Co-constructing Meaning
Teaching science in the Early Childhood Classroom Using the 5e Learning Cycle Model
Things to do today...

1. 5e Learning Cycle Model
2. What is Waterford?
3. Hands-on
The 5e Learning Cycle Model
5e Learning Cycle Model
What is Waterford?
Waterford

...In a Nutshell
One size does not fit all
Diagnose individual student strengths & weaknesses
prescribe an individualized path of learning
Engaging Interactive Software
IWB Center

Density

19
Animal bodies
• To Chuck
Student Books & DVDs

Level One DVD Collection

Mela's Water Pot
Based on a Folk Tale

Written by Shelly Hurst Lonn
Illustrated by Haia Wittwer

ALWAYS LEARNING

PEARSON
Classroom Resource Kits
FARM FRIENDS

Farm Count

Visit a farm and observe a farmer at work. List the animals students see on the farm. Take the list back to class and make a chart, counting the number of animals on the farm.

Feetprints

- Horseshoe
- Hoof
- Marker

Trace around each student’s feet (five of each on a piece of construction paper for each student) and then arrange the footprints in order from 1 to 10. Then each student can arrange the footprints on the floor, with each footprint numbered and lined up, to help the farm animals to jump over.

Five and Four Fids

- 2 fids
- 4 fids
- 5 fids
- 6 fids
- 7 fids
- 8 fids
- 9 fids
- 10 fids

Many Fabringer-class activities require a group of students to work in teams. One way to use this idea is to have the students work as a team to solve a problem. For example, have the students work in groups of five or six to solve a problem involving a logical sequence or a problem-solving task.

FOAM

- Whirligig
- Toy gears
- Foam cubes

Fill a container with foam and allow students to explore the surface. Have them pretend to show the foam through a piece of paper, or use the foam to make a picture.

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Think with Me

These activities encourage students to think about the observation. Students identify the correct items, and write down the questions to the teacher.

REACHING ACTIVITIES

Objective

Identify the students who can recognize between objects by using visual cues:

REACHING ACTIVITIES

- Object recognition: Students identify objects that are present in the room, such as a clock, a book, or a toy. They are asked to locate the object and say its name.

SENSORS

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Alphabet Sort

- Case
- Marker
- Magnetic letters

Label each box with a letter of the alphabet. Give the students the names of a few objects and ask them to match the objects to the correct letter.

Letter Match

- Index cards
- Marker

Provide one card for each letter of the alphabet. Students match the letter on the card to the correct letter on the index card.

Farm Letters

- Table
- Whipped cream

Cover a long table with plastic and lay out a row of letters. Students pick up the letters and place them in the correct order. Discuss similarities and differences of different letters.

PEARSON
Co-constructing Meaning
The 5e Learning Cycle

- **Explore**
  - Perform Experiment
  - Construct a Model
  - Gather info

- **Explain**
  - Assessments
  - Thinking Map
  - Reflection

- **Engage**
  - Demonstration
  - Hands-on Activity
  - Video Clip

- **Elaborate**
  - Formulate new ?s
  - Utilize new vocab
  - Think Pair Share

- **Evaluate**
  - Assessments
  - Thinking Map
  - Reflection

*Start*
Model Lesson
Traits Song
Start

The 5e Learning Cycle

1. **Engage**
   - *Demonstration*
   - *Hands-on Activity*
   - *Video Clip*

2. **Explore**
   - *Perform Experiment*
   - *Construct a Model*
   - *Gather info*

3. **Explain**
   - *Assessments*
   - *Thinking Map*
   - *Reflection*

4. **Elaborate**
   - *Formulate new q's*
   - *Utilize new vocab*
   - *Think Pair Share*

5. **Evaluate**
   - *Assessments*
   - *Thinking Map*
   - *Reflection*

Start
**Activity**

1. Guess and record how many people at your table …
   - have freckles
   - can bend finger
   - can curl tongue

- Poll and record results
- Create graph to show results
George and Jack
Written by Elisa Black
Illustrated by Bruce Martin
The 5e Learning Cycle

