Crosswalk of the LEAP Framework with the *Framework for K-12 Science Education*
developed by the iHub Team

Learning Environment

Positive Classroom Culture and Climate (LE.1, LE.2)
A key principle of the *Framework* is that instruction should build on diverse student interests and experiences. It recommends teachers build on students' "cultural funds of knowledge," that is, the knowledge of the natural world that different cultural groups bring to science classrooms. It also recommends building on the assets and skills that members of different cultural groups bring.

Effective Classroom Management (LE.3, LE.4)

Implements high, clear expectations for students' behavior and routines (LE.3). Behavior expectations in *Framework-aligned* instruction are for students to "act like scientists," which often includes students engaging in reasoned argument with each other. It is critical that the norms students follow are the norms of science and engineering practices.

Routines and rituals are motivational and organized around the structure of science and engineering practices (e.g., planning an investigation, engaging in argument from evidence), and by the end of the school year, students understand how to carry out these routines with minimal teacher guidance.

Classroom resources and physical environment support students and their learning (LE.4). Exemplars of student work displayed should show different levels of student thinking as represented in a *hypothetical learning progression*. The progressions in the *Framework* specify increasingly sophisticated levels of skill in participation in science and engineering practices, as well as understanding of disciplinary core ideas.

Science tools and equipment necessary for student investigation are available or are developed by students in *Framework*-aligned instruction.

Instruction

Masterful Content Delivery (I.1, I.2, I.3., I.4)
Clearly communicates the standards-based content-language objective(s) for the lesson, connecting to larger rationale(s) (I.1). In *Framework-aligned* instruction, the teacher does not post the standard on the board, because it would give away what the students are expected to figure out using science and engineering practices. Instead, the driving question or design challenge could be posted. What should always be clear to students is why they are doing what they are doing. Students should be able to describe how what they are doing helps to explain a scientific phenomenon or solve an engineering design problem. In addition,

a language objective can be made clear in terms of students' contribution to classroom discussion.

Provides rigorous tasks that require critical thinking with appropriate digital and other supports to ensure students' success (I.2). In *Framework-aligned* classrooms teachers provide appropriate, rigorous and authentic tasks that engage students in critical thinking and analysis related to science practices. Students will justify their reasoning and construct explanations to be delivered verbally or in writing. Teachers facilitate the critical thinking and analysis process by asking driving questions to guide student thinking and provide appropriate digital resources/tools to support rigorous investigations.

Intentionally uses instructional methods and pacing to teach the content-language objective(s) (I.3). In *Framework-aligned* classrooms, students make connections among the relationships of various core ideas through rigorous investigations, discussion, and explanation. They identify these as crosscutting concepts in science. The teacher uses appropriate instructional strategies (addressing misconceptions, science practices, asking questions, appropriate student/teacher talk) and tools (media, digital technology) to engage students in building content knowledge and engaging in science practices.

Ensures all students active and appropriate use of academic language (I.4). Language expectations in *Framework-aligned* classrooms engage students in scientific practice by using appropriate academic language through reading, writing, listening, and speaking.

High-Impact Instructional Moves (I.5, I.6, I.7, I.8)

Checks for understanding of content-language objective(s) (I.5). In *Framework*-aligned instruction, teachers use a variety of assessment tasks that allow them to assess progress toward "three-dimensional" science learning; that is, they assess integrated understandings of disciplinary core ideas (DCIs), science and engineering practices (SEPs), and crosscutting concepts (CCCs).

Provides differentiation that addresses students' instructional needs and supports mastery of content-language objective(s) (I.6). In *Framework*-aligned instruction, teachers interpret student responses to assessment tasks in light of a hypothetical learning progression for how student understanding might be expected to develop.

Provides students with academically-focused descriptive feedback aligned to content-language objective(s) (I.7). In *Framework*-aligned instruction, teachers' questions elicit students' reasoning about and application of disciplinary core ideas, not just their understanding of facts. They provide opportunities for students to express their understanding in both verbal and written responses and in responses that use symbols, graphics, and visual models.

Promotes students' communication and collaboration utilizing appropriate digital and other resources (I.8). In *Framework*-aligned instruction, students are accountable not only to the teacher but to one another for supporting their claims with evidence and for relating evidence to scientific principles (reasoning).

In *Framework*-aligned instruction, the teacher finds out about relevant interests and experiences of students and organizes instruction around them. In addition, students are able to pose their own questions for science investigations related to an overall, class-level question being investigated.

In *Framework*-aligned instruction, the teacher differentiates instruction both according to students' academic and linguistic needs and a hypothetical learning progression.

In *Framework*-aligned instruction, the teacher provides regular opportunities for students to reflect on and get feedback on what they have "figured out" so far, in terms of explaining a scientific phenomenon they are studying or developing a solution to an engineering problem.

CHECKLIST SUMMARY: Key Look Fors in a *Framework*-Aligned Classroom

Learning Environment

- ❏ Identify and build on student interests and experience in designing science instruction (LE.1, LE.2)
- ❏ Tie behavioral expectations directly to components of science and engineering practice ("acting like a scientist") (LE.3)
- ❏ Display student work that reflects different levels of student thinking in learning progressions (LE.4)
- ❏ Science tools for engaging students in planning and conducting investigations are available in the classroom (LE.4)

Instruction

- ❏ Communicates and explains why students are doing what they are doing, providing the driving questions for the design problem (I.1)
- ❏ Provides rigorous and authentic tasks related to the design problem with driving questions that facilitate student thinking (I.2)
- ❏ Teachers use appropriate instructional strategies and tools to engage students in building content knowledge and engaging in science practices (I.3)
- ❏ Teachers use and expect the use of scientific language through reading, writing, listening and speaking (I.4)
- ❏ Teachers use a variety of formats to elicit what students know and can do (I.5)
- ❏ Teachers require students to justify claims with evidence and reasoning using science principles (I.8)
- ❏ Teachers' assessment tasks require students to demonstrate understanding while engaging in a science or engineering practice, not just recall facts (I.5, I.7)
- ❏ Teachers interpret student responses using learning progressions in the *Framework for K-12 Science Education* (I.6)
- ❏ Teachers differentiate instruction using their knowledge of student learning needs and a learning progression (I.8)

LINKS to Learn More about the *Framework for K-12 Science Education and Next Generation Science Standards*

The Next Generation Science Standards: What's different and do they matter?
http://stemteachingtools.org/brief/14

Are there multiple instructional models that fit with the science and engineering practices in NGSS? (Short answer: Yes.)
http://stemteachingtools.org/brief/4

Framework for K-12 Science Education
http://www.nap.edu/catalog/13165/a-framework-for-k-12-science-education-practices-crosscutting-concepts

Next Generation Science Standards
http://www.nap.edu/catalog/18290/next-generation-science-standards-for-states-by-states