Curriculum Exchange: Framing Engineering – Templates to aid in instructional design

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Target Grade Level: K-12

Designed for: Teachers, Content Coaches, Instructional Specialists, CTE leaders, Curriculum Designers

Background
Framing routines are a widely used literacy strategy to support students in the organization of topics, main ideas and details of information. Framing techniques can be used to support teachers in the design of engineering curriculum into the K12 classroom. In this session, several framing templates will be presented. Some templates presented were designed by school districts in Palm Beach County, Florida, while others were developed by the author. These easy to use tools have been presented to, and tested by over 100 teachers in Palm Beach County, Florida during professional development sessions, and have been found to allow teachers to design their own engineering activity within their classrooms based on the specific need of the teacher. Several examples of teacher designed lessons using the templates will be presented.

Using the Frame Routine – teachers use content from their Common Core, and Next Generation Science Standards to design an engineering activity. The frame takes the big ideas from each of the content areas, helps teachers to break the ideas into topics, and then performance tasks that will be incorporated into an engineering activity for students within their grade level. For example, in one professional development session teachers, using strands from social studies, mathematics, science and language arts, designed an engineering activity to “build a better shelter”. Teachers designed an integrated unit where students in grades 3-5 learned about native American shelters, the climate, environment and biomes that these shelters existed in, the mathematics behind the shape, materials and structure of the shelter, and then using an engineering design activity, students designed and tested improved shelters for their selected native culture. Students then communicated their findings through writing and drawing. The Frame Routine guided teachers into finding curriculum learning objectives and knitting them together to create an engineering activity that allowed for integrative learning for students. In addition to the Frame Routine that guides the teacher, there is an Engineering Design Frame that supports teachers in creating the engineering design activity in accordance with accepted engineering design principles. Teachers reported using these frames helped them create integrated units that culminated in an engineering design activity tied to curriculum content.

During curriculum exchange copies of the tools will be available to teachers, and examples of teacher created units using the templates will be shown. Teachers will be able to start to work through and use the design templates to get a better feel for how they can be incorporated into lesson design. These tools are ideal for use in Lesson Study or Professional Learning Communities, or as part of co/team teaching.

Below is an example of a filled Frame:
### Engineering Idea

*Students will make a model of a particular Native dwelling and seek to improve upon the existing design.*

<table>
<thead>
<tr>
<th>Main Idea - mathematics</th>
<th>Male Idea - science</th>
<th>Main Idea - literature</th>
<th>Main Idea - social studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Looking for pattern in shape &amp; purpose</td>
<td>Taxonomy of Science</td>
<td>Compare native cultures &amp; dwellings Americas</td>
<td>Comparing Cultures: Native People</td>
</tr>
</tbody>
</table>

**Essential details & Sketch**

- Students will see a pattern between dimensions in Native dwellings & a purpose by purpose design.

**What students will do**

- Sort sizes of dwellings into categories.

**Essential details & Sketch**

- Students will investigate dwelling design to design to habitat of native people.

**What students will do**

- Create a question to investigate patterns.

**Essential details & Sketch**

- Students will identify loops of dwelling design & use dimensions to design a dwelling.

**What students will do**

- Ask a dwelling question related to structure - students will use engineering design to help answer this question.

**Essential details & Sketch**

- Students will make a chart to identify natural resources, habitat, culture & climate constraints on dwelling design.

**What students will do**

- Students will design a poster to present findings.

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**3rd grade**