Early Excellence
Inspirational Learning

Exploring STEM in the Early Years

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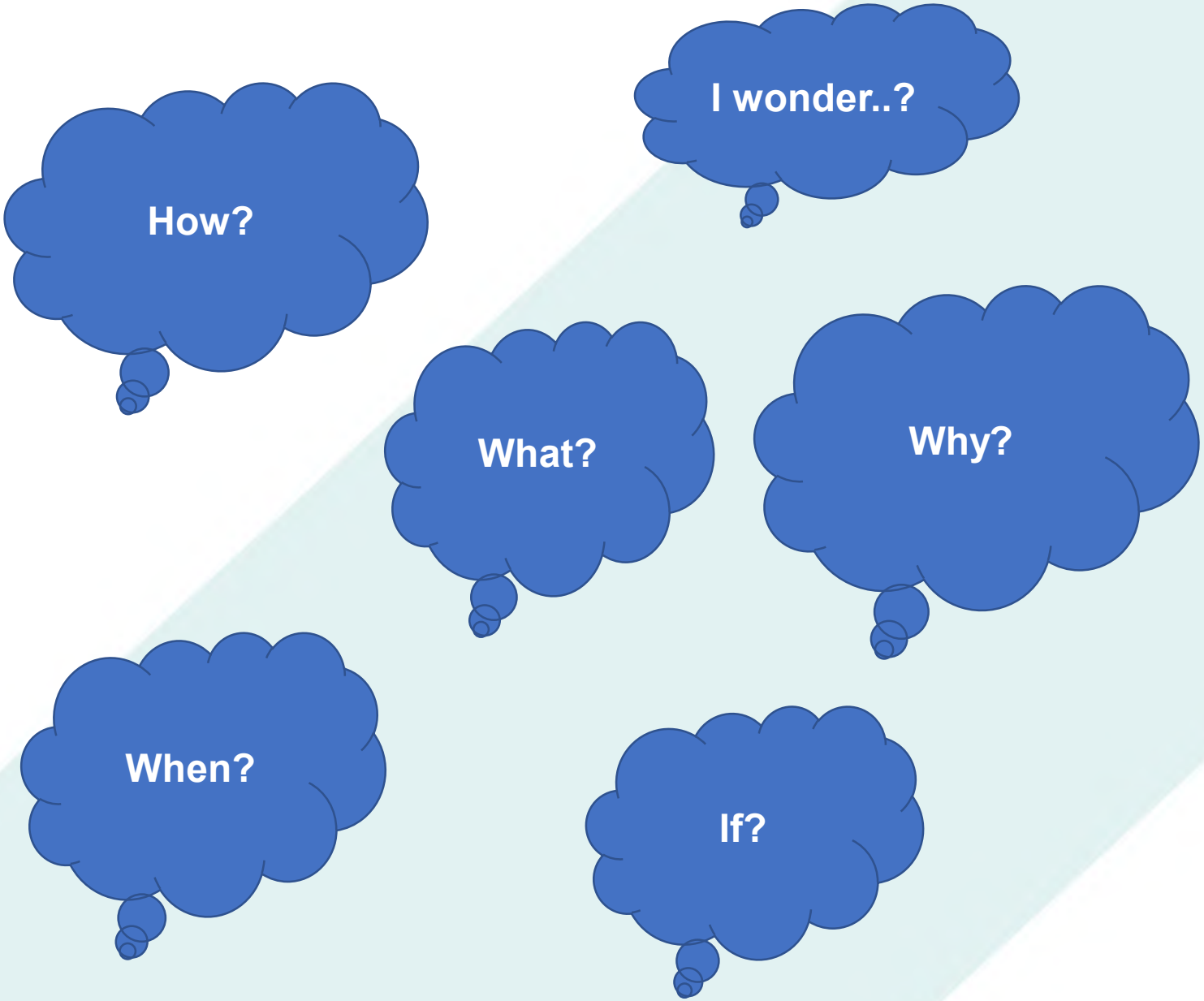
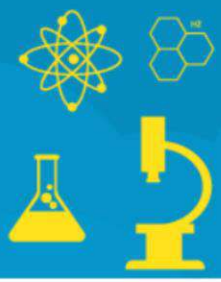
curiouser
&
curiouser


I wonder..?
How?
What?
Why?
When?
If?

What is STEM?

S
SCIENCE

Observing, experimenting, making predictions, asking questions



T
TECHNOLOGY

Being inventive, using tools, making things work, identifying issues, using computers

E
ENGINEERING

Solving problems, using materials, designing and creating, building

M
MATH

Patterning, sequencing, exploring shapes, numbers, volume and size

“STEM really is a philosophy. STEM is a way of thinking about how educators at all levels—including parents—should be helping students integrate knowledge across disciplines, encouraging them to think in a more connected and holistic way.”

naaee
North American Association for Environmental Education

Why STEM in Early Childhood?

Because integration is what we do best

- The Focus in ECE is on the whole child
- EC Educators understand that learning doesn't happen in silos

Because hands-on learning is our focus

- Following children's interests is at the core of our planning
- Engagement with the activities to construct knowledge is what we do

Because Positive dispositions are what we develop

- Children in the early years develop long-term habits of learning!

“The secret is to tap into children’s natural and innate curiosity about the living world. By simply allowing them to investigate, by encouraging them to ask questions about the real world, you are engaging children in STEM.”

naaee
North American Association for Environmental Education

“Curiosity thrives best in an environment where the rigid adherence to a plan is not a necessity.”

