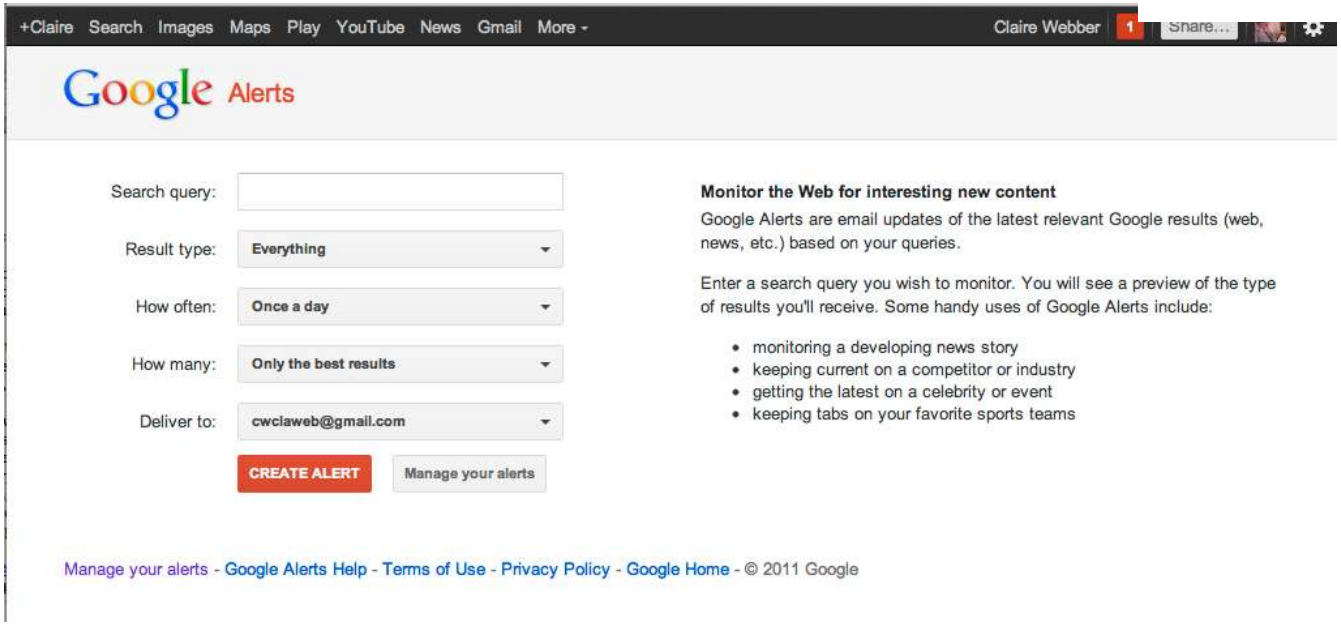
A Blank Wall to Post....

OER

OPEN EDUCATIONAL RESOURCES

http://padlet.com/

Practical tools for the teachers



Narration: TTS (Text To Speech)

i.e. Oddcast

http://www.oddcast.com/home/demos/tts/tts_example.php

QR CODE GENERATOR

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www.smallpdf.com

For adobe Pdf documents

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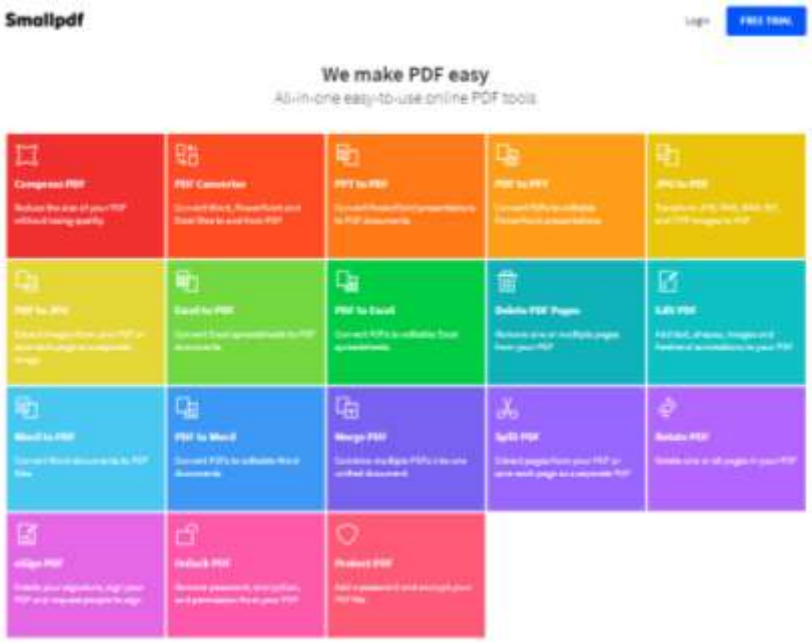
- Resize
- And etc.



www.voki.com

- Personalities, that can speak. You can even record your voice.

Augmented & Virtual Reality (AR & VR)

Augmented reality vs virtual reality

- Google VR glasses
- Buy in aliexrpess for 2 euros
- youtube – write VR films and enjoy the films

OSMO suite – need Apple Ipads

https://www.playosmo.com/en/


ICE

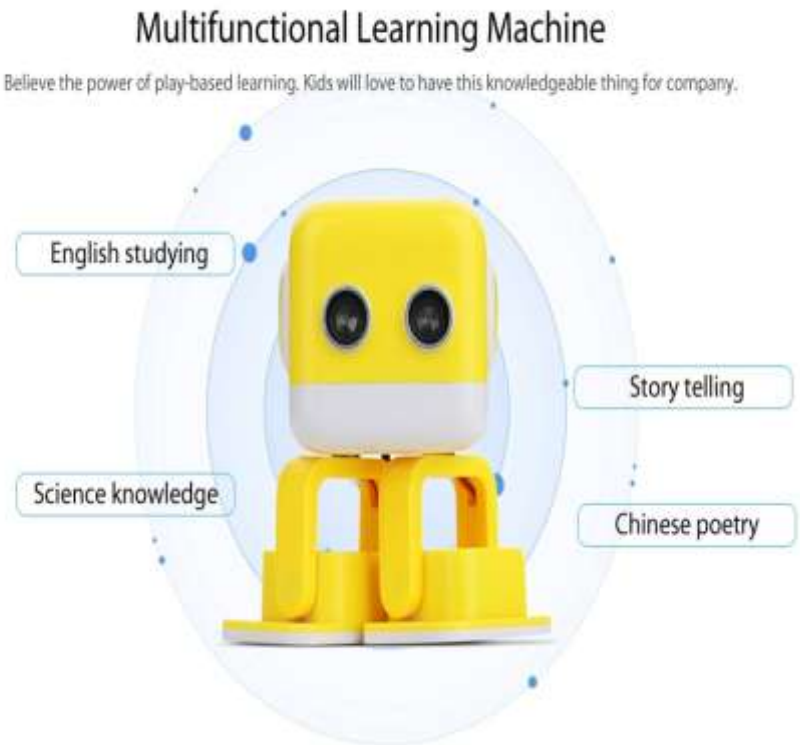
Octagon Studio -

Ozobot – mini robot with coding

Makey Makey

Robo3 http://www.robo3.cn

Cubee Programmable R



Lego educational tools

coding express

Steam park

Lego bingo

Programming on the net

www.code.org

Coding Galaxy
https://codinggalaxy.com

Coding Galaxy, a platform for learning computational thinking, is designed for students aged 5