Cultivating your English Vocabulary through STEM Activities

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Webinar Goals

• **Define** STEM English and examine how it relates to other key English language teaching concepts

• **Demonstrate** how to use Inquiry-based Instruction to teach STEM content – especially vocabulary

• **Explore** how to apply vocabulary learning strategies in the classroom
What is STEM English?

STEM
Science
Technology
Engineering
Math

STEM English
**STEM English** is also referred to as **STEMM** (Science, Technology, Engineering, Math, and **MEDICINE**)

**STEAM** (Science, Technology, Engineering, the **ARTS**, and Math)
What is General English?
What is English for Specific Purposes?

English for Specific Purposes is also called ESP

Let’s take a poll!
STEM and ESP - Similarities

• STEM
  Science, Technology, Engineering, and Math

• ESP
  English for Specific Purposes

Let’s take a poll!
STEM English is different from General English

Greek words

Latin words
Other examples of Greek or Latin words in English

**Bio** – 
life

*Autobiography* – a book about a person’s life written by that person

*Biology* – the study of life

*Photobiology* – the study of light (photo) and life

**Rept** – 
to crawl

*Reptile* – cold-blooded animal with scales that often crawls

*Crept* – to crawl (past tense)

*Surreptitiously* – to do something in a sneaky way, like a crawling animal

**Geo** – 
of the earth

*Geology* – the study of the history of the earth

*Geography* – the study of physical features of the earth

*Geopolitical* – international relations (of the earth)

Source: American Heritage Dictionary, Free Dictionary
STEM Lesson - Hydroponics and Vocabulary
Vocabulary Activity
How to make a foldable vocabulary book
Vocabulary Activity
How to make a foldable vocabulary book
Help students write in their new vocabulary foldable!

- Greek prefix
- Prefix meaning
- Greek root
- Root meaning

Hydro
- Greek meaning: hydro or water
- Greek meaning: to labor or to work

Ponics
- Greek meaning: ponos or to labor to work
Help students write in their new foldable!

- Draw a picture of the word
- A list of related words (hydro-)
- A list of related words (-ponics)

- hydrate
- dehydrate
- rehydrate
- hydration

- Aeroponics
- Geoponics
- Aquaponics
Your new foldable vocabulary page is complete!

Aeroponics
Geoponics
Aquaponics
What is Content-based Instruction?

- Meaningful
- Relevant content
- Contextual
- Authentic materials
More about Content-based Instruction

ENGLISH WITH TASKS

Do something with English
More about Content-based Instruction
5 Steps for Creating Inquiry-based Instruction (The 5 E’s)

1. ENGAGE
2. EXPLORE
3. EXPLAIN
4. ELABORATE
5. EVALUATE

Adapted from: National Academy of Science National Science Education Standards (1996)
1. ENGAGE

- Curious students
- Background knowledge
- Personal connections
- Visual aids
1. ENGAGE - ACTIVITY
## 1. ENGAGE - ACTIVITY

<table>
<thead>
<tr>
<th>K-KNOW</th>
<th>W-WANT TO KNOW</th>
<th>L-LEARNED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Kinds of agricultural techniques in my country</td>
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<tr>
<td></td>
<td>Local vegetables</td>
<td></td>
</tr>
<tr>
<td></td>
<td>What are useful words to describe hydroponics?</td>
<td></td>
</tr>
</tbody>
</table>
2. EXPLORE

Cooperative Learning

• Investigate
• Observe
Fun ways to group students

1. Pass out a different colored piece of paper to each student

2. Direct students to different corners of the room
Fun ways to group students

Pink – stalks
Green – stems
Blue – leaves
Yellow – roots
2. EXPLORE - ACTIVITY

Make a word wall

Help students group words

Brainstorm a list of words

PRESENT CONTINUOUS
- growing

SIMPLE PAST
- found

ACADEMIC WORDS
- submerge
- administered
- suspended

verbs
2. EXPLORE - ACTIVITY

Help students group words – make a word wall
2. EXPLORE - ACTIVITY

Make a Graphic Organizer

Hydroponics

Hydrate
Rehydrate
Dehydrate
Hydration

Hydro -
water

ponics –
to work, to
labor
2. EXPLORE - ACTIVITY

Hydroponics

From Open Source Ecology

Main > Food and Agriculture > Controlled-environment growing

Hydroponics is the practice of growing plants in nutrient-enriched water rather than soil.