Eisner, E. 2002: 7

“Babies rely upon their senses as they explore the concrete, observable aspects of their immediate surroundings. Their world is full of wonder and newness. They gaze at faces, put objects into their mouths, respond to voices and sounds – all to gain more experience and information.”

(Thornton, 2003, as cited in Ogu & Schmidt, 2009)

Viewing childhood development as a scientific investigation provides insight into how children learn, but it also offers a provocative perspective on science and scientists. Why do young children and scientists seem to be so much alike?

Psychologists Alison Gopnik, Andrew Meltzoff, and Patricia Kuhl have proposed that science as an endeavour — the impulse to explore, explain, and understand our world — is simply a holdover from our infancies.

"It is not that children are little scientists but that scientists are big children."

Children's interests are rooted in familiarity…

Me and my family

For example… home, food, bedtime, birthdays, celebrations, hobbies, babies, gardening, shopping, pets, holidays, etc

The immediate environment and everything in it

For example… weather, nature, animals, new life, natural materials, how things work and move, pattern and colour, etc

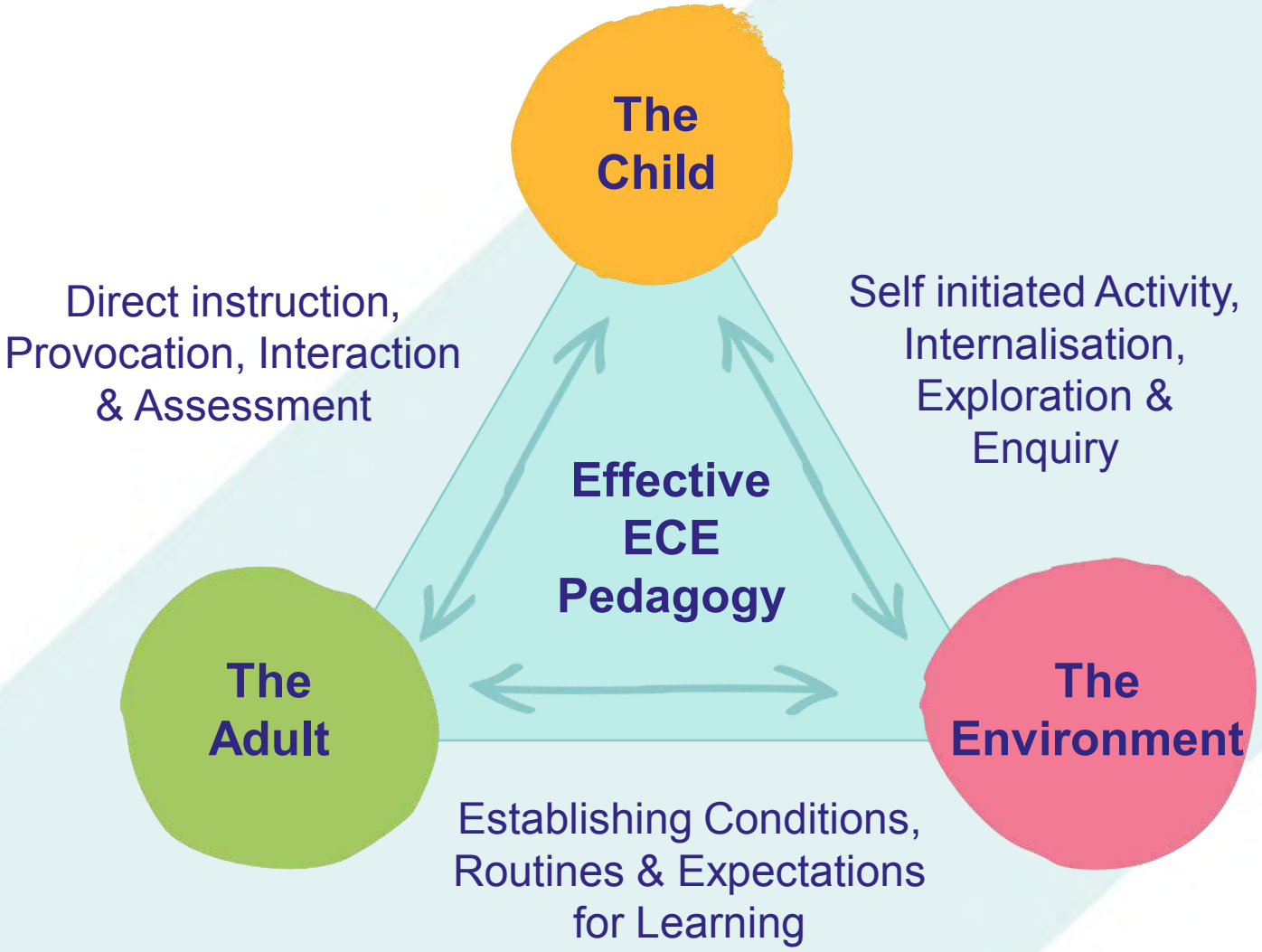
The local community & the wider world

For example… people, places, transport, events, festivals, etc

Fantasy and make believe

For example… fictional and TV characters

Early Excellence development model:



Young children should *frequently* have the following experiences:

- Being intellectually **challenged, engaged and absorbed**.
- Being engaged in **extended interactions** (e.g., conversations, discussions, exchanges of views, arguments, participation in planning)
- Being involved in **sustained investigations** of aspects of their own environment and experiences worthy of their interest, knowledge, and understanding
- **Taking initiative** in a range of activities and **accepting responsibility** for what is accomplished

- Experiencing the **satisfaction** that can come from overcoming obstacles and setbacks and solving problems
- Having **confidence** in their own intellectual powers and their own questions
- **Helping others** to find out things and to understand them better
- **Making suggestions** to others and **expressing appreciation** of others' efforts and accomplishments
- **Applying** their developing basic literacy and numeracy skills in purposeful ways
- Feeling that they **belong** to a group of their peers

Lilian Katz

Extensive experience of working with young children and their teachers confirms the supposition that all children are **innately curious and eager to explore** their environments and learn about a wide variety of causes and effects.