**Explore**
- *Perform Experiment*
- *Construct a Model*
- *Gather info*

**Engage**
- *Demonstration*
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- *Reflection*

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- *Formulate new questions*
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- *Think Pair Share*

**Evaluate**
- *Assessments*
- *Thinking Map*
- *Reflection*

**Start**
Vocabulary

Inherited instinct/behavior - *a trait one is born with*

Learned behavior – *a trait that must be taught and learned*
Animal parents and baby cards

Activity

Match animal parent with its baby

Discussion

1. What trait does the baby inherit from his parent?
2. What behavior/trait does the baby learn from his parent?
The 5e Learning Cycle

**Engage**
- Demonstration
- Hands-on Activity
- Video Clip

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Start
### Activity

<table>
<thead>
<tr>
<th>Inherited Trait</th>
<th>Learned Behavior</th>
</tr>
</thead>
</table>

What did you learn?
1. Fold paper in half
2. Label
3. Draw pictures

What are some similar and different learned traits/behaviors that you share with your Partner?
The 5e Learning Cycle

Start

Evaluate
- Assessments
- Thinking Map
- Reflection

Engage
- Demonstration
- Hands-on Activity
- Video Clip

Explore
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Explain
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Always Learning

Pearson
Activity

Inherited or Learned Trait?

- Read each trait
- Categorize each trait as Inherited or Learned.
The 5e Learning Cycle

- Evaluate
  * Assessments
  * Thinking Map
  * Reflection

- Engage
  * Demonstration
  * Hands-on Activity
  * Video Clip

- Explore
  * Perform Experiment
  * Construct a Model
  * Gather info

- Explain
  * Assessments
  * Thinking Map
  * Reflection

- Elaborate
  * Formulate new ?s
  * Utilize new vocab
  * Think Pair Share

Start

Always Learning

Pearson
Make and Take Activity

Resources

Waterford Materials
Science Book
Lessons and Resources pages
Masters and Worksheets
Parent Newsletter

5e Lesson Plan Template
What is the role of the teacher?

Lesson preparation?

Expectations?

Thoughtful planning
1. Use software as recommended
2. Monitor student progress and performance
3. Home to school connection
4. Integrate student worksheets and certificates
5. Use the teacher resource materials
6. Customize the program
7. Provide ongoing professional learning opportunities
The 5e Learning Cycle

- **Engage**
  - * Demonstration
  - * Hands-on Activity
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- **Evaluate**
  - * Assessments
  - * Thinking Map
  - * Reflection

**Start**
How will the 5e Learning Cycle impact the way you teach science?
Questions???
The 5 E's of Science & Inquiry

**Engage**

May include one of the following...

- Demonstration
- Hands-on Activity
- Thinking Map
- Video Clip
- Internet Resource
- Magazine Article
- KWL chart

**Explore**

- Construct a Model
- Play with a material to gain prior knowledge
- Perform a give experiment
- Design an experiment
- Gather information from Internet sites

**Explain**

- Student discussion of results
- Structured questioning
- Creation of graphs and charts
- Draw a diagram
- Thinking Map - including the double frame
- Interaction with an expert

**Elaborate/Extend**

- Formulating new questions
- Utilizing new vocabulary
- Record observations
- Draw conclusions
- Think pair share

**Evaluate**

- Formative or summative assessments
- Thinking Map
- Finishing the KWL
- Reflection
- Portfolios

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**Levels of Inquiry**

**Direct Inquiry**

Activities are designed for students to analyze the data collected. The question and procedures are given.

Example: Students are given a stack of 5 nickels and told they will be removing the bottom nickel using a ruler, a nickel, and a toothpick. They are to find out which tool will move the bottom nickel farthest away from the stack. Then students will analyze the results.

**Coupled Inquiry**

Activities begin as direct inquiry, but as students draw conclusions, they then begin to test their own questions, or try a new procedure, or utilize different materials. This is a combination of direct and guided or open-ended inquiry.

