Science Instruction Companion to the Danielson Framework

Introduction: The New Jersey State Board of Education adopted the *Next Generation Science Standards* in July 2014. In May 2016, the science standards were renamed the *New Jersey Student Learning Standards for Science* (*NJSLS-S*). The content of the documents are the same. The science curriculum in grades 6-12 is to be based on the NJSLS-S by September 1, 2016 and grades K-5 needs to be updated by September 1, 2017. Becoming proficient with new academic standards takes time and considerable effort. This companion document uses the Danielson framework to examine what quality science instruction under the new standards looks like. Although this document is based on the Danielson framework, we anticipate it will be useful as a crosswalk for districts using other evaluation instruments as well. This companion focuses on two high-leverage domains, which are Planning and Preparation and The Classroom Environment. These two domains were chosen as the areas of focus, because they are the ones in which the shift in the standards are most evident in what will be observed in science instruction.

Purpose: The new standards are richer and more complex than previous editions shifting a science educator's focus from simply teaching science ideas to helping students figure out phenomena and design solutions to problems. It is because of this, past instructional practices may not be sufficient to support student success in meeting the new Performance Expectations.

This document is a companion to the Danielson Framework classroom observation instrument. The purpose of this document is two-fold. First, the document provides science specific observable evidence that supervisors of science teachers can reference during and after classroom observations. Secondly, the document is envisioned to be used as a common reference for professional conversations with and among the science faculty.

Throughout this document, the user will find hyperlinks to concise resources that explain the technical language. Individuals who are not familiar with the New *Jersey Student Learning Standards for Science* should take the time to view the following videos and read Chapter 3 of *Guide to Implementing the Next Generation Science Standards* (NRC, 2015). The following videos present an overview of key innovations in the NJSLS-S.

- Science Standards: A Vision for K-12 Science Education
- Disciplinary Core Ideas in the Science Standards
- Science & Engineering Practices in the Science Standards
- Crosscutting Concepts in the Science Standards

Finally, the Science website at the New Jersey Department of Education provides easy access to a considerable digital library of resources for supervisors and teachers.

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	"The proficient teacher displays solid knowledge of the important concepts in the discipline and how these relate to one another. The teacher demonstrates accurate understanding of prerequisite relationships among topics. The teacher's plans and practice reflect familiarity with a wide range of effective pedagogical approaches in the subject" (Danielson, 2013).	*"The teacher displays extensive knowledge of the important concepts in the discipline and how these relate both to one another and to other disciplines. The teacher demonstrates understanding of prerequisite relationships among topics and concepts and understands the link to necessary cognitive structures that ensure student understanding. The teacher's plans and practice reflect familiarity with a wide range of effective pedagogical approaches in the discipline and the ability to anticipate student misconceptions"* (Danielson, 2013).
	Proficient	Distinguished
1A: Demonstrating Knowledge of Content and Pedagogy	*Evidence of a Proficient Teacher:* ✓ The teacher's unit/lesson plans are based on the core ideas described in a *Framework for K-12 Science Education* (NRC, 2012). ➢ The core ideas provide an organizational structure among Disciplinary Core Ideas. ➢ The context for the learning is relevant and engaging for the students. ➢ The unit/lesson builds on prior learning and prepares students for what is next in the course or the next grade. ✓ Student work is driven by questions arising from phenomena or by an engineering design problem. ✓ Students have opportunities to apply their developing science knowledge to explain phenomena or design solutions to real-world problems. ✓ The unit/lesson requires students interact with each other as they conduct investigations; represent data; interpret evidence; gather additional information; and develop explanations, models, and arguments. *[Note: see pp. 31-33 of A Framework for K-12 Science Education, (NRC, 2012)].*	*Evidence of a Distinguished Teacher:* ✓ The teacher's unit/lesson plans are based on the core ideas described in a *Framework for K-12 Science Education* (NRC, 2012). ➢ Teacher scaffolds student conversations so that student curiosity drives the investigations. ➢ The unit/lesson is authentic and supports self-directed learning. The self-directed learning is structured to insure that students are making progress toward proficiency with the Performance Expectations. ✓ The teacher insures that the intra- and interdisciplinary connections are explicit for the students. ✓ The teacher's plans demonstrate awareness of possible student misconceptions and how they can be addressed. ✓ The teacher's plans reflect current understandings and/or recent developments in science.