In this sense, our **early education pedagogical methods** should support these basic dispositions and provide a wide **range of contexts** for young children to use them.

Characteristics of Effective Learning

Playing & Exploring – Engagement
Finding out and exploring
Playing with what they know
Being willing to ‘have a go’

Active Learning – Motivation
Being involved and concentrating
Keeping trying
Enjoying achieving what they set out to do

Creating and Thinking Critically – Thinking
Having their own ideas
Making links
Choosing ways to do things

What are the essential elements to promote STEM investigation?

- The environment as a place to make connections
- Real and relevant experiences
- Open ended and inspiring resources
- Time
- Texts and stories which raise questions and lead them to link ideas
- **A culture of possibility**
- An atmosphere for questioning
- Technical knowledge of how to use resources and equipment

An environment which enables thinking, offers…

- Opportunity
- Familiarity
- Real experiences
- Choice
- Engagement
- Time

In order to make connections, the environment needs…

- To provide opportunities to become involved in activities that intrigue and interest
- Open access to rich provision which allows for connections to be made
- Space to move, make, do and watch things both in and outdoors

Warehouse of wonders

Does your learning environment....

- Develop a sense of mystery?
- Evolve throughout the year?
- Excite and inspire children every day?

A definition: Technology is…

- The application of scientific knowledge for practical purposes

- Machinery and devices developed from scientific knowledge

Oxford Dictionary

By the end of reception…

- Technology: children recognise that a range of technology is used in places such as homes and schools. They select and use technology for particular purposes
- This is the only statutory requirement for technology
- The information in development matters / early years outcomes is non-statutory and only guidance

Making decisions about technology

- What do we as a setting believe about technology?
- What do children use at home?
- Does it support the characteristics of effective learning?
- How does it support children's learning across the seven areas?
- How does it reflect the natural desires of the children?
- Does it connect with children's predictable interests?
- Is it part of continuous provision (available daily) or used as an enhancement?

Engineering:

“The branch of science and technology concerned with the design, building, and use of engines, machines, and structures.”

Children become nascent engineers every time they use hands-on materials during the classroom day. Everything from beads and puzzles to Lego®, blocks, and carpentry constitute valid, developmentally appropriate engineering experiences (meaningful practice at designing, building, and using objects).”

Dan Gartrell

Current picture of engineering

- The UK only home grows 50% of its engineers
- There are a projected 1.86 million jobs for engineers over the next 10 years
- Lack of female engineers – around 10% of positions are filled by females
- Engineering is 19% of the UK's workforce

7 Principles of Early Years engineering education

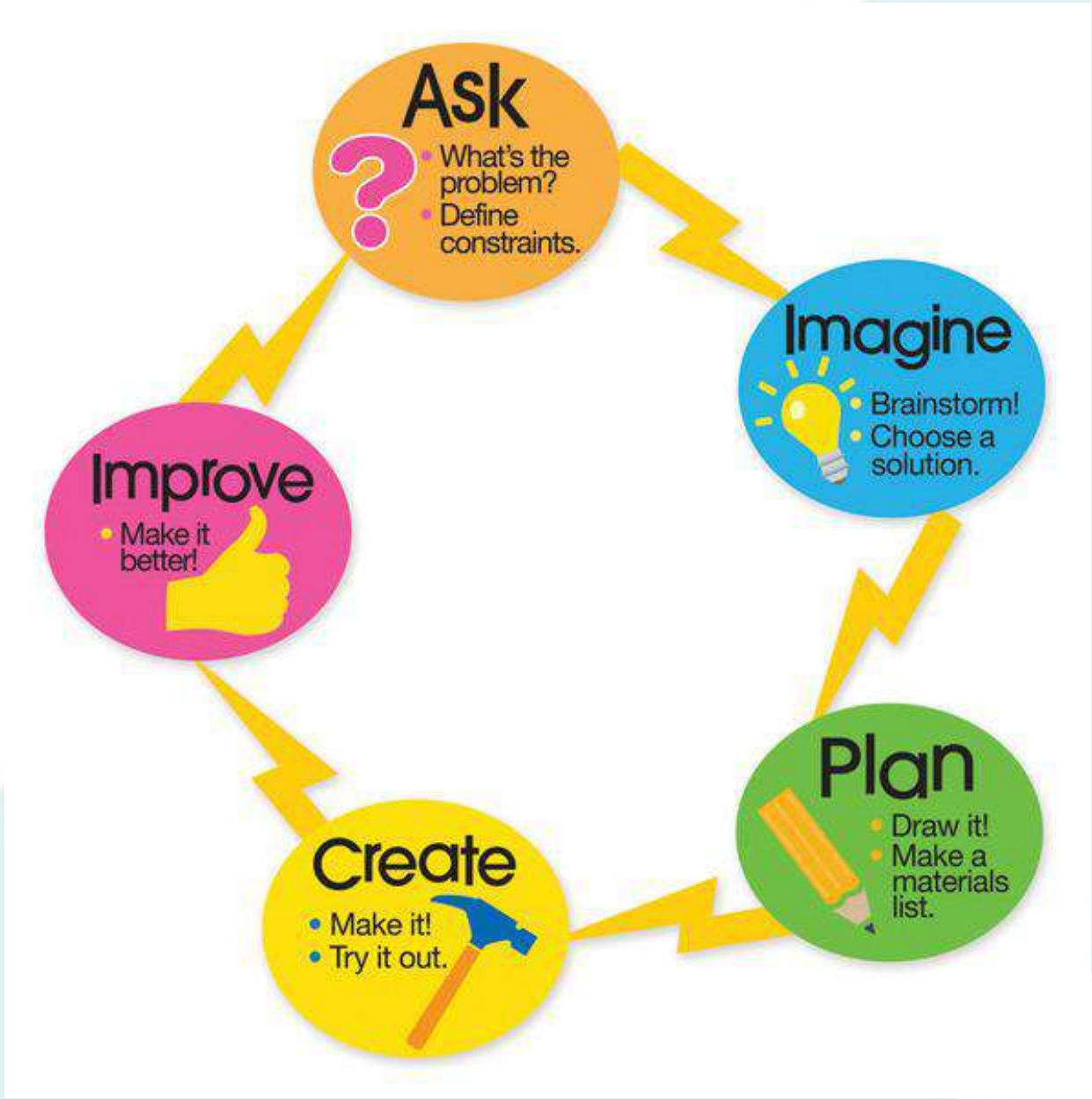
1. Children are engaged in purposeful and practical problem solving
2. Children take ownership of the process
3. Children embrace and learn from failure
4. Children's curiosity and creativity is responded to
5. Children demonstrate links with other aspects of learning
6. Children draw on a range of thinking skills and personal capabilities
7. Children's learning experiences are guided by a whole setting approach

