## Using the Elements of Effective Science Instruction to support English Language Learners in Science Classrooms

The *Elements of Effective Science Instruction (EESI*) is the result of the research and study of Washington State's nine Regional Science Coordinators. EESI is a summary document of current literature on science instruction, closely anchored to classroom practice. The four common themes or "elements" of the EESI model were identified as those most consistently found in these sources. The structure is intended to provide a coherent message about science instruction to Washington teachers. In this document, we aim to highlight those Elements of Effective Science Instruction that also support English language development, while suggesting additional instructional strategies science teachers should implement to ensure their instruction is sheltered for English Language Learners.

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### The EESI Elements:

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| **Science Content** | Student acquisition of the content of science requires opportunities to learn content standards in the context of a conceptual framework. Access to this learning is best achieved through sequencing learning objectives into learning progressions that inform teacher's instructional decision making. |
| **Designing Instruction for Understanding** | Effective instruction is built on understanding *all* students' initial and developing ideas and identifying the gap between students' current understanding and content learning targets. In order to build understanding of science concepts, classroom experiences should help students make sense of the phenomena under study, to articulate their understanding and to defend their reasoning. Students should be intellectually engaged in the processes of science such as investigation and discussion. |
| **Sense Making** | To ensure sense making, teachers should intentionally help students to understand the connections between the science learning activity and the intended learning targets. Teachers must make certain that students draw appropriate conclusions and see the purpose of their investigations. Opportunities should also be given for learners to apply learned concepts to new situations and to be reflect on the change in their thinking over time (metacognition). |
| **Classroom Culture and Environment** | Science content should be made accessible to each student in the class. To accomplish this, teachers and students must begin with a belief that all students can learn science. The classroom environment should be motivating and provide opportunities for students to be actively and productively engaged in science that is relevant and connected to students' lives. Students should understand and practice appropriate norms for presenting scientific arguments and engage in productive social interactions with peers in the context of classroom science investigations. |

| Element of Effective Science Instruction | Effective instruction for ALL students includes elements that are essential for English language development (*) | Science teaching is sheltered when, *in addition* to effective science instruction, the following is in place: |
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| **Sense Making** | ***In a classroom where sense making is a key element of science instruction:***<br><br>**Teachers will:**<br>• Plan for sense-making opportunities throughout the lesson.*<br>• Facilitate student talk and argument to understand the activity or topic.*<br>• Ask open-ended questions and provide multiple explanations when appropriate to foster sense making.*<br>• Encourage students to explain their observations and data.<br>• Scaffold sense-making opportunities so that students make scientifically accurate connections between new learning and previous learning and big ideas.*<br>• Coordinate opportunities for students to apply learned concepts to new situations.<br>• Provide time and encourage students to examine changes in their thinking.<br><br>**Students will:**<br>• Engage in talk and argument around science concepts.*<br>• Understand the targeted concepts underlying investigations and activities.*<br>• Make connections between new learning and previous learning and big ideas.*<br>• Apply learned concepts to new situations.*<br>• Reflect on their thinking and changes in their thinking (metacognition).<br>• Engage in scientific discourse and critique.<br>• Make claims and defend the claims with evidence.<br>• Continually review and revise their ideas to deepen their understanding. | ***In a classroom where sense making is sheltered for English Language Learners:***<br><br>**Teachers will also:**<br>• Expect that students at all levels of English language development engage in meaningful sense-making activities.<br>• Encourage students to use their primary language to clarify key concepts.<br>• Provide differentiated scaffolds for making sense of content, based on language levels (e.g.: gestures, visuals, non-linguistic representations, writing and speaking frames).<br>• Revisit key content vocabulary terms to clarify and check for understanding.<br><br>**Students will also:**<br>• Have the opportunity to explain and reflect on their understanding at their language level. |

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| **Classroom Culture and Environment** | ***In a classroom where the culture and environment support effective science instruction:***<br><br>**Teachers will:**<br>• Structure classroom experiences that are meaningful, relevant and connected to the learners.*<br>• Connect to students' cultural backgrounds and life experiences.*<br>• Motivate and encourage students to be productively involved in the science classroom.*<br>• Foster creativity, excitement and passion for learning science.<br>• Promote a climate of trust and respect.*<br>• Teach and model effective discourse.*<br>• Use collaborative strategies purposefully.*<br><br>**Students will:**<br>• See themselves as learners of science.<br>• Share their thinking and openly discuss their learning.*<br>• Respect one another and value each other's ideas.*<br>• Engage respectfully in scientific communication and critique.<br>• Engage collaboratively in the enterprise of science.<br>• Use evidence to support their argumentation. | ***In a classroom where the culture and environment is sheltered for English Language Learners:***<br><br>**Teachers will also:**<br>• Provide sufficient wait time for English Language Learners to process questions.<br>• Consciously allow students time to express their thoughts fully without interruption.<br>• Ensure the speech in their classroom is appropriate for students' language levels (clear, slow, articulate).<br>• Provide opportunities for students to connect their in-class learning to their personal home and family experience.<br><br>**Students will also:**<br>• Believe that the teacher has the same content understanding expectations for all students, regardless of their language level.<br>• Feel safe to practice communicating in English.<br>• Feel that their primary language is valued and they can use it to understand and communicate content concepts as needed.<br>• Be placed in groups in ways that support the language and content objectives of the lesson. |