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	"The teacher understands the active nature of student learning and attains information about levels of development for groups of students. The teacher also purposefully acquires knowledge from several sources about groups of students' varied approaches to learning, knowledge and skills, special needs, and interests and cultural heritages" (Danielson, 2013).	*"The teacher understands the active nature of student learning and acquires information about levels of development for individual students. The teacher also systematically acquires knowledge from several sources about individual students' varied approaches to learning, knowledge and skills, special needs, and interests and cultural heritages" (Danielson, 2013).*
	Proficient	Distinguished
1B: Demonstrating Knowledge of Students	*Evidence of a Proficient Teacher:* ✓ The teacher attends to the Learning Progressions of the practices, disciplinary core ideas, and crosscutting concepts when developing lessons/units. ✓ The teacher has researched and uses Universal Design for Learning principals when developing lessons/units. ✓ The teacher has read current science specific literature on making science accessible to *all* students and the adaptations are evident in the lesson/unit plan.	*Evidence of a Distinguished Teacher:* ✓ The teacher includes prior and future learning in their lesson/unit plans. ✓ The teacher reads professional journals* to keep current on the literature. (**This link is provided as an example, not to be an inclusive of all appropriate resources*.) ✓ The teacher consults colleagues who are experts on English language learners, special education, diversity, etc. and incorporates the strategies they are teaching the students to use as part of the planning process.

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1C: Setting Instructional Outcomes	*"Most outcomes represent rigorous and important learning in the discipline and are clear, are written in the form of student learning, and suggest viable methods of assessment. Outcomes reflect several different types of learning and opportunities for coordination, and they are differentiated, in whatever way is needed, for different groups of students" (Danielson, 2013).*	*"All outcomes represent high-level learning in the discipline. They are clear, are written in the form of student learning, and permit viable methods of assessment. Outcomes reflect several different types of learning and, where appropriate, represent both coordination and integration. Outcomes are differentiated, in whatever way is needed, for individual students" (Danielson, 2013).*
	Proficient	Distinguished
	Evidence of a Proficient Teacher: ✓ The teacher identifies one or more grade appropriate Performance Expectations as the learning outcome(s). *[Note: the science standards are for adults. They are not intended to be written on the board for students. Recording the main question and subsequent student questions are worthy of documenting for students.]* ✓ The teacher uses an overarching engaging question(s) to frame the unit and students understand how the teacher will assess their performance. *[Note: See* p. 28, Connecting to Students' Interests and Experiences (NRC, 2015).] ✓ The teacher uses multiple instructional models that fit with this vision for teaching and learning described in the NJSLS-S.	*Evidence of a Distinguished Teacher:* ✓ The teacher bundles Performance Expectations from different domains (Earth and space, life, and physical sciences) together to create rich learning opportunities for students. ✓ The students and teacher collaborate to establish an overarching question(s) for the learning and on refining a standardized rubric to more precisely evaluate student learning regardless of how the student chooses to make their thinking visible. *(Note: The core of the rubric is based on the correctness of their claim, the quality of their evidence, and the soundness of their reasoning.)* ✓ The teacher provides students with choices about how they are going to learn.
1D: Demonstrating Knowledge of Resources	*"The teacher displays awareness of resources beyond those provided by the school or district, including those on the Internet, for classroom use and for extending one's professional skill, and seeks out such resources"* (Danielson, 2013).	*"The teacher's knowledge of resources for classroom use and for extending one's professional skill is extensive, including those available through the school or district, in the community, through professional organizations and universities, and on the Internet"*(Danielson, 2013).
	Proficient	Distinguished
	Evidence of a Proficient Teacher: ✓ The teacher acquires knowledge from professional science education organizations, recent journal articles, blogs, webinars, conferences, and/or virtual science education communities with a specific emphasis on the discipline(s) of science that they teach.	*Evidence of a Distinguished Teacher:* ✓ The teacher collaborates with colleagues to use the EQuIP Rubric for Lessons & Units: Science to evaluate and/or modify classroom resources prior to use.

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1E: Designing Coherent Instruction	*"Most of the learning activities are aligned with the instructional outcomes and follow an organized progression suitable to groups of students. The learning activities have reasonable time allocations; they represent significant cognitive challenge, with some differentiation for different groups of students and varied use of instructional groups"* (Danielson, 2013).	*"The sequence of learning activities follows a coherent sequence, is aligned to instructional goals, and is designed to engage students in high-level cognitive activity. These are appropriately differentiated for individual learners. Instructional groups are varied appropriately, with some opportunity for student choice"* (Danielson, 2013).
	Proficient	Distinguished
	Evidence of a Proficient Teacher: ✓ The design of the unit is structured by a storyline with an accompanying main question, leading most students to proficiency with the Performance Expectations. *[Note: Storylines are the unit's central focus. What do students need to be introduced to first? How would the ideas and practices develop over time?]* ✓ The teacher provides a variety of resources from which the students can gather evidence. These may include non-fiction text, videos, experiments, virtual simulations, large data sets, etc.…)	*Evidence of a Distinguished Teacher:* ✓ The storyline drives the design of the unit plans leading virtually all students to proficiency with the Performance Expectations. ✓ The teacher consults with media specialists, librarians, and professionals in the community to identify and secure a variety of resources.

