Iowa Science Standards

IMpACT

Implementation Map for Administrators, Coaches & Teachers

Introduction:

This Innovation Configuration tool (known simply at the IMpACT) is designed as a self-reflection to assist in determination of the level of implementation of the Iowa Science Standards and the five innovations of the Next Generation Science Standards (NGSS). These innovations include: the use of relevant phenomena, three-dimensional learning, coherence of instruction, integration of math and ELA, and a focus on addressing inequalities. The IMpACT draws heavily from Achieve's EQuIP rubric and PEEC alignment tools, Wisconsin Department of Public Instruction as well as the appendices of the NGSS.

Intended Uses:

Administrators - it should be noted that the IMpACT is **not designed as a teacher evaluation tool**. School leaders may choose to use the IMpACT as means to inform conversations with science teachers, assist in making decisions about instructional materials and curriculum, and/or generally support teachers' implementation of the Iowa science standards and three-dimensional teaching and learning outlined in the NGSS.

Instructional Coaches - the IMpACT can serve as a meaningful resource during coaching cycles and professional learning. Instructional coaches might use the IMpACT to help teachers initially characterize their implementation of the Iowa science standards and help to inform the focus of subsequent coaching conversations. Resources provided at IowaCore.gov may provide support during coaching cycles.

In- and Pre-service Teachers - the IMpACT gives teachers intentional language around the implementation of the Iowa science standards. Teachers may choose to focus on one criteria (see below), one aspect of one criterion, or use the entire IMpACT to characterize their implementation. The descriptors for each aspect of implementation should provide insight into what actions teachers can take to deepen implementation of the standards and help focus ongoing professional learning. Additionally, the linked resources on the IowaCore.gov website will provide targeted opportunities to learn more about each aspect.

Informal Educators & Professional Development Providers - the IMpACT can also serve as a guide for those entities that support teachers and support science education in informal environments. The criteria presented are good reminders of the expectation of the Iowa Science Standards with regard to how science instruction and learning should look. Informal educators and professional development providers are encouraged to weave the IMpACT into their work, making both implied and explicit connections when able.

Organization:

The IMpACT provides a description of five implementation criteria, an outcome statement, and descriptors of various levels of implementation. In order to help educators identify areas of strength as well as areas of potential growth, the IMpACT provides descriptors of no implementation, beginning implementation, implementation, and expanding implementation for each category within the five criteria. The five criteria include:

- Criteria 1: Authentic Learning Experiences
- Criteria 2: Three-Dimensional Learning
- Criteria 3: Coherence
- Criteria 4: Appropriate Integration of ELA/Literacy and Mathematics
- Criteria 5: Supporting *All* Learners

Created 2018 through the work of M. Sanderman, P. Christensen, K. Kilibarda; Updated 2020 through the work of E. Hall, M. Sanderman, T. Jarrett, S. Nelson, K. Schmidt

Criteria 1 – Authentic Learning Experiences

Students engage in the process of science as it is practiced in the authentic scientific community. Therefore, students should be working to "figure out" a scientific phenomenon or engineering problem and investigations should be focused on scientific phenomena that are relevant and important to their community and/or to them personally.

Outcome:

Students will engage in science in an authentic manner through the use of relevant phenomena.

