CUR106- STEM in Early Childhood Education - Handout

Welcome to CUR106

This course provides basic information about STEM (Science, Technology, Engineering, and Mathematics) education so early childhood educators can promote the development of foundational science and math skills in young children.

Course Objectives:

By taking notes on the handout and successfully answering assessment questions, participants will meet the following objectives as a result of taking this course:

- Recognize reasons why STEM should be emphasized in the early childhood environment
- Identify major branches of science
- Recognize the types of activities best suited to promoting the development of science and math skills in the early childhood environment
- Define intellect and identify activities that promote intellectual engagement in young children
- Identify the purpose and phases of the Project Approach to STEM learning
- Define recommended teaching practices, such as intentional teaching and encouraging inquiry
- Recognize the importance of integrating the arts and sciences
- Identify appropriate STEM content areas for the early childhood environment
- Identify characteristics of the appropriate use of technology in the early childhood classroom

References:


Additional Resources:

www.fredrogers.org
www.nga.org/center
http://teach.com/stem-education
www.edudemic.com
http://redleafpressblog.org/2013/02/06/stem-in-early-childhood/
http://www.teachpreschool.org/2012/06/stem/
http://successfultemeducation.org
http://ecrp.uinc.edu/beyond/seed/zan.html
http://www.claytonearlylearning.org/blog/?p=541
http://www.claytonearlylearning.org/blog/?p=1311
**Introduction to STEM**

*Use the space provided to record important information from this section of the course.*

What is STEM and why is it so important?

What are the branches of science?

List some science disciplines:

Why is it important to teach STEM topics during early childhood?

**Curriculum and Instruction**

As an early childhood professional, you should always keep in mind that - in addition to play and meaningful interaction - children learn best through:

**Teaching Goals**

*Intellect* is:

**Remember:** Young children learn through observation, exploration, experimentation, and through meaningful interactions and play. These are active, interactive, hands-on pursuits. (Yes, observation is both active and interactive, at least as far as the brain is concerned, especially when the child is observing the effects of a particular action or reaction.)
Academic instruction—lectures, memorization—typically puts children in a passive and receptive role rather than in an active and interactive role. By contrast, when children are investigating or involved in projects, they are more active, take responsibility and show initiative when it comes to representing and reporting data.

The Project Approach

What is the Project Approach and why is it appropriate and effective in the early childhood setting?

Basic Steps in the Project Approach

Phase 1—Getting Started
1. Children choose what to investigate, with some guidance from the teacher. Projects can be conducted as a whole group, in small groups, or on the individual level. Until children are familiar with the process, it is generally recommended that teachers encourage the class to agree on a single topic, for simplicity's sake, but this still leaves plenty of room for small groups or individuals to follow their own interests.
2. Children discuss what they already know about the topic. The teacher helps record their ideas.
3. With help from the teacher, the children list questions that they want to answer during their study.
4. Children talk about what answers they might find to their questions. The teacher lists their predictions.

Phase 2—Collecting Information
1. During class meetings, children report what they find in their fieldwork. The teacher encourages them to ask questions and make comments about each other's findings.
2. The children might organize and describe their findings by drawing or making models, taking photos, and creating graphs of their findings (such as measurements), depending on the nature of their inquiry. As they learn more, they can revise what they have made.

Project Approach—Phase 3—Concluding the Project
1. Children discuss the evidence they have found that helps them answer their questions. The teacher helps them compare what they have learned with what they knew before the project began.
2. Children decide how to show what they did and what they found out to parents and peers who were not involved in the project (such as children from another class).
3. Children create displays to share the story of the project with others. Displays might include their drawings, notes, stories, taped conversations, photographs, models, graphs, and videos. Children can also act out what they have learned (dramatic play).
4. Children might invite parents and other guests to a presentation about their project. The teacher can help the young investigators decide how to tell the story of what they did and what they learned.

Case Study

Teaching Practices
Intentional Teaching

Teaching for Understanding

Encouraging Inquiry

Providing Read-World Contexts

Building STEM Competencies
  
  
  
  
Following are three points to remember about young children and their abilities.

1)

2)

3)
Don’t Forget the Arts

Practical Methods for Implementing and Integrating STEM in the Classroom

Here is a short list of materials that promote learning related to STEM:

Key Content in Early STEM Education

Science

Physical Science

Life Science
Earth Science

Mathematics

Numbers and Operations

Algebra

Geometry

Measurement

Data Analysis

Technology

Engineering
Shaping the Environment

Learning Centers

Outdoor Environment

Author Amy Shillady outlines the things we look for in early childhood education when it comes to gardening and nature play in her book *Exploring Science*. Outdoor learning activities should be:

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Activities
TRY THIS!

**Shadow Dancing**
This activity enhances body awareness while introducing two basic concepts of Physical Science – light and shadow (Pica, 2009).
You will need:
- Large White Sheet
- String
- Lamp
- Recorded music

Have the children help you build a screen (Engineering) by holding the sheet as you swing it over a bar or a string that you have attached to the wall. Have the children face the screen. Set a lamp behind the children so that when you turn it on their shadows will appear on the screen (Technology). Start the music (Technology) and encourage the children to move any way they want. Have them describe how their shadows move on the screen. Ask them to move forward and back. Ask them if their shadow gets bigger or smaller (Math).

TRY THIS!

**Listening Walk**
This will give the children an opportunity to focus on the sense of hearing, appreciate their natural surroundings and get some additional physical exercise (Pica, 2009).
You will need:
- Listening ears
- Tape Recorder
- Chart Paper

Take the children on a walk explaining that they will need to listen very carefully noting all the different sounds they hear (Science). Notice if there are trees rustling, birds chirping, dogs barking, cars honking, etc. Record the sounds you hear (Technology) and play for the children when you get back to the classroom. Make a chart of the sounds the children recognized on the walk. Graph (Mathematics) how many children heard each sound. Encourage the children to portray each identified object, either by taking on its shape (Mathematics) or performing its movement. For example, after hearing leaves rustling in the breeze, they might take on the shape of a leaf or pretend to be a leaf shaking in the wind.