1F: Designing Student Assessments	*"All the instructional outcomes may be assessed by the proposed assessment plan; assessment methodologies may have been adapted for groups of students. Assessment criteria and standards are clear. The teacher has a well-developed strategy for using formative assessment and has designed particular approaches to be used"* (Danielson, 2013).	*"All the instructional outcomes may be assessed by the proposed assessment plan, with clear criteria for assessing student work. The plan contains evidence of student contribution to its development. Assessment methodologies have been adapted for individual students as the need has arisen. The approach to using formative assessment is well designed and includes student as well as teacher use of the assessment information"* (Danielson, 2013).
	Proficient	Distinguished
	Evidence of a Proficient Teacher: ✓ Formative assessment data is gathered while the students are engaged in learning activities. Assessment and instruction are intertwined. ✓ Formative assessments provide evidence about students' proficiency with using cross-cutting concepts, science and engineering practices and disciplinary core ideas. ✓ Most benchmark assessments are based on the Evidence Statements for the Performance Expectations.	*Evidence of a Distinguished Teacher:* ✓ Formative assessment data is used by students in reflecting on their own learning. ✓ Students use the Evidence Statements to create rubrics for how they make their thinking visible. *[Note: In essence, students define quality.]* ✓ All benchmark assessments are based on the Evidence Statements for the Performance Expectations.

<table>
<tr><td rowspan="3">3AB: Communicating with Students</td><td>“The instructional purpose of the lesson is clearly communicated to students, including where it is situated within broader learning; directions and procedures are explained clearly and may be modeled. The teacher’s explanation of content is scaffolded, clear, and accurate and connects with students’ knowledge and experience. During the explanation of content, the teacher focuses, as appropriate, on strategies students can use when working independently and invites student intellectual engagement. The teacher’s spoken and written language is clear and correct and is suitable to students’ ages and interests. The teacher’s use of academic vocabulary is precise and serves to extend student understanding” (Danielson, 2013).</td><td>“The teacher links the instructional purpose of the lesson to the larger curriculum; the directions and procedures are clear and anticipate possible student misunderstanding. The teacher’s explanation of content is thorough and clear, developing conceptual understanding through clear scaffolding and connecting with students’ interests. Students contribute to extending the content by explaining concepts to their classmates and suggesting strategies that might be used. The teacher’s spoken and written language is expressive, and the teacher finds opportunities to extend students’ vocabularies, both within the discipline and for more general use. Students contribute to the correct use of academic vocabulary” (Danielson, 2013).</td></tr>
<tr><td>Proficient</td><td>Distinguished</td></tr>
<tr><td>Evidence of a Proficient Teacher:
✓ The instruction engages students in authentic and meaningful scenarios which provide them with a purpose for what they are learning.
✓ Teacher provides students with purposeful learning experiences that motivate them to engage in three-dimensional thinking.</td><td>Evidence of a Distinguished Teacher:
✓ Students contribute to their purpose of learning by explaining concepts to their classmates and suggesting strategies that might be used.
✓ Students engage in three-dimensional thinking with little to no teacher assistance.</td></tr>
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	"While the teacher may use some low-level questions, he poses questions designed to promote student thinking and understanding. The teacher creates a genuine discussion among students, providing adequate time for students to respond and stepping aside when doing so is appropriate. The teacher challenges students to justify their thinking and successfully engages most students in the discussion, employing a range of strategies to ensure that most students are heard" (Danielson, 2013).	*"The teacher uses a variety or series of questions or prompts to challenge students cognitively, advance high level thinking and discourse, and promote metacognition. Students formulate many questions, initiate topics, challenge one another's thinking, and make unsolicited contributions. Students themselves ensure that all voices are heard in the discussion"* (Danielson, 2013).
	Proficient	Distinguished
3B: Using Questioning and Discussion Techniques	*Evidence of a Proficient Teacher:* ✓ The questions that the teacher asks are ones that cannot be answered with a quick search on the internet. ✓ The teacher has established a culture where students expect to be asked to justify their answer with evidence and reasoning. ✓ The teacher has established a culture where students ask questions of each other about the texts they read, the features of the phenomena they observe, and the conclusions they draw from their models or scientific investigations. ✓ The teacher has established a culture for solving engineering challenges so that students ask questions to define the problem to be solved and to elicit ideas that lead to the constraints and specifications for its solution.	*Evidence of a Distinguished Teacher:* ✓ The questions that the teacher asks challenges the students thinking and promotes metacognition. ✓ The teacher has established a culture where students ask questions of each other about the texts they read, the features of the phenomena they observe, and the conclusions they draw from their models or scientific investigations. ✓ The teacher has established a culture where students expect to be asked to justify their answer with evidence and reasoning. Students then compare and critique the arguments and analyze whether they have similar or different evidence and/or interpretations of facts. ✓ The teacher has established a culture where students respectfully provide and receive critiques about one's explanations, procedures, models, and questions by citing relevant evidence and posing and responding to questions that elicit pertinent elaboration and detail. ✓ The teacher has established a culture for solving engineering challenges so that students ask questions to define the problem to be solved and to elicit ideas that lead to the constraints and specifications for its solution.