	Expanding Implementation	Implementation	Beginning Implementation	No Implementation
Feature 1a	Learning experiences are organized around students experiencing and investigating meaningful phenomena and/or designing solutions to problems and include intentional access points and supports so all students can use targeted SEPs, CCCs and DCIs as the central component of learning.	Learning experiences provide opportunities for students to experience phenomena directly or through rich multimedia or to design solutions to problems. However, students may not receive the support necessary for them to use targeted SEPs, CCCs, and DCIs to build their understanding.	Learning experiences use scientific phenomena as an engagement strategy or lesson "hook" but students are not engaged with using their conceptual understanding in figuring out the scientific phenomenon. Students receive minimal support in the application of targeted SEPs, CCCs and DCIs.	Learning experiences are isolated topic-based lessons where students read about science concepts or follow a step-by-step procedure to ensure they learn the science content (DCI) and vocabulary.
Feature 1b	Learning experiences are designed around phenomena, scenarios, and/or problems that are relevant to a wide range of student abilities, backgrounds, and interests. When appropriate, local opportunities are utilized to foster authenticity during the sense-making of phenomena. Students make authentic connections in collaboration with their peers.	Learning experiences are organized around phenomenon/problems that are interesting/relevant to students with the goal of making sense of the world (not just covering content). The phenomenon/problem appears loosely connected to the students' cultural, community or personal identities/interests. The teacher makes the authentic connections for the students.	Learning experiences are organized by 'big ideas" but have limited explicit connection to students' day-to-day lives. Any authentic connections are by chance instead of by design and while learning may be difficult, it is not conceptually rigorous.	Learning experiences are not organized around big ideas or meaningful phenomena, or the phenomenon/problem are likely of interest to a select group of students (i.e - just of interest to males, high SES, native speakers).
Feature 1c	Students examine and experience science content in authentic ways that encourage greater depth of knowledge and build towards answering essential questions. When appropriate, students use science concepts from different domains (Earth/space, life, physical) to construct explanations.	Students interact with science content within one domain (Earth/space, life, physical) by figuring out phenomena. Any connections to prior learning or across science domains is loose or requires teacher prompting for students to see the connections.	Students interact with science content in some ways that encourage greater depth of knowledge (i.e. students read about a phenomenon or talk about how scientists/engineers engage with a related phenomenon or problem) but do not apply the content to real-world situations or phenomena.	Students interact with the science content mostly through reading a text, answering teacher-developed questions, or completing worksheets.
Feature 1d	Students use information from previous investigations to revise their understanding of the phenomena/problem/design and to initiate their next steps/next investigations.	Students design their own investigations/next steps to build evidence for their claims and to deepen their understanding of the phenomenon/design.	Students conduct investigations that are designed to confirm what was previously learned or students follow a teacher-provided procedure that has a clear, predetermined conclusion.	Students do not engage in scientific investigations.

Criteria 2 - Three Dimensional Learning

Instruction should be planned to ensure students explicitly utilize science practices and cross-cutting concepts to develop a deep understanding of the core ideas and to understand the relevance to the concept(s).

Outcome:

Students will use science and engineering practices to build their understanding and apply their learning across disciplines.