Example: Once students completed the direct inquiry scenario above, they may choose to try the experiment with blocks to see if it is easier or more difficult to remove the bottom object. The student might choose to flick different sized coins at the bottom nickel to see which is most effective.

**Guided Inquiry**

Activities are student designed and evaluated. Only the question is given to students.

Example: Students are given the question, "How can we remove the bottom item from a stack of 5 without touching it with your hands?"

**Open-Ended Inquiry**

Activities are completely student designed, including the question.

Example: Provide students with a variety of items associated with the topic being covered. In other words, if your objective is for the students to learn how levers lift heavy objects, provide students different size/thickness wood (lever) and different weight objects and a fulcrum.

[https://sites.google.com/site/spectacularsensationalscience/the-5](https://sites.google.com/site/spectacularsensationalscience/the-5)
What is a 5E instructional model?
This model describes a teaching sequence that can be used for entire programs, specific units and individual lessons. NASA eClips™ supports the 5E constructivist learning cycle, helping students build their own understanding from experiences and new ideas.

**ENGAGEMENT**

The teacher or a curriculum task assesses the learners’ prior knowledge and helps them become engaged in a new concept through the use of short activities that promote curiosity and elicit prior knowledge. The activity should make connections between past and present learning experiences, expose prior conceptions, and organize students’ thinking toward the learning outcomes of the current activities.

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The purpose for the ENGAGE stage is to pique student interest and get them personally involved in the lesson, while pre-assessing prior understanding. During this experience, students first encounter and identify the instructional task. During the ENGAGE stage, students make connections between past and present learning experiences, setting the organizational ground work for upcoming activities. NASA eClips™ are designed to ENGAGE students. Through discussions, the videos may be used to uncover students’ prior understanding. The video format arouses students’ curiosity and encourages them to ask their own questions.

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These lessons mentally engage the students with an event or question. Engagement activities help students to make connections with what they know and can do.

**What the Teacher Does**

- Creates interest
- Generates curiosity
- Raises questions
- Elicits responses that uncover what the students know or think about the concept/topic

**What the Student Does**

- Asks questions, such as Why did this happen? What do I already know about this? What can I find out about this?
- Shows interest in the topic
EXPLORATION

Exploration experiences provide students with a common base of activities within which current concepts (i.e., misconceptions), processes, and skills are identified and conceptual change is facilitated. Learners may complete lab activities that help them use prior knowledge to generate new ideas, explore questions and possibilities, and design and conduct a preliminary investigation.

The purpose for the EXPLORE stage is to get students involved in the topic; providing them with a chance to build their own understanding. In the EXPLORATION stage the students have the opportunity to get directly involved with phenomena and materials. As they work together in teams, students build a set of common experiences which prompts sharing and communicating. The teacher acts as a facilitator, providing materials and guiding the students' focus. The students' inquiry process drives the instruction during an exploration. Students are actively learning through inquiry-based science instruction and engineering challenges. Emphasis is placed on: Questioning, Data Analysis and Critical Thinking. NASA eClips™ help students EXPLORE new topics on their own. Through self-designed or guided exploration students make hypotheses, test their own predictions, and draw their own conclusions.

Students work with one another to explore ideas through hands-on activities. Under the guidance of the teacher, students clarify their own understanding of major concepts and skills.

What the Teacher Does

• Encourages the students to work together without direct instruction from the teacher
• Observes and listens to the students as they interact
• Asks probing questions to redirect the students’ investigation when necessary
• Provides time for students to puzzle through problems
• Acts as a consultant for students
What the Student Does

• Thinks freely, but within the limits of the activity
• Tests predictions and hypothesis
• Forms new predictions and hypotheses
• Tries alternatives and discusses them with others
• Records observations and ideas
• Suspends judgment

***

• Construct a Model
• Play with a material to gain prior knowledge
• Perform a given experiment
• Design an experiment
• Gather information from Internet sites

EXPLANATION

The explanation phase focuses students’ attention on a particular aspect of their engagement and exploration experiences and provides opportunities to demonstrate their conceptual understanding, process skills, or behaviors. This phase also provides opportunities for teachers to directly introduce a concept, process, or skill. Learners explain their understanding of the concept. An explanation from the teacher or the curriculum may guide them toward a deeper understanding, which is a critical part of this phase.

