Content Connections | Secondary Science

Educator Effectiveness

This past year, BVSD science teachers came together and identified effective practices that align with Boulder Valley Educator Effectiveness Standards 1 and 3. The identified connections are not evaluation criteria, but rather were created to provide examples of effective classroom instruction. This is an ongoing collaborative partnership that will continue to provide targeted examples.

Standard I: Teachers demonstrate mastery and pedagogical expertise in the content they teach

What does "Effective" look like in the classroom?	
Element a – *Alignment*	
Connect Learning Environment	• Use examples of real-world application of scientific concepts. • Engage students in authentic, project-based, science learning experiences. • Explicitly describe the rationale for the sequence of concepts, units, or lessons to students – for example "We study evolution and natural selection first because it serves as the organizing framework for all other topics in biology."
Respond to Student Misconceptions	• Explain misunderstood concepts to students in a new or different way – for example, have students act out the process of cell division, rather than repeat the PowerPoint presentation. • Overtly address misconceptions, use direct examples to develop correct concepts.
Collaborate Vertically and Horizontally	• Collaborate with other science teachers to ensure common language and supports for students about scientific practices that are common across scientific disciplines. • Collaborate with teachers in other content areas to ensure common language and supports for students about practices that are common across contents, such as analyzing and interpreting data in math, science and social studies. • Collaborate with other science teachers to ensure a smooth and logical progression of skills and knowledge across grade levels.
Prepare Student for Next Level	• Explicitly describe the expectations of the next level and how the current learning experiences are designed to prepare students to meet those expectations. For example, "In Physical Science, it is important for you to develop a understanding of the basic structure of the atom, because in Biology and Chemistry, you will use this understanding to describe and explain how and why molecules interact with each other in the way they do."

Element b – *Literacy*	
Provide Literacy Instruction	● Support students' information literacy through explicitly teaching skills about how to find, use and appropriately cite information in lab reports, research projects and other assignments. ● Provide multiple opportunities for students to engage in critical thinking, inquiry, creativity and innovation. ● Provide structured opportunities for students to collaborate and communicate what they have learned in science (jigsaw, think-pair-share, etc.) ● Teach analytical thinking using reading, writing, speaking, and listening. ● Explicitly teach and frequently model reading, writing, speaking, and listening strategies. ● Coach students to help them develop speaking and writing skills that support scientific arguments.
Teach Students How to Apply Literacy Skills	● Support students' reading skills through the use of effective practices for supporting the reading of informational text, including reciprocal teaching, SQ3R, pre-reading discussions, scaffolding, graphic organizers and other techniques that help students understand text. ● Support students' writing skills through the use of effective practices for supporting the writing of informational text, including modeling, graphic organizers for planning, banks of common words or phrases used in science writing (In conclusion… This evidence supports…). ● Provide clear expectations for writing and speaking in science through rubrics or exemplars. ● Display writing samples (that are current and connected to the curriculum). Expose students to model exemplars of proficient writing. Share the exemplars, discussing strengths and weaknesses. ● Provide explicit and direct language instruction about language form tied to lesson content. Language form deals with the internal grammatical structure of words. Use correct forms of adjectives to describe and differentiate findings in labs (fast, faster, fastest). Develop skills of writing for a scientific audience and improve word choice and voice. ● Provide students with supports such as scaffolded outlines and word walls to assist them in employing content-specific formating and vocabulary in their discussions, presentations, and writing. ● Model the use evidence from scientific sources to support ideas in oral and written formats.
Element c – *Numeracy*	
Connections to Math	● Highlight the connections of scientific concepts, practices or themes to mathematics -- for example, working with ratios or fractions is an important tool for understanding the principles of Mendelian genetics.
Knowledge of Math Concepts	● Explicitly integrate mathematical concepts into science – for example, the expression y = mx +b can be used to describe a linear relationship between variables, such as distance, rate and time or force, mass and acceleration.