	Expanding Implementation	Implementation	Beginning Implementation	No Implementation
Feature 2a	Learning is framed by big ideas of science/themes (cross-cutting concepts) in a grade-appropriate manner* that would allow students to make sense of phenomena within or across disciplines. Students use cross-cutting concepts to connect more than one science discipline. *Grade band progression; Appendix G	Learning is framed by big ideas of science/themes (cross-cutting concepts) but likely would not be explicitly seen by students without teacher prompting or guidance.	Learning may be framed by big ideas of science/themes (cross-cutting concepts) but connections are implicit or very loosely connected	Learning is not framed by big ideas of science/themes (cross-cutting concepts) and concepts are disconnected from unit to unit.
Feature 2b	Students engage in grade-appropriate elements of the scientific and engineering practices* to learn about the world around them and solve problems with little prompting and teacher guidance. *Grade band progressions, Appendix F	Students engage in grade-appropriate elements of the science and engineering practices but their engagement is teacher-directed.	Students engage in the science and engineering practices in service to learning the disciplinary core ideas but engagement does not meet grade level expectations.	Students use a standard scientific method or are given a set of step-by-step procedures to follow.
Feature 2c	Students use elements of the SEPs, CCCs, and DCIs to make sense of given phenomenon/problems and are able to transfer their understanding/skills to explain related phenomenon or design solutions to new, related problems.	Student engagement in making sense of phenomena/designing solutions requires student performances that integrate grade-appropriate elements of the SEPs, CCCs, and DCIs.	Students engage in all three dimensions, but they are incorporated as 3 separate entities. Instructional activities utilize two of the three dimensions (disciplinary core ideas, or science/engineering practices, or cross-cutting concepts)	Students learn the three dimensions in isolation of each other. Instructional activities appear to only utilize one of the three dimensions with student learning centered on facts; content is an end in itself.
Feature 2d	Students provide evidence of learning in all three dimensions in a way that allows the teacher to determine and provide feedback related to student progress in each of the dimensions. Classroom assessments align to, look like, and are part of classroom instruction.	Students provide evidence of learning in all three dimensions in a stand-alone assessment event (i.e. test, project). The assessments might utilize scenarios to show application of learning but the majority of the assessment focuses on content with an uneven balance of the other assessed dimensions.	Students provide evidence of learning in one or two of the dimensions in a singular event that is isolated from instruction. Additional assessments such as vocabulary quizzes are utilized during instruction but the results are not used to inform instruction or learning.	Students provide evidence of learning on summative assessments that are predominantly focused on disciplinary core ideas. These assessments often use recall type questions.
Feature 2e	Formative assessments are utilized by the teacher in making instructional decisions and students use peer and teacher-provided feedback to revise or extend their oral or written explanations/models/arguments	Formative assessments are utilized to assist in identifying student misconceptions and progress in more than one dimension and there is an instructional plan for how to move student learning based on the evidence obtained.	Formative assessments are focused on obtaining evidence of students' understanding of disciplinary core ideas or identifying misconceptions without an instructional plan for how to move student learning based on the evidence obtained.	Formative assessments are not used to guide instruction or learning.

Criteria 3 – Coherence

Lessons and units should build on discoveries from prior life experiences and/or background knowledge, student investigations and concepts covered in prior units and, when applicable, prior grade bands.

Outcome:

Students will build on concepts discovered in prior years as well as building knowledge and skills throughout each unit.

	Expanding Implementation	Implementation	Beginning Implementation	No Implementation
Feature 3a	In designing and implementing instructional units, the teacher uses knowledge of the progressions of all three dimensions (DCI Matrix, SEP progressions, CCC progression:) and actively seeks information from students about previous instructional and life experiences to build upon prior knowledge and skills.	The teacher is aware of the progressions of all three dimensions (DCI Matrix, SEP progressions, CCC progression:) and works to connect current learning to past concepts but does not attempt to uncover what knowledge and skills students bring to the unit from life experiences.	The teacher is aware of past experiences students have engaged in but only for the reason of not repeating them in the current grade level.	The teacher is unaware of prior learning and experiences so each instructional unit starts from scratch with foundational ideas and skills.
Feature 3b	Throughout the instructional unit, students engage in investigating an anchor phenomenon and related lesson level phenomenon and use their learning from each lesson to figure out different aspects of the natural event through their investigations.	Throughout the instructional unit, students are investigating different lesson level phenomena that are conceptually connected or are exploring an anchor phenomenon but students do not figure out different aspects of the natural event or do not need to tie current learning with prior learning.	Throughout the instructional unit, students are engaged in science activities/laboratory experiences that relate to a big idea but students are not able to articulate that relationship.	Throughout the instructional unit, students engage in isolated lessons or investigations that are grouped together around a science topic or textbook chapter.
Feature 3c	The instructional unit is coherent and when asked students are able to identify how what they are learning on a given day was related to previous learning and/or how it will guide future learning.	The instructional unit has conceptual coherence; however, when asked, students may not consistently be able to identify how what they are learning on a given day was related to previous learning and/or how it will guide future learning.	The instructional unit appears to have a loose conceptual coherence but appears to be organized around a topic or theme instead of phenomena with sequenced lessons to build conceptual understanding.	The instructional unit is organized by content, each section/chapter having "cookbook labs" or activities that largely confirm learning about content.
Feature 3d	Student learning targets/objectives are three-dimensional learning performances that build towards the big ideas of the unit because they are designed and coordinated over time to ensure students build understanding of all three dimensions of the standards.	Student learning targets/objectives are three-dimensional learning performances that are designed to build student understanding.	Student learning targets/objectives are one or two-dimensional and are typically focused on student mastery of learning particular content or skills but are not focused on all three dimensions.	Student learning targets/objectives are performance expectations themselves and are treated as singular items to be learned in isolation from one another
Feature 3e	Students and the teacher collaborate to establish driving question(s) and subsequent lesson-level questions build coherently to allow students to make sense of a phenomenon while building towards performance expectations.	Students and the teacher collaborate to establish driving question(s) then the teacher determines which questions will be investigated and subsequent questions/investigations are not necessarily sequenced to build understanding.	The teacher selects driving question(s) and the question is not complex enough to require building understanding over the course of several investigations.	Students answer content-based questions at the beginning and/or end each lesson, unit, and/or chapter. Questions/prompts do not offer opportunities for students to show understanding of crosscutting concepts or science/engineering practices.