Hydroponics is incredibly productive and requires little space. For example, Factor e Farm's experiments found that they could grow $1 of lettuce per square foot per week. And the Institute of Simplified Hydroponics (http://carbon.org/) has found that they can grow 2kg of vegetables a day on 20m² of space [1].


There are 6 main techniques used in hydroponics. The Drip hydroponics system (http://uponics.com/hydroponics-system/) continuously drips nutrient solution onto the plants roots. The Ebb and Flow (Flood and Drain) system floods the grow bed and hydroponics growing medium (http://uponics.com/hydroponics-system/) with a nutrient solution, then this solution slow drains back to the reservoir. Roots benefit from these periods of wetness and dryness. Deep Water Culture simply submerges roots in a nutrient solution. Less common hydroponics systems include the Wick System (where a fabric material wicks nutrient solution from the reservoir up to the roots), Nutrient Film Technique (where nutrient solution runs down long channels or tubes and passes over bare roots), and Aeroponics (where nutrients are administered via misting suspended and bare-rooted plants).

See here (http://www.hydroponicsonline.com/blog/easy-to-build-hydroponic-system) for free instructions on building several different hydroponic systems. N55 have a design for a vertical hydroponic system here (http://www.n55.dk/MANUALS/HOME_HYDRO/HOME_HYDRO.html). See Wikipedia on hydroponics (http://en.wikipedia.org/wiki/Hydroponics) for more information.

Open source software for automating hydroponic systems (http://hmeter.sourceforge.net/).

http://opensourceecology.org/wiki/Hydroponics

New vocabulary

• misting
• submerge
• aeroponics
• reservoir
• eliminate
3. EXPLAIN

- Teacher-directed
- Introduce scientific and technical information
- Clarify students’ misconceptions
3. EXPLAIN

Direct (explicit) instruction

Hydroponics is the practice of growing plants in nutrient-enriched water rather than soil.

Hydroponics is incredibly productive and requires little space. For example,
Hydroponics is the practice of growing plants in nutrient-enriched water rather than soil.

Hydroponics is incredibly productive and requires little space. For example, Factor e Farm's experiments found that they could grow $1 of lettuce per square foot per week. And the Institute of Simplified Hydroponics (http://carbon.org/) has found that they can grow 2kg of vegetables a day on 20m² of space [1].
3. EXPLAIN – Review word beginnings/endings with students

Common Prefixes and Suffixes – Group Words

<table>
<thead>
<tr>
<th>NOUNS</th>
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<tbody>
<tr>
<td>SUFFIX</td>
<td>MEANING</td>
<td>EXAMPLE</td>
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<tr>
<td>--------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>-ion</td>
<td>action, condition</td>
<td>hydration</td>
</tr>
<tr>
<td>-ic</td>
<td>quality, related to science</td>
<td>hydroponic</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VERBS</th>
<th></th>
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<tr>
<td>--------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>-ate</td>
<td>to cause to be</td>
<td>hydrate</td>
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<table>
<thead>
<tr>
<th>PREFIX</th>
<th>MEANING</th>
<th>EXAMPLE</th>
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<tbody>
<tr>
<td>re-</td>
<td>again and again</td>
<td>rehydrate</td>
</tr>
<tr>
<td>de-</td>
<td>remove, separate</td>
<td>dehydrate</td>
</tr>
</tbody>
</table>
3. EXPLAIN - Teach words in context

“Indoor growing in a greenhouse greatly reduces losses to pests.”

3. EXPLAIN - Teach words in context

DEFINITION CLUES

autotroph

Many organisms cannot produce their own food, unlike autotrophs. (CONTRAST)

Autotrophs are organisms capable of nourishing themselves. (DEFINE)

auto - self

troph - to nourish

SOURCE: Biologyonline.org
3. EXPLAIN - Teach words in context

SYNONYM CLUES

tegmentum

The tegmentum, with many layers of tissue twisting under the cranium, provided us with an excellent medical example for class.

