An Integrated Approach to Teaching High School Earth and Space Science Standards

Jennifer Garland, Belleville HS
Rebecca Caldwell, Livonia PS
Michigan Merit Curriculum requires students to earn 3 science credits which address the full spectrum of standards specified in the Michigan Science Standards.
But what if your school sequence is...
In this quick sorting activity, place the HS NGSS Earth Science standards into an existing course.

Sorting PEs Cards

Livonia Course Alignment
## LPS Integration LITE

<table>
<thead>
<tr>
<th>Class</th>
<th>Life Science</th>
<th>Physical Science</th>
<th>Earth Science</th>
<th>Total Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology</td>
<td>24</td>
<td></td>
<td>7</td>
<td>31</td>
</tr>
<tr>
<td>Chemistry</td>
<td>13</td>
<td>12</td>
<td>3</td>
<td>16</td>
</tr>
<tr>
<td>Physics</td>
<td>12</td>
<td></td>
<td>1</td>
<td>13</td>
</tr>
</tbody>
</table>

- 11 of 19 ESS are found within 3 course sequence
- Remaining standards are found in electives
Chemistry

- HS-PS1-8. Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.

Earth Science

- HS-ESS1-1. Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun’s core to release energy that eventually reaches Earth in the form of radiation.
- HS-ESS1-3. Communicate scientific ideas about the way stars, over their life cycle, produce elements.
Atomic Theory: Part 1

Phenomenon: Radioactivity

100 Greatest Discoveries

Self Assessment

Students talk with partners and discuss what they already know about radiation. Then fill out a self assessment and watch video… make observations and generate questions.

Story line

● Q1: What is the current model of an atom?
● Q2: Are all atoms radioactive?
● Q3: What are the different types of radiation?
● Q4: How long does it take for something to radioactively decay?
● Q5: What are the uses of radioactivity?
Atomic Theory: Part 2

How does fusion power the sun?

Q1: What are the similarities and differences of fission and fusion?

Q2: How does fusion on the sun work?

Q3: Life span of the sun… does that mean the sun will die? Is this the same or different than other stars?

Q4: How does the existence of stars explain where elements came from?
Articles from ChemMatters

Nuclear Chemistry

- The Sun - Fusion at Work
- Where Do Chemical Elements Come From?
How to introduce phenomenon and get students to generate their own questions?

- Record observations → Go Public
- Generate some initial explanation or model → Go Public
- Examples of related experiences → Go Public
- What questions could we investigate to help explain the phenomenon?
How to introduce phenomenon and have students generate their own questions?

RIGHT QUESTION FORMULATION TECHNIQUE

- Brainstorm questions
- Label open/closed
- Revise questions
- Prioritize Questions
Supported with ELA and SS
Using **Project Based Learning** to meet Life and Earth Sci NGSS Standards in BioLit
Biology Bundling DCIs

**Life Science**

- Ecosystems: Interactions, Energy, and Dynamics

**Earth Science**

- Earth Systems
- Earth & Human Activity
Bundling Performance Expectations

**Biology**

HS-LS2-7.

Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*

[Clarification Statement: Examples of human activities can include urbanization, building dams, and dissemination of invasive species.]

**Earth Science**

ESS3-4.

Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.*

[Clarification Statement: Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use]
HIP to Make a Change

HIP = Human Impacts & Populations
What’s the problem?

Who needs your help?
Greta sits in front of parliament on Fridays instead of going to school.

#FridaysForFuture
What’s Currently being done?
What Human Impacts are having *Negative* Impacts?

1) With your team- choose one impact to research

2) Investigate it, evaluate solutions, & suggest improvements to it

3) PSA- Use your Ethos/Pathos/ Logos training to get ‘em

4) Be a part of our “FriDay of Change”
Major Deliverables

- Design your own survey about your human impact and have the other 9th grade students take it
- Collect the data, analyze it, use google sheets to graph it
- PSA - Solution to an Impact
- “ReTrash It” piece
ReTrash It

Design, build, and construct a new item made from trash or items headed to the landfill

The Belleville Area Arts Council will select 3 pieces to enter into a youth competition in southeastern Michigan and members of those teams will be invited to an art expo hosted by Waste Management on November 2nd.
#FridaysForFuture
Our Contact Information

Rebecca Caldwell
Livonia Public Schools
rcaldwel2@livoniapublicschools.org

Jennifer Garland
Belleville High School
jgarland@vanburenschools.net