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Criteria 4 - Appropriate Integration of ELA/Literacy and Mathematics

While engaging in the science and engineering practices, students call on the skills of disciplinary literacy in order to make sense of phenomena.

Outcome:

Students will call on disciplinary literacy skills to allow them to communicate scientifically.

	Expanding Implementation	Implementation	Beginning Implementation	No Implementation
Feature 4a	Students interact with each other and use appropriate disciplinary language/vocabulary when they conduct investigations; represent and interpret data; negotiate understanding; gather additional information; and develop explanations, models, and arguments.	Students interact through structured whole-class discussions and small group work to defend their claims with evidence and use their interactions to negotiate understanding and/or to revise their explanations/models/arguments. Students' use of disciplinary language/vocabulary is an after-thought instead of a focus of the interactions.	Supports interact through structured whole-class discussions and small group work but the interactions do not promote student discourse that allows for negotiating understanding or providing peer feedback.	Students interact predominantly with the teacher through answering questions that communicate their understanding of science content or processes. Students experience science vocabulary as information/facts to be learned through disconnected practice or memorization.
Feature 4b	Students use journals/notebooks to record and reflect on data/evidence. Students appropriately communicate scientific ideas/designs to different audiences through multiple modes of expressions including drawing, writing, video, etc. and use self, peer or teacher feedback to revise their understanding or to improve their communication skills.	Students utilize science notebooks/journals as a way to record information in words, drawings, graphs, etc and as a way to organize their own ideas and explanations, but do not have the opportunity to use peer or teacher feedback to revise their understanding or to improve their communication skills.	Students use journals/notebooks to record and organize information and build on these ideas throughout their learning.	Students record information on worksheets or in class notes but do not refer to these items in subsequent learning experiences.
Feature 4c	Students create, evaluate, or analyze mathematical models and/or graphical displays of data in their explanations which encourage conceptual understanding, vocabulary development, and mathematical or computational thinking.	Students use scientific formulas, make calculations, and appropriately represent and analyze data to deepen their conceptual understanding.	Students perform mathematical calculations, graph their data and make sense of various displays of data but their analysis does not advance conceptual understanding.	Students use mathematical calculations to determine correct answers. Students learn graphing skills in isolation of context (i.e. there is a measurement and graphing unit).
Feature 4d	Students are able to obtain, evaluate, and utilize resources to assist in making sense of phenomena. Students look to a variety of expert resources to provide evidence for their scientific claims.	Students utilize a variety of sources of information to support their scientific claims but these sources are typically supplied by a teacher.	Students utilize teacher-provided expert texts to answer questions.	Students use their textbook as the predominant/sole source of information to analyze or interpret data or to construct their scientific explanations.

Criteria 5 - Supporting *All* Learners

Science instruction, materials, and resources support equitable access to science education for *all* students.