*tég* - cover

*ment* - refers to mind or brain
PROBLEMS

• Importing seafood
• Not enough food for fish
• Soybean shortage

SOLUTIONS

• Saving natural resources
• Aquaculture research
4. ELABORATE
4. ELABORATE - ACTIVITY

- Design a tourism brochure
- Create an instruction manual
4. ELABORATE - ACTIVITY

Interview a local farmer

Create a recipe using local produce
5. EVALUATE

INFORMAL EVALUATION
- brochure
- observation
- vocabulary activities

FORMAL EVALUATION
- test
- quiz
- report
Phototropism

The experiment included the idea of phototropism because as the sun emerged, the plant directed itself toward the light.

Let’s take a poll!
Phototropism: A new STEM-related vocabulary lesson

Content-based instruction

Gather critical vocabulary related to Tropism (content-specific)

Students do something with the new vocabulary

Inquiry-based Instruction (5 Es)

Engage, Explore, Explain, Elaborate, Evaluate

Authentic Materials

- Science textbook
- Videos
- News articles
Vocabulary Notebook – a second way
Vocabulary Notebook – a second way

Fold the corner
Write a sentence in context:

"Phototropism is when a plant moves toward the sun."

Phototropism

Define word parts:
- **photo**: (Greek) light

List synonyms:
- **luminous**
- **SYNONYM** luminous
- **SYNONYM** react

Provide many ways for students to encounter words (rich, deep contexts):
Design and conduct an experiment

Phototropism

Materials
- 1 small container
- 2 rubber bands
- 1 small wild plant
- 1 napkin
- Water
- Classroom shelf
- 2 pieces of plastic

Adapted from Loeschnig, L.V. (1996). Simple earth science experiments with everyday materials
Create a lab report with your new STEM-related vocabulary

LAB REPORT

• Title
• Introduction
• Hypothesis
• Materials
• Procedures
• Results
• Conclusion
**Title:** Effects of **excessive** water on phototropism in classroom **vegetation**

<p>| <strong>Introduction:</strong> | Objectives, purpose, Why? |
| <strong>Hypothesis:</strong> | Explanation, theory |
| <strong>Materials:</strong> | |
| <strong>Procedures (Experiment):</strong> | |
| <strong>Results:</strong> | |
| <strong>Conclusion:</strong> | |</p>
<table>
<thead>
<tr>
<th><strong>Title:</strong> Effects of <strong>excessive</strong> water on phototropism in classroom vegetation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction:</strong></td>
</tr>
<tr>
<td><strong>Hypothesis:</strong></td>
</tr>
<tr>
<td><strong>Materials:</strong> List of items (soil, nutrients, container)</td>
</tr>
<tr>
<td><strong>Procedures:</strong> Describe the steps</td>
</tr>
<tr>
<td><strong>Results:</strong></td>
</tr>
<tr>
<td><strong>Conclusion:</strong></td>
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</table>

**Use adverbs of time**
- today, later, after, frequently

**Use adjectives**
- First, second, third, etc.

**Units of measurement**
- Kilogram
**Title:** Effects of *excessive* water on phototropism in classroom vegetation

<table>
<thead>
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<table>
<thead>
<tr>
<th>Procedures:</th>
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<table>
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<tr>
<th>Results: Shares the findings of the experiment</th>
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<table>
<thead>
<tr>
<th>Conclusion: A summary; very short</th>
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</thead>
</table>

- According to...
- My results indicate...
- conclude
- identified

**What have you found? What did you discover?**
Give yourself a hand!

You’ve successfully helped students learn new STEM-related vocabulary through:

Content-based Instruction, Inquiry-based Instruction and vocabulary activities!

Let’s take a final poll!
Cultivating your English Vocabulary through STEM Activities

Thank you!
Sources

• American Heritage Dictionary: https://ahdictionary.com/

• Biology Online: biologyonline.com


• Open Source Ecology - Hydroponics: http://opensourceecology.org/wiki/Hydroponics