Guidance around NGSS Curriculum Mapping Decisions

The process of creating a useful curriculum map likely begins with 'bundling' the performance expectations (PEs) into instructional units. Different ways to bundle have been suggested in literature related to the NGSS ranging from a focus on one, to all three of the dimensions of the NGSS. The following guidance is based on bundling of PEs which incorporate all three dimensions of the NGSS; Disciplinary Core Ideas, Science and Engineering Practices, and Cross Cutting Concepts. There are a number of factors that can potentially influence how these bundles are configured. Factors to consider in creating bundles ***might*** include:

- **Similarities in content**-Are there certain ideas that logically belong together?
- **Instructional efficiency**- Do some performance expectations listed in different topics within the science make sense together because of factors other than content (such as requiring similar math skills or using similar lab practices)?
- **Collaboration opportunities**- Would bundling in a certain way allow for cross-disciplinary planning? For example, an economics unit in social studies could be taught together with a science unit that is intentionally bundled to include the performance expectations addressing cost/benefit analysis and constraints on design solutions to reduce human impacts?
- **Access to resources**- Do certain bundles of PEs make sense because a useful resource exists to aid in instruction when configured in a particular way? Some examples include local partnerships with industry or professional organizations, access to science/engineering practitioners or access to facilities.
- **Incorporation of the Engineering Design standards**- Do certain configurations of PEs allow for a logical and relevant opportunity to engage in some or all of the Engineering Design (ETS) PEs for the grade band? **The Kentucky Core Academic Standards for Science (KCAS) assign all of the appropriate grade band Engineering Design (ETS) standards to each grade level, so the unit bundles for every grade/year need to incorporate all Engineering Design standards.**

When considering these factors, it is likely that any grade level or course can be configured in multiple ways that are equally reasonable and instructionally sound.

The bundling process:

The KCAS incorporates the topic version of the NGSS, so the performance expectations are already sorted into topics. The most simplistic approach to bundling would be to simply adopt the PEs in each topic as individual units, but this approach has only speed as an advantage. There are significant disadvantages of this approach because it considers few of the factors noted above. This approach is also incomplete because it does not incorporate the engineering design standards into the other topics in a thoughtful way.

A more thorough approach is to intentionally sort the performance expectations based upon their individual content. A process to consider is to enlarge and print all of the performance expectations(http://education.ky.gov/curriculum/sci/Documents/Science%20Curriculum%20Mapping%20Cards.zip) for a specific grade/course, then cut them apart into individual slips so they can be physically manipulated. These slips can be configured in multiple ways until agreement is reached on the most useful instructional groupings. It is recommended to print multiple copies of the ETS standards if using this process, because they can be incorporated into multiple bundles. Doing this also helps to discourage creating just a single engineering design unit that doesn't tightly integrate with other concepts for this course.

Bundling is the first step in both curriculum mapping and also instructional unit design. For more detailed guidance on creating true instructional units from these bundles, download the KDE Guide to Developing Standards-based Units (http://education.ky.gov/curriculum/docs/Documents/How%20to%20Develop%20a%20Standards%20Based%20Unit%20of%20Study.pdf)

Sequencing the bundles:

After agreement is reached on the configuration of the bundles, they can then be arranged into an instructional sequence.

Sequencing considerations:

- Are there particular PEs or dimensions within the PEs that serve as strong "linkages" –or "transitions" between units? Do those links imply an instructional sequence; in other words, must one unit be taught first in order for the link to make sense conceptually or instructionally?

- Does the instructional sequence tell a coherent "story"? Is there a logical progression of the units so that each 'flows' into the next in a way that provides students with opportunities to discover connections and the interrelated nature of the various disciplines of science?

- Are there external factors that must be considered in establishing a sequence, such as seasonal availability of resources, sharing of materials, length of time needed for ongoing investigations, etc.?

- Are there instructional connections that can be made across content areas? For example, are there mathematics concepts that must be mastered earlier in the year before a science concept can be taught?

Documenting the process:

In an attempt to validate this curriculum mapping process and uncover any potential difficulties, a team of teachers worked to bundle and map the standards for three courses: 1st grade, 8th grade