Element d – *Content*	
Appropriately Sequenced Lessons	● Within a sequence of lessons about a specific scientific concept, allow multiple opportunities for students to develop understanding through both guided and independent practice -- for example, have students explore the concept of density through multiple activities involving liquids, solids and gasses, some more teacher-directed, and some self-directed.
Explanations and Representations	● For a given scientific concept, use varying ways to explain and represent the same idea -- for example, to represent a chemical reaction, demonstrate the actual reaction using reagents, draw a visual representation of the reaction, have students act out the reaction, and write the reaction using chemical symbols. ● Explicitly teach academic language, including vocabulary, but also including instruction to help students develop academic language skills at the sentence and discourse level. For example, "I observed …, which supports my hypothesis that…". ● Use graphic organizers and visuals to reinforce the content to be learned.
Inquiry Methods	● Engage students in the full range of scientific practices including developing questions, forming testable hypotheses and/or predictions, designing investigations, analyzing and interpreting data, constructing and communicating explanations and critiquing the explanations of others. ● Model scientific practices for students by demonstrating how equipment works and talking aloud about your own thinking as you engage in the practices. ● Allow some opportunities for students to pursue their own questions.
Element e – *Connectedness*	
Build Connections	● Facilitate students in building connections among concepts and disciplines through structured activities such as concept-mapping. ● Revisit interconnections among concepts and disciplines throughout a course to gradually build an increasingly complex picture.
Element f – *Relevance*	
Students Make Connections	● Elicit students' pre-existing ideas and experiences about scientific concepts. Encourage connection to everyday and informal experiences with science such as cooking, gardening, or sports.
Addresses Learning Objectives	● Inquire about students' interests and what they find meaningful; then, connect learning objectives to interests that you identify, taking care to connect with a diverse range of interests. ● Encourage students to research and explore careers that connect to the concepts being learned.

Standard II: Teachers establish a safe, inclusive and respectful learning environment for a diverse population of students

What does "Effective" look like in the classroom?	
Element a - *Learning Environment*	
Value Diverse Perspectives	● Demonstrate that the scientific process is a global endeavor ● Show global connections and differences ● Use evidence to support hypotheses and general conclusions ● Model evidence-based reasoning
Model Respect for Diversity	● Highlight contributions of scientists from diverse backgrounds.
Conducive for Learning	● Use strategies to reduce stereotype threat and praise efforts.
Element b - *Community*	
Sense of Community	● Build a sense of community by collaboratively establishing shared norms and expectations. ● Build a sense of community by publicly celebrating important events in students' lives -- for example, congratulating a student on a strong performance in an athletic event or theatre performance. ● Create opportunities to share writing and ideas with peers, and model the peer review process
Effective Student Interactions	● Provide and scaffold opportunities for students to collaborate, including explicit discussion about what good collaboration looks like. ● Set the expectation that students acknowledge and question each other's ideas
Respect for Differences	● Give and allow for alternative assignments which respect cultural values ● Include different perspectives, so that every voice is heard and diverse thinking is respected ● Model purposeful, meaningful, and respectful conversations
Positive Social Relationships	● Model effective group work characteristics and individual responsibilities ● Model effective work ethic characteristics
Element c – *Student's Strengths*	
Ask Challenging Questions	● Ask open ended questions which require critical thinking: analysis, and synthesis—including those with multiple perspectives and/or answers ● Pose level one, two, and three questions (gathering, processing, applying) ● Create and ask questions that strategically build and deepen student understanding ● Use strategies that require all students to engage with and share answers to each question, such as think/pair/share ● Ensure that all students are being asked for contributions

Scaffold Questions	● Provide resources that students can access 24/7 that will assist them in answering challenging questions. ● Provide tips and examples for breaking down a complex question into smaller parts ● Use pre thinking activities and accessible opening questions to guide initial understandings and to encourage student inquiry ● Provide opportunities for students to consider and give responses such as Think, Pair, Share. ● Create and distribute pre-discussion assignments that are targeted and well organized in order to build student confidence and knowledge
Wait Time	● Provide opportunities for students to process information and formulate ideas ● Monitor one's own wait time to check that wait time is being used equitably.
Flexible Grouping	● Create structures that allow students to interact with diverse groups of students ● Use a variety of groupings during a lesson or unit, including student choice and teacher-directed groupings. ● Use a variety of groupings during a lesson or unit. Group students based on a variety of factors including readiness, interest level, learning style, preference, and/or product choice.
Total Student Participation	● Provide opportunities to engage in the scientific process and monitor to ensure that all students are engaged. ● Ensure that all voices have an opportunity to express themselves and be heard ● Provide opportunities for frequent discussions with diverse groups/partners ● Ensure that the size of the group allows for and requires full participation
Element d – *Differentiation*	
Solicit Input	● Invite specialists to meet to collaborate around planning instructional adaptations for individual students. ● Provide opportunities for students to work with specialists according to their needs
Differentiated Strategies	● Provide blended learning opportunities that incorporate digital tools to extend learning beyond the classroom and school day. ● Include multiple ways to learn the content ● Include multiple ways to assess student learning ● Encourage students to use cross-language connections such as cognates and literacy skills in their own language to support their understanding of the lesson (i.e., clarification; access background knowledge; confirmation rather than side-by-side translation). ● Incorporate differentiated and varied levels of reading, writing, speaking, and listening experiences, assessments and instruction so that students of all levels achieve growth ● Have students represent their learning through multiple models: visual, written, spoken, etc.