Outcome:

***All* students will be supported appropriately and provided opportunities to engage, learn, and be empowered to impact their world.**

	Expanding Implementation	Implementation	Beginning Implementation	No Implementation
Feature 5a	Materials utilized by teachers reflect diverse learners and allow *all* students to see themselves represented. Instructional materials foster learning experiences that *all* students can connect with and use to make progress toward common goals through multiple modes of learning. Materials are available to and usable by each and every student regardless of their personal and physical characteristics.	Materials help students learn the information while also growing students' ability to see themselves as scientists and engineers. The materials provide students opportunities to make their thinking visible, revisit ideas, and engage in scientific discourse with peers. *All* students' needs and abilities are accommodated in the classroom.	Materials represent mostly dominant groups, but the instructor makes an effort to include materials and experiences that demonstrate a variety of student identities and interests, and provides accommodations and modifications for those students who require them.	Materials represent only dominant groups and there is little to no differentiation provided for the variety of learning needs and abilities of all students.
Feature 5b	*All* students are provided necessary support (e.g., scaffolding, extension, or accommodations) to aid in the sense-making process. Students use additional and/or related phenomena within the targeted DCI to stretch their use of the SEPs and conceptual understanding (CCCs) for enrichment when they demonstrate mastery. Engagement in these practices is language intensive and requires students to participate in intentional science discourse. Differentiation occurs within and across all three dimensions and allows *all* students to grow in their sense making abilities.	Learning experiences are designed to differentiate so that all students are appropriately challenged in their sense-making and communicate that each and every student is capable of learning and doing well. Planned learning provides opportunities for students to use multiple modes of communication as they present ideas or engage in reasoned argumentation. *All* students engage in the SEPs as part of the scientific sense-making process as they develop scientifically-based conceptual understandings (CCCs) to explain phenomena (DCIs).	Learning experiences are designed for the "average ability" student. Accommodations or modifications are in place for students, as required by documentation (i.e., IEP and/or 504 plan). Students' use of the SEPs is limited and lacks intentionality and therefore does not support conceptual understanding (CCC) to explain phenomena (DCIs).	Learning experiences are aligned to the "average ability" student, with little-to-no differentiation for diverse learning styles and students' needs. Planned learning provides limited or no opportunities for students to practice the SEPs, develop conceptual understanding (CCCs) or explain phenomena (DCIs).
Feature 5c	Students' families and caregivers are supported in utilizing the relationship between science education and life outside the classroom to improve opportunities. Diverse community stakeholders regularly partner with classroom science experiences, leading students to apply content and skills. Technology is used to enhance partnerships in innovative and novel ways, allowing *all* students to engage in ways that would not be possible otherwise.	Students' families and caregivers are made aware of the relationships between science education and life outside the classroom. Stakeholders have access to classroom and school science experiences, with partnerships being intentionally diverse. Technology facilitates the development and sustaining of partnerships while recognizing and accommodating for accessibility issues and limitations.	Students' families and caregivers may be made aware of the experiences and relationships between science education and life outside the classroom. Stakeholders may have access to classroom and school science experiences, but these partnerships lack intentionality.	Students' families and caregivers are largely unaware of the experiences students have in science classes. Stakeholders are not regularly provided access to classroom experiences and partnerships are not present.
Feature 5d	Classroom experiences do not underestimate or constrain what students are able to display intellectually. The teacher focuses on helping students find meaning in classroom experiences and ways to deepen engagement. Intentional and complex connections are made to students' lives, and learning experiences leverage students' sense of place, funds of knowledge and cultural experiences to improve engagement and outcomes.	Classroom experiences make space for students to contribute their cultural knowledge to the development of skills and understanding. Connections are explicit between a students' engagement and learning in the lesson. Intentional connections are made to students' sense of place, funds of knowledge and cultural experiences.	Classroom experiences provide students with minimal connections to funds of knowledge, expertise, cultural background, family work experiences. Limited consideration is given when planning instruction to students' and family members' knowledge and expertise based on roles in their family, community, and culture.	Classroom experiences do not utilize student funds of knowledge, expertise, cultural background, or family work experiences. No consideration is given to students' and family members' expertise and knowledge when planning instruction.

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