“The reality is that too many adults have had limited opportunities to use building tools, especially hammers and nails, during their formative years.

If we want girls and boys to think of themselves as potential engineers, or at least as handy at building and repairing things, we need to provide them with repeated, practical building experiences as they are growing up.”

Dan gartrell

The design process


Ask
What's the problem?
Define constraints.
Imagine
Brainstorm!
Choose a solution.
Plan
Draw it!
Make a materials list.
Create
Make it!
Try it out.
Improve
Make it better!

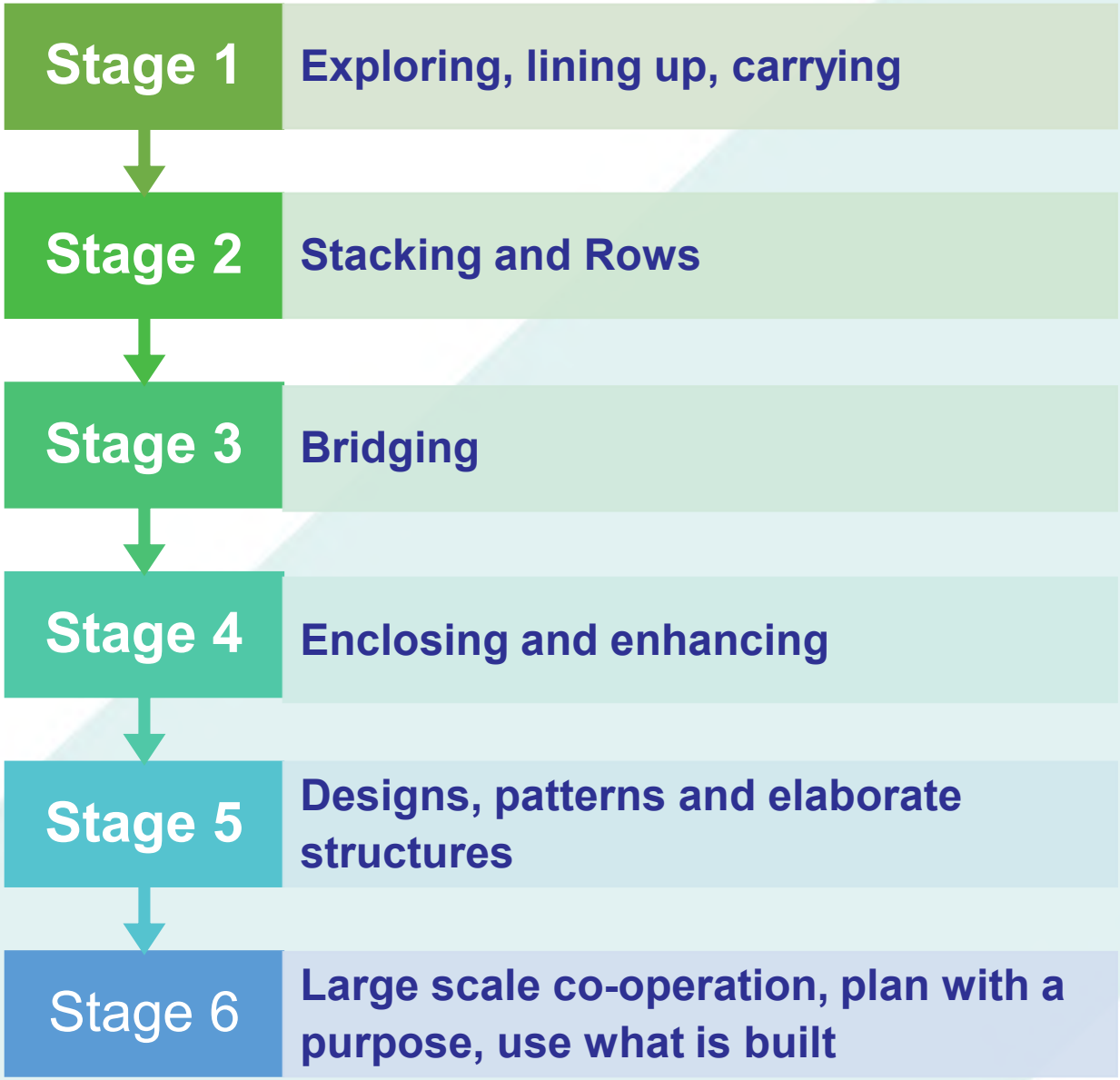

Small Construction
Work in Progress
Finished Work


MEGA MACHINE DRIVERS
This is my
digger
Small
Constructi
Wo
Progres
Big Digging

Continuous provision for blocks and building

- Children do not need complex building resources, they use whatever is to hand and their own imaginations
- Resources should be as open ended as possible
- Building and constructing involves moving and doing, the way young children learn best
- We need to know how to use resources too!