Adapt Instructional Strategies	• Scaffold and differentiate lessons depending on student needs • Provide lesson extensions as needed that include greater depth and complexity • Provide multiple paths for students to show their learning
Challenge and Support Students	• Guide all students toward appropriately challenging work based on their unique learning needs
Element e – Home/School Connection	
Partner with Families	• Provide resources for parents to support their students and communicate these resources through multiple channels - back-to-school night, parent newsletter, email to parents, printed materials sent home, parent section of website for your course.
Coordinate Information	• As necessary, help parents connect with appropriate service providers at the school. Be willing to introduce a parent to a school staff member whom they haven't met.
Seek Services and Resources	• Research resources and services that might help address the needs of specific students.
Frequent Family Communication	• Elicit input from families about the best way to communicate with them, and incorporate these communication ideas into your tool kit for communicating to parents.
Element f – Management for Learning	
Expectations Understood by Students	• Take time to discuss what the expectations for classroom behavior mean - for example: What does it look like to treat peers and teachers with respect? • Support students to develop and monitor their own norms and expectations for collaboration
Safe and Orderly Environment	• Research and implement safe procedures regarding lab activities and demonstrations prior to performing them with students. • Discuss possible hazards with students before beginning an activity, provide clear instructions for minimizing risk, provide clear instructions for how to respond if an accident does occur, and supervise students at all times when they are engaging in potentially hazardous activities.
Appropriate Response to Misbehavior	• Avoid any responses to misbehavior that humiliate or denigrate students.
Maximum Use of Instructional Time	• Minimize time spent on purely procedural tasks such as turning in homework and taking attendance. Aim for "bell-to-bell" instruction.

Standard III: Teachers plan and deliver effective instruction and create an environment that facilitates learning for their students

What does "Effective" look like in the classroom?	
Element a - *Child/Adolescent Development*	
Adapt Lessons to Strengths and Weaknesses	● Identify students' strengths and weaknesses (for example through pre-assessments, clicker questions, etc.), and plan instruction accordingly. ● When appropriate, provide choice in products or process based on learning styles, language level, multiple intelligences or other factors.
Implement Modifications and Accommodations	● Take proactive steps to plan modifications and accommodations tailored to students' individual needs.
Knowledge of Current Developmental Science	● Apply key ideas to instruction about how students learn science: o Identify and engage pre-existing ideas o Support students development of a body of knowledge embedded within a conceptual framework o Strengthen metacognition. For example, student written reflections about what new things they have learned, what concepts they are finding difficult, verbalizing habits of mind. o Interweave scientific practices, core ideas and cross-cutting themes. For example, the same data analysis techniques can be used in the life, physical, and Earth sciences.
Collaboration with Colleagues	● Collaboratively plan lessons with colleagues that seek to incorporate understandings about how students learn science. ● Ask a colleague for feedback on a lesson plan that seeks to incorporate understandings about how students learn science.
Element b – *Assessments*	
Adjustment Based on Assessment	● If students are not understanding a concept or practice, take the time to engage students with the concept or practice in a slightly different way. ● Ask students to respond to comprehension check questions in pairs, small group, and whole class situations—verbally and in writing.
Encouraging Academic Risk	● Failure is a natural and expected component of the scientific endeavor, thus it is important to encourage students to attempt tasks that are slightly more difficult than tasks for which they have previously demonstrated competence through assessments.