TRY THIS!

**Window Prism**
Children will see colors and patterns. They will notice that this rainbow−like image may appear in different parts of the classroom at different times of the day (Moomaw, 2013).
You will need:
- Prism

Hang a prism (Technology) in a window that lets in sunlight. This will produce a rainbow−like image that will move around the classroom. Ask the children to stand in between the image and the window and see what happens. They may understand that the light from the window is related to the images (Science). They can position the prism in different locations to see how the results differ. This is spatial awareness (Mathematics).

TRY THIS!

**Rock Collecting**
You will need:
- Rocks
- Balance Scale
- Magnifying Glass
- Books about rocks

Have the children collect rocks from around the school or bring some in from home. Provide magnifying glasses for them to look at the texture, color and shape of the rocks, a balance scale (Technology) to weigh the rocks, and books so that they can identify types of rocks. Encourage them to sort by size and shape and weigh them to see which one weighs the most or least (Mathematics). Introduce the rocks into the Block Center so children can use them in building (Engineering).
TRY THIS!

**Building with Mirrors**
You will need:
- Building blocks
- Blocks with mirrors mounted into frames, or small unbreakable mirrors, such as those made for school lockers

Children can position the mirrors in different areas of their block structure. They will discover that this allows them to see things that they otherwise could not see because the objects reflected by the mirror are positioned behind or to the side of the child’s position.

Ask the children to turn their mirror to see their friends building. Encourage them to place the mirror at the top of their building as see what happens.

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**Soft and Hard Building Surfaces**
**Materials Needed:**
- Wooden blocks
- Fabric
- Foam crafting material
- Cardboard

Provide both soft and hard items in the Block Center for building. Watch as children use the fabric to make roofs over their structures and cardboard to prop up against structures (Engineering). Talk about the flexibility and strength that each item has. The rigidity or stiffness of a material refers to its ability to resist being deformed when force is applied to it (Science). They may notice that when the cardboard and foam are creased to form an angle the cardboard is better able to maintain this shape (Math).

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**Natural Building Materials**
**Materials Needed:**
- Wooden classroom blocks
- Wooden cylinders cut from branches
- Assorted natural materials such as bamboo, dried grasses, bark, grapevine

Allow children to build freely with traditional wooden blocks and more natural materials (Engineering). Grapevine, for example, provides children with a somewhat pliable material to add to their creations to connect buildings or make “rope” ladders. As children examine the wood pieces they may see rings where the trees grew outward and not just upward. This is a Science concept. The other wood pieces probably come in many different sizes and shapes. Children can compare and sort these which would relate to Math concepts.

**Dino—Sorting**
**Materials Needed:**
- 12 or more toy dinosaurs of various sizes and colors
- Sorting tray divided into boxes by tape
- Variety of non-fiction books on dinosaurs

Many young children are interested in dinosaurs (Science). The idea of the activity is for the children to group the dinosaurs by attributes (Mathematics) such as color, size, type, horns or no horns, and meat or plant eater. Once they have sorted them you can help them graph them on the tray. Once they see all the dinosaurs in each column or row, they can tell which group has the most, fewest, and whether any groups have the same amount of dinosaurs (Mathematics). Various books about dinosaurs will add to the Science content. Books such as *Digging up Dinosaurs* by Aliki can help children make the Engineering connection.

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**Hold that Balance**
This cooperative activity involves balance (Science). The children will count to measure time which is a Math skill. The teacher can also use a stop watch to time the children (Technology).

**Materials Need:**
Stop watch

Have children stand in a circle and place their hands on the shoulders of the child next to them. Ask the children to rise onto their tiptoes and count the number of seconds they can remain still. Try this several times. Let one child help you set the stop watch as you time the children while they count. Do they always get the same number? What was the lowest number? What was the highest number? You can make this more challenging by asking them to stand on one foot. Record the times of this as well. Could they stand longer on one foot or two feet?

TRY THIS!

Wind Chimes
By making wind chimes children will discover that the force of moving air has the power to move objects, which can create sounds when they touch each other.

Materials Needed:
- Thick stick or wooden dowel 12 inches long for each child
- Selection of metal, wooden, and natural objects
- Cord or flexible wire

Let children select various sizes of metal washers, brass hoops, seashells, bells, pieces of bamboo and small sections of metal pipe (sanded to remove rough edges). Encourage them to compare the size and shape of objects (Mathematics). Help the children attach each item to string or flexible wire and attach to wooden stick or dowel (Engineering). Ask children to listen to the different sounds the items make and tell them this is called timbre in music (Science). Provide pictures of windmills and more modern wind turbines that you have found on the internet (Technology) so the children can see how wind power is used in other ways.

TRY THIS!

Tricycle Tracks
Materials Needed:
- Tricycles or other riding toys
- Tub of water
- Towels

Encourage children to ride over a wet area of the pavement or a wet towel you have laid on the pavement. They will then be able to see the tracks they made on the continuation of the pavement. They will notice that the water stuck to their tires which is adhesion (Science). You can place a dry towel down for them to ride over and they will see that there is not adhesion. Point out that the tire marks are always the same distance apart which is called parallel lines (Mathematics) and that they never cross as long as they continue in the same direction. The children will notice that the round tires created the straight line which in turn will draw their attention to the wheel and axle mechanism of the tricycle. The wheel and axle is a historic engineering and technological innovation that remains an important part of our lives. Tricycles themselves are in fact, a form of technology (Moomaw, 2013).

Field Trips