Developmental stages of block play


Stage 1
Exploring, lining up, carrying
Stage 2
Stacking and Rows
Stage 3
Bridging
Stage 4
Enclosing and enhancing
Stage 5
Designs, patterns and elaborate structures
Stage 6
Large scale co-operation, plan with a purpose, use what is built


Small World
Blocks
Are your blocks mathematically regular?


INVENTIONS
ROSIE REVERE ENGINEER
Architect Area


First Encyclopedia of the Human Body
FUNKYBONES
Science

The magic of potions

Children’s natural desire to create and explore mixtures and potions


ry Caterpillar

A wonderfully multi-sensory environment

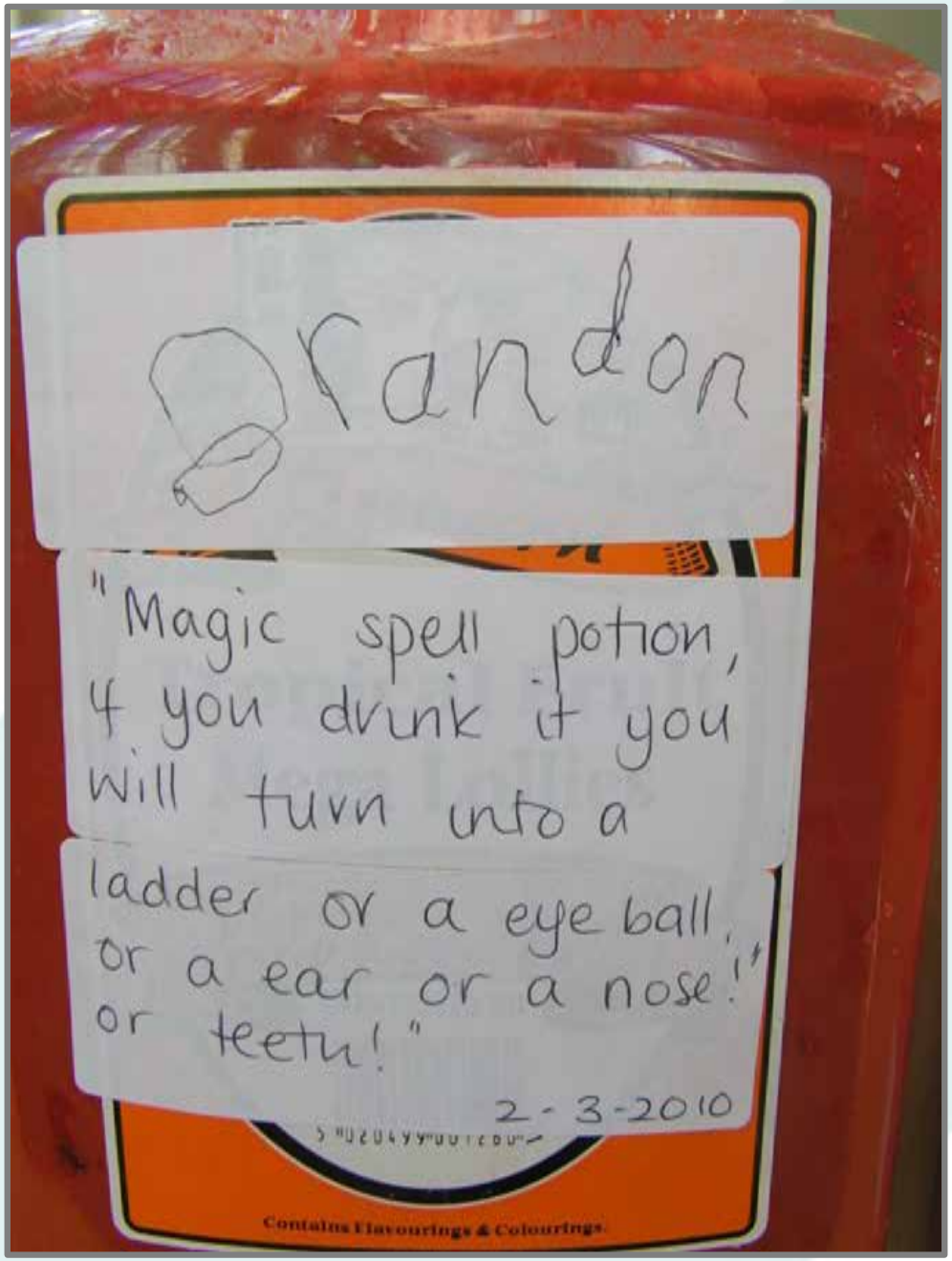
Didsbury Road Primary School, Stockport

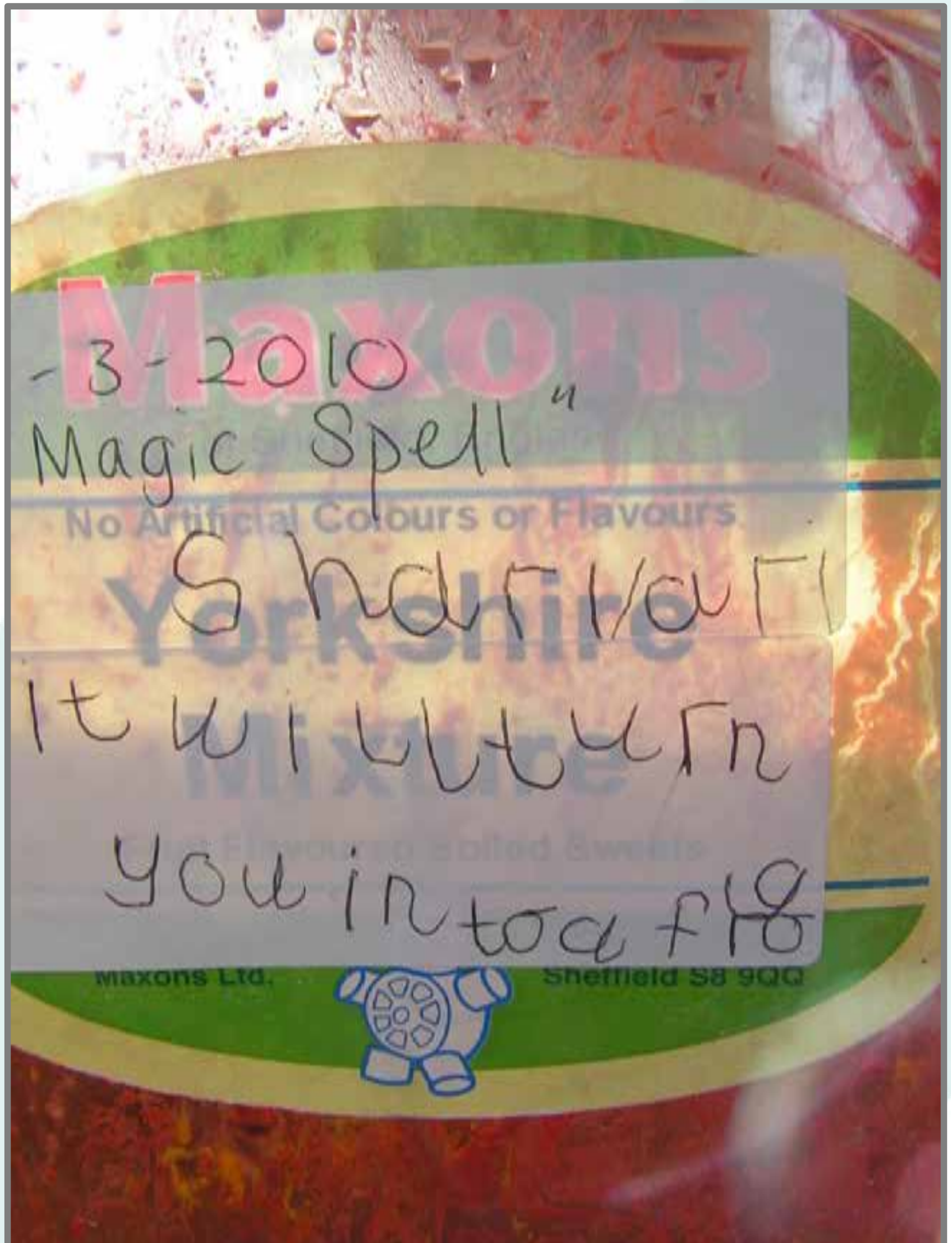
Creating potions

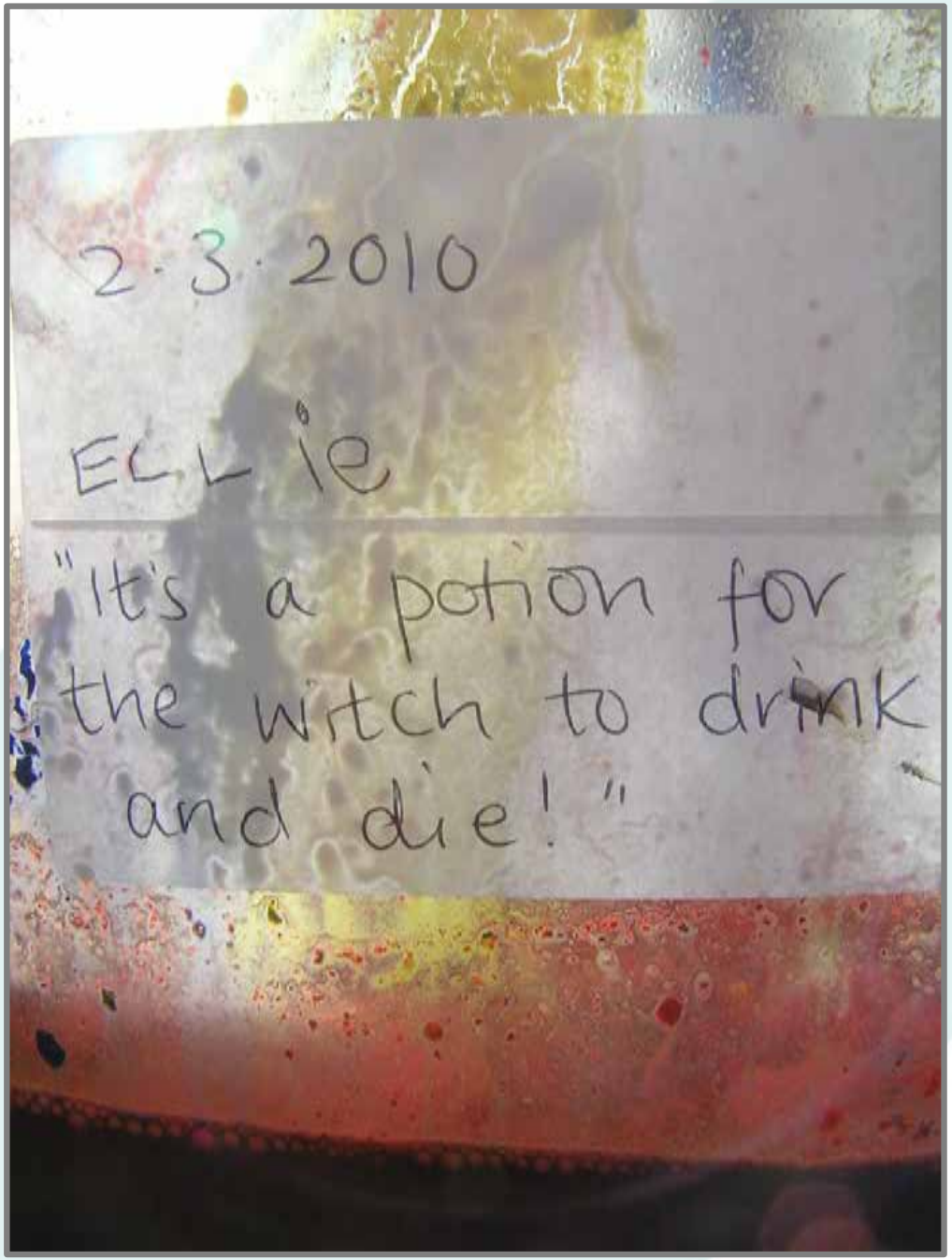
- Tunes into children's natural desires to mix, use their senses, imagine and share their ideas
- Encourages them to see the characteristics of substances through first hand experiences
- Helps children to consider consistency, texture, similarities and differences