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The purpose for the EXPLAIN stage is to provide students with an opportunity to communicate what they have learned so far and figure out what it means. EXPLAIN is the stage at which learners begin to communicate what they have learned. Language provides motivation for sequencing events into a logical format. Communication occurs between peers, with the facilitator, and through the reflective process. Once students build their own understanding, they may use NASA eClips™ to help summarize or EXPLAIN their own ideas. These segments introduce vocabulary in context and correct or redirect misconceptions.

***

Students explain their understanding of the concepts and processes they are learning. Teachers clarify students’ understanding and introduce new concepts and skills.

What the Teacher Does

• Encourages the students to explain concepts and definitions in their own words
• Asks for justification (evidence) and clarification from students
Formally provides definitions, explanations, and new labels

Uses students’ previous experiences as the basis for explaining concepts

What the Student Does

- Explains possible solutions or answers to others
- Listens critically to one another’s explanations
- Questions one another’s explanations
- Listens to and tries to comprehend explanations the teacher offers
- Refers to previous activities
- Uses recorded observation in explanations

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- Student discussion of results
- Structured questioning
- Creation of graphs and charts
- Draw a diagram
- Thinking Map - including the double frame
- Interaction with an expert

ELABORATION/EXTENSION

Teachers challenge and extend students’ conceptual understanding and skills. Through new experiences, the students develop deeper and broader understanding, more information, and adequate skills. Students apply their understanding of the concept by conducting additional activities.

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The purpose for the EXTEND stage is to allow students to use their new knowledge and continue to explore its implications. At this stage students expand on the concepts they have learned, make connections to other related concepts, and apply their understandings to the world around them in new ways. NASA eClips™ segments help students EXTEND and apply what they learned to new and unfamiliar situations

***

These lessons challenge students to apply what they have learned and build on the students’ understanding of concepts to extend their knowledge and skills.
What the Teacher Does

• Expects the students to use formal labels, definitions, and explanations provided previously
• Encourages the students to apply or extend the concepts and skills in new situations
• Reminds the students of alternative explanations
• Refers the students to existing data and evidence and asks: What do you already know? Why do you think...? (Strategies from Explore apply here also.)

What the Student Does

• Applies new labels, definitions, explanations, and skills in new, but similar situations
• Uses previous information to ask questions, propose solutions, make decisions, design experiments
• Draws reasonable conclusions from evidence
• Records observations and explanations
• Checks for understanding among peers

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• formulating new questions
• utilizing new vocabulary
• record observations
• draw conclusions
• think pair share

EVALUATION

The evaluation phase encourages students to assess their understanding and abilities and provides opportunities for teachers to evaluate student progress toward achieving the educational objectives.

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The purpose for the EVALUATION stage is for both students and teachers to determine how much learning and understanding has taken place. EVALUATE, the final "E", is an on-going diagnostic process that allows the teacher to determine if the learner has attained understanding of concepts and knowledge. Evaluation and assessment can occur at all points along the continuum of the instructional process. Some of the tools that assist in this diagnostic process are: rubrics, teacher observation, student interviews, portfolios, project and problem-based learning products. Video segments can be used to determine students’ depth of understanding. Students will be excited to demonstrate their understanding through journals, drawings, models and performance tasks.
Students assess their own knowledge, skills, and abilities. These lessons allow teachers to evaluate students’ progress.

What the Teacher Does

• Observes the students as they apply new concepts and skills
• Accesses students’ knowledge and/or skills
• Looks for evidence that the students have changed their thinking or behaviors
• Allows students to access their own learning and group-process skills
• Asks open-minded questions, such as Why do you think...? What evidence do you have? What do you know about it? How would you explain it?