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| **Designing Instruction for Understanding** | ***In a classroom where science instruction is designed for understanding:***<br><br>**Teachers will:**<br>• Reveal and engage pre-conceptions and reasoning.*<br>• Use student conceptual understanding data to inform instruction.*<br>• Provide students with opportunities to confront or build upon initial understanding.<br>• Use the conceptual sequence of the unit to design instruction.*<br>• Communicate learning targets in student-friendly language.*<br>• Engage students with scientifically-oriented questions and use probing questions to clarify student thinking.*<br>• Provide activities with opportunities for students to make claims, use evidence, and communicate reasoning.<br>• Provide feedback so that students become owners of their own learning.*<br><br>**Students will:**<br>• Engage in science as scientists practice science.<br>• Reveal preconceptions.<br>• Observe, investigate, collect data, and reason..<br>• Formulate explanations from evidence.<br>• Communicate and justify explanations.<br>• Think about their thinking.<br>• Communicate how their investigations connect to the learning target.<br>• Recognize the evidence of understanding in their work and provide suggestions for what to work on next or where to go for additional resources. | ***In a classroom where the design of science instruction is sheltered for English Language Learners:***<br><br>**Teachers will also:**<br>• Anticipate and plan for instances where the density of language in student learning tasks could become a barrier for understanding.<br>• Use multiple methods to make content comprehensible to students at their language level (e.g.: modeling, visuals, gestures).<br>• Include materials that make the lesson clear and meaningful to students at their language level (eg. graphs, models, charts, simulations).<br>• Use strategies to ensure that directions or explanations of learning tasks are comprehensible by students at various levels of English proficiency (eg: modeling, charts, sample products).<br>• Use scaffolding techniques consistently and as appropriate to the task and intended learning.<br>• Provide a variety of ways for students to learn, remember and use English vocabulary terms that are critical for the content.<br>• Intentionally teach academic vocabulary associated with scientific skills (e.g.: compare, contrast, analyze, evaluate, prove).<br><br>**Students will also:**<br>• Use all domains of language (reading, writing, speaking listening) in activities.<br>• Use hands-on materials and manipulatives to build and practice using content knowledge.<br>• Access scaffolds to help them engage in scientific communication (verbal and written) at their language level. |

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| **Science Content** | ***In a classroom where science content is being effectively addressed:***<br><br>**Teachers will:**<br>• Make science standards accessible through science content that is relevant and appropriate.*<br>• Utilize learning progressions to drive instructional decisions.<br>• Clearly communicate the learning objectives in student-friendly language.*<br>• Craft essential questions related to the big ideas in the science standards.<br><br>**Students will:**<br>• Gain deep understanding of content appropriate to grade level.*<br>• Be actively involved in formative assessment processes for that particular conten.t*<br>• Know and understand their current progress towards the learning targets.*<br>• Be able to apply the science content to their lives.* | ***In a classroom where science content is sheltered for English Language Learners:***<br><br>**Teachers will also:**<br>• Ensure that all students, regardless of English Language proficiency, are engaged in tasks to build content knowledge.<br>• Include objectives for English language development or students goals for developing specific content language proficiencies.<br>• Identify concept vocabulary critical for student understanding of the texts, materials and instruction associated with science content.<br><br>**Students will also:**<br>• Participate in activities that meaningfully integrate science concepts with English language practice opportunities. |

Supporting resources:

How People Learn (HPL) Bransford, et al
Effective Science Instruction Banilower, et al
Designing Effective Science Instruction Tweed
Ready, Set, Science! Michaels, et al
Science Classroom Observation Guide (SCOG) NCOSP (unpublished)
AAAS Atlas of Science Literacy, Vol. 1-2
LASER Classroom Observation Protocol (unpublished)
Classroom Assessment for Student Learning, Stiggins, pp3-18
Inside the Black Box, Black and Wiliam
Transformative Assessment, Popham