	"The learning tasks and activities are fully aligned with the instructional outcomes and are designed to challenge student thinking, inviting students to make their thinking visible. This technique results in active intellectual engagement by most students with important and challenging content and with teacher scaffolding to support that engagement. The groupings of students are suitable to the activities. The lesson has a clearly defined structure, and the pacing of the lesson is appropriate, providing most students the time needed to be intellectually engaged" (Danielson, 2013).	*"Virtually all students are intellectually engaged in challenging content through well-designed learning tasks and activities that require complex thinking by students. The teacher provides suitable scaffolding and challenges students to explain their thinking. There is evidence of some student initiation of inquiry and student contributions to the exploration of important content; students may serve as resources for one another. The lesson has a clearly defined structure, and the pacing of the lesson provides students the time needed not only to intellectually engage with and reflect upon their learning but also to consolidate their understanding"* (Danielson, 2013).
	Proficient	Distinguished
3C: Engaging Students in Learning	*Evidence of a Proficient Teacher:* ✓ Students consistently demonstrate proficiency through science and engineering practices (ex: model development, charts, experiments, etc*.) with teacher support.* ✓ Teacher supports differentiated instruction in the classroom so that every student's needs are addressed by: a) Connecting instruction to the students' home, neighborhood, community and/or culture as appropriate. b) Providing appropriate reading, writing, listening, and/or speaking alternatives (e.g., translations, picture support, graphic organizers) for students who are English language learners, have special needs, or read well below the grade level. c) Adding extra support (e.g., phenomena, representations, tasks) for students who are struggling to meet the performance expectations. d) Structures lesson using Universal Design for Learning principles. e) Providing extensions for students with high interest or who have already met the performance expectations to develop deeper understanding of the practices, disciplinary core ideas, and crosscutting concepts. f) Learning activities focus on grade appropriate elements of the practices, disciplinary core ideas, and crosscutting concepts.	*Evidence of a Distinguished Teacher:* ✓ Students consistently demonstrate proficiency through science and engineering practices (ex: model development, charts, experiments, etc.) with *limited to no* teacher support. *[Note: This indicator is time dependent. One would not expect to observe this early in the academic year. The level of teacher support should diminish as the academic year progresses.]* ✓ Students are given the flexibility to decide how they are going to make sense of a phenomena or to solve an engineering challenge. *[Note: This indicator is time dependent. One would not expect to observe this early in the academic year. The level of teacher support should diminish as the academic year progresses.]*

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<tr><td rowspan="3">3D: Using Assessment in Instruction</td><td>“Students appear to be aware of the assessment criteria, and the teacher monitors student learning for groups of students. Questions and assessments are regularly used to diagnose evidence of learning. Teacher feedback to groups of students is accurate and specific; some students engage in self-assessment” (Danielson, 2013).</td><td>“Assessment is fully integrated into instruction, through extensive use of formative assessment. Students appear to be aware of, and there is some evidence that they have contributed to, the assessment criteria. Questions and assessments are used regularly to diagnose evidence of learning by individual students. A variety of forms of feedback, from both teacher and peers, is accurate and specific and advances learning. Students self-assess and monitor their own progress. The teacher successfully differentiates instruction to address individual students’ misunderstandings” (Danielson, 2013).</td></tr>
<tr><td>Proficient</td><td>Distinguished</td></tr>
<tr><td>Evidence of a Proficient Teacher:
✓ Instruction elicits direct, observable evidence of the level of students’ proficiency with using cross-cutting concepts, science and engineering practices and disciplinary core ideas.
✓ Assessment includes rubrics and scoring guidelines, that are based on the NJSLS-S and that provide guidance for interpreting student performance.</td><td>Evidence of a Distinguished Teacher:
✓ Students are provided the flexibility with how they will provide direct, observable evidence of their own proficiency with using cross-cutting concepts, science and engineering practices and disciplinary core ideas.
✓ Formative assessments are embedded throughout the instruction and teacher has planned for students to engage in self-reflection.</td></tr>
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