	● Create and maintain a safe environment for students to take academic risks, that may even result in failure, by giving students positive recognition for trying something even if they do not succeed on the first attempt.
Student Success	● Plan extensions for lessons and units so that students who meet learning objectives early can still progress toward higher levels of proficiency.
Element c – *Effective Practices*	
Clear Lesson Objectives	● Engage students in unpacking and rephrasing lesson objectives to ensure that they are understood. ● Content language objectives (CLOs) are grade level appropriate and based on BVSD standards. The CLO has a domain: listening, speaking, reading and writing; a function of language; content; and differentiated supports by levels of language.
Create Authentic Discussion	● Create a list of questions before a lesson that are designed to provoke thoughtful discussion. ● Provide opportunities for students to discuss in small groups. ● Provide scaffolds for students to use to ask each other questions -- for example, sentence starters posted with common question frames "Can you explain what you mean when you say...?"
Student Reflection on Learning	● Provide structures that require students to reflect on their learning. ● Model reflection on learning by sharing an experience in which you learned something, how you learned it, and what it helped you realize about yourself as a learner.
Varied Instructional Strategies	● Employ the strategic use of three or more different instructional strategies during a given class period. ● Employ strategies that are student-centered. ● Use problem-based learning activities that require students to speak, write, view, listen, read, and synthesize.
Element d – *Technology*	
Research Effective Technology Approaches	● Seek information about which technology tools are most impactful for learning and in what contexts.
Develop Student Knowledge and Skills	● Use a range of effective technology tools that are designed to improve a student's ability to demonstrate what they know and understand. ● Use a range of technology tools that are used to analyze and display data. For example, spreadsheets, graphing calculators, online data analysis tools. ● Develop students' digital literacy as a crucial component of literacy development such as sharing documents for collaborative work, using commenting features to share feedback and questions, using social media tools as an avenue for communication and learning together.

Engaging and Motivating Experiences	● Use technology tools that incorporate elements of gaming, social media, and rewards such as digital badges.
Digital Resources	● Use a range of technology tools that are designed to deliver content or provide students opportunity to practice skills.
Element e – *Critical Thinking*	
Meet High Expectations with Support	● Use a variety of supports, available within and outside of class, to support students in challenging tasks.
Higher-Order Thinking and Problem-Solving	● Support student development of scientific explanations (hypotheses) through appropriate scaffolds. ● Provide opportunities for students to develop, test and refine conceptual models (hypotheses) in science ● Support students in illustrating processed data with the appropriate type of graphical representation. ● Support students in data and error analysis and statistical hypothesis testing. ● Consistently engage students in critical thinking, inquiry, creativity, collaboration, presentation, and innovation through the modes of science communication: reading, technical writing (including creating tables, graphs, drawings, and other illustrations), speaking, and listening.
Element f – *Student Collaboration*	
Grouping Matches Task and Needs	● Employ strategic use of different grouping strategies matched to task, for example if students are engaging in small group discussion, and you have English language learners who share a common native language, group them together. ● Utilize the WIDA Can Do Descriptors to assist in purposeful grouping and to provide the appropriate supports for students such as sentence stems, graphic organizers, and teacher "talk moves."
Varied Groups	● Use a variety of strategies to group students including student choice as well as teacher-directed groupings.
Students' Collaborative Efforts	● Discuss what effective collaboration looks like and have a group reflect upon their level of cooperation by referring to a rubric or specific points from that conversation. ● As appropriate, assign roles or ask students to develop and assign roles within their group, encouraging students to take on different roles throughout the course.

Element g – *Communication Skills*	
Model and Teach Effective Skills	● Explicitly model how to phrase questions and statements using scientific discourse, and coach students on using more scientific discourse. ● Model polite discourse and how to listen effectively.
Practice Communication Skills	● Provide opportunities for students to write, read, speak, listen and use additional information such as images, audio, or animation to communicate a concept. ● Discuss the role of purpose and audience in crafting effective communication.
Element h – *Feedback*	
Frequent Feedback	● Use structures that help students understand their progress toward learning goals and what they need to do to improve.
Students Using Feedback	● After providing feedback, ask students to write or share what action they are going to take based on the feedback.
Informal Assessment Methods	● Use methods that give a quick snapshot of each individual student's level of understanding