Traffic Light
Mega Lollies


roll


Brandon
"Magic spell potion, if you drink it you will turn into a ladder or a eye ball, or a ear or a nose!" or teeth!"
2-3-2010
Contains Flavourings & Colourings


Maxons
-3-2010
"Magic Spell"
No Artificial Colours or Flavours
Yorkshire
It will turn
Mixture
you in toa frog
Maxons Ltd.
Sheffield S8 9QQ


2.3.2010
Ellie
"It's a potion for the witch to drink and die!"

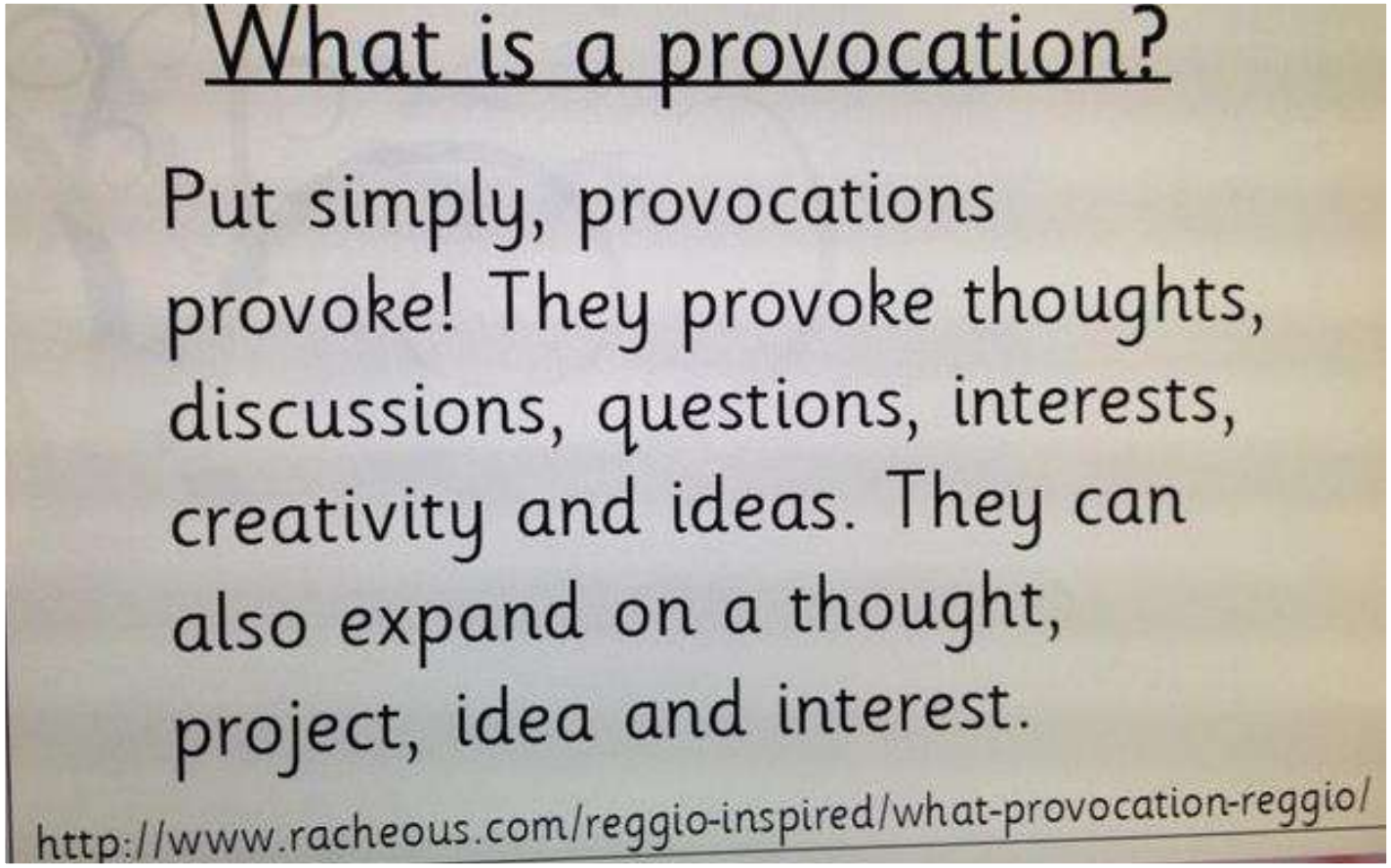

Leah 2.3.2010
"it will make your garden lovely"
Mega Lollies
JOSEPH DOBSON & SONS LTD
ELLAND YORKSHIRE HX5 ORU
Established 1850
CONTENTS 90

Potion Making Ideas


Bob

Exploring Collections

- For Children, collecting, sorting and using materials is the start of an amazing adventure
- For adults, it means rediscovering the richness and beauty in natural, unexpected and recyclable objects that are all around us, but often not noticed
- The goal is to let children become fluent with materials as if the materials were a language


What is a provocation?
Put simply, provocations provoke! They provoke thoughts, discussions, questions, interests, creativity and ideas. They can also expand on a thought, project, idea and interest.
http://www.racheous.com/reggio-inspired/what-provocation-reggio/

Setting up a studio space: A laboratory for thinking!

A place where thinking can be expressed through materials.

“The atelier, in our approach, is an additional space within the school where to explore with our hands and our minds, and where to refine our sight.....”

(Loris Malaguzzi, the founder of the schools for young children in Italy’s Reggio Emilia - the hundred languages of children)

“ Nevertheless, curiosity does not automatically lead to learning. Children’s spontaneous desire to explore is reinforced by the ‘practitioner’ when (s)he encourages the children to ask questions and think, providing them with opportunities to plan, observe, collect, process and interpret data, to reach and present conclusions.

The ‘practitioner’ must broaden the child’s horizons, expanding those horizons to take in new and meaningful experiences. In this way the children are initiated into the basic skills of the investigative process, and gradually begin to carry out more methodical inquiries.”

(Michalopoulou, 2012)

Think about the language of thinking

Think about the language of thinking

- Conversation is the sharing of ideas
- Talk is part of the toolkit for learning
- Use daily routines for extending scientific thinking
- Avoid closing down conversations with closed questions
- Your enthusiasm nurtures their thinking and supports them to pose questions
- Foster the language of observation and detail
- Introduce technical language to describe properties and what they see

Use ‘what’ instead of ‘why’

- What happened there?
- What did you try?
- What have you changed about what you are making?
- What are some of the ideas you have talked about that you haven’t tried yet?
- What have you seen other people trying?
- What do you notice about _____?
- What do you think will happen if we _____?

Challenge…

Create a set of challenges for children using a variety of building materials.