What the Student Does

• Answers open-ended questions by using observations, evidence, and previously accepted explanations
• Demonstrates an understanding or knowledge of the concept or skill
• Evaluates his or her own progress and knowledge
• Asks related questions that would encourage future investigations

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formative or summative assessments

Thinking Map

finishing the KWL

reflection

portfolios

SOURCES

(Bybee, Taylor, Gardner, Scotter, Powell, Westbrook & Landes, 2009, p. 2)

http://www.nasa.gov/audience/foreducators/nasaclips/5eteachingmodels/

http://sd54.org/science/5es/

https://sites.google.com/site/spectacularsensationalscience/the-5
<table>
<thead>
<tr>
<th>Teacher:</th>
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<tr>
<td>Date:</td>
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<tr>
<td>Subject / grade level:</td>
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<td>Materials:</td>
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**NC SCOS Essential Standards and Clarifying Objectives**

**Lesson objective(s):**

**Differentiation strategies to meet diverse learner needs:**

**ENGAGEMENT**
- Describe how the teacher will capture students’ interest.
- What kind of questions should the students ask themselves after the engagement?

**EXPLORATION**
- Describe what hands-on/minds-on activities students will be doing.
- List “big idea” conceptual questions the teacher will use to encourage and/or focus students’ exploration.

**EXPLANATION**
- Student explanations should precede introduction of terms or explanations by the teacher. What questions or techniques will the teacher use to help students connect their exploration to the concept under examination?
- List higher order thinking questions which teachers will use to solicit student explanations and help them to justify their explanations.

**ELABORATION**
- Describe how students will develop a more sophisticated understanding of the concept.
- What vocabulary will be introduced and how will it connect to students’ observations?
- How is this knowledge applied in our daily lives?

**EVALUATION**
- How will students demonstrate that they have achieved the lesson objective?
- This should be embedded throughout the lesson as well as at the end of the lesson.
**The Teaching Process**

<table>
<thead>
<tr>
<th>Instructional Sequence</th>
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<tbody>
<tr>
<td><strong>Phase One: Engage the Learner</strong></td>
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<tr>
<td>These activities mentally engage students with an event or question. Engagement activities capture students' interest and help them to make connections with what they know and can do. The teacher provides an orientation to the unit and assesses students' prior understanding of the concepts addressed in the unit.</td>
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<tr>
<td>What’s the teacher doing?</td>
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<tr>
<td><strong>Phase Two: Explore the Concept</strong></td>
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<tr>
<td>Students encounter hands-on experiences in which they explore the concept further. They receive little explanation and few terms at this point, because they are to define the problem or phenomenon in their own words. The purpose at this stage of the model is for students to acquire a common set of experiences from which they can help one another make sense of the concept. Students must spend significant time during this stage of the model talking about their experiences, both to articulate their own understanding and to understand another's viewpoint.</td>
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### Phase Three: Explain the concept and define terms

Only after students have explored the concept does the curriculum and/or teacher provide the scientific explanation and terms for what they are studying. The teacher may present the concepts via lecture, demonstration, reading, or multimedia (video, computer-based). Students then use the terms to describe what they have experienced, and they begin to examine mentally how this explanation fits with what they already know.

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### Phase Four: Elaborate the Concept

Students elaborate on their understanding of the concept. They are given opportunities to apply the concept in unique situations, or they are given related ideas to explore and explain using the information and experiences they have accumulated so far. Interaction between the students is essential during the elaboration stage. By discussing their ideas with others, students can construct a deeper understanding of the concepts.

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### Phase Five: Evaluate students’ Understanding of Concept

The final stage of the model has a dual purpose. It is designed for the students to continue to elaborate on their understanding and to evaluate what they know now and what they have yet to figure out. Evaluation of student understanding should take place throughout all phases of the instructional model. The evaluate stage, however, is when the teacher determines the extent to which students have developed a meaningful understanding of the concept.

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