- How tall can you make it?
- Build a tunnel you can crawl through
- Build something as a team
- Build something in five minutes
- ‘Unbuild’ Slowly take apart a tower until it tumbles down

“The scientist is not a person who gives the right answers, he’s the one who asks the right questions.”

Claude Levi Strauss

‘Le Cru et le cuit’ 1964

“I wonder…” represents a class of linguistic lubricants. It marks the offering of a possible hypothesis, or a tentative idea with an invitation, (but not an insistence) to pick it up and improve it or take it further. For group discussions to take place such lubricants are necessary. Other examples include “maybe”, “seems like”, “perhaps” or “I think”…this kind of “exploratory talk” brings multiple minds together to work on the same problem in powerful ways.”

Peter Johnson

Interaction after their play

To help consolidate their learning and support your knowledge of what they know…

- Invite children to share their experiences
- Put their experiences into words
- Set the context for further play the next day

Ways to capture STEM

- Pictures, paintings, drawings
- Displays
- Photographs, video, computer, audio recording
- Graphs, pictograms and grids (initially through concrete representations)
- Photo recipe books
- Telling others!
- Floor books

Developmentally appropriate STEM cannot happen by itself.

To effectively implement STEM, teachers need to -:

- Bring intentional openness to new teaching and learning opportunities
- To work at organizing intriguing learning opportunities
- To nurture and celebrate children's amazing responses while doing activities

Energy, organization, and reflective enthusiasm are required on the educator's part.

Developmentally appropriate STEM is holistic. For the child, scientific problem-solving, artistic creative expression, and building and using meaningful structures all take similar self affirming, brain building exploratory processes.

Interaction with others about these experiences is natural, and positive interaction, especially with adults, is vital.

Dan Gartrell

"Play - play - and play some more! Trust in staff that they will drive toward high standards - *it's what they do best*, they have ingrained senses to do the right thing by children. But they need to be fascinated too - they need time to experiment - talk and 'play' with ideas together."

Nichola Potts, Head Teacher
Christ the King RC Primary School, Salford, Greater Manchester

ROYAL ACADEMY OF ENGINEERING

“I should ask that a gift to each child in the world be a sense of wonder so indestructible that it would last throughout life, as an unfailing antidote against the boredom and disenchantments of later years, the sterile preoccupation with things that are artificial, the alienation from the sources of our strength…

If a child is to keep alive his inborn sense of wonder, he needs the companionship of at least one adult who can share it, rediscovering with him the joy, excitement, and mystery of the world we live in.”

Rachel Carson, The Sense of Wonder (1998)

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