AY24 Bureau of Indian Education Science Summative Assessment Standards-Validation Report

July 26, 2024

Prepared by Cognia

TABLE OF CONTENTS

TABLE OF FIGURES

Chapter 1. Overview of Standards-Validation Procedures

This report outlines the standards-validation process for the Bureau of Indian Education (BIE). In 2022, a standard-setting process took place in another state utilizing the same secure science item bank. BIE subsequently adopted assessments based on this science item bank. The goal of the standards validation is to ensure that the performance standards set in 2022 are appropriate for BIE's student population. The primary goal is to validate the knowledge, skills, and abilities (KSAs) necessary for categorizing BIE students into the four performance levels: Novice, Near Proficiency, Proficient, and Advanced, ensuring alignment with their educational outcomes.

The standards-validation meeting took place from April 30th to May 2nd, 2024. It involved 16 panelists recruited from BIE educators, grouped into three teams: 5 for Grade 5, 4 for Grade 8, and 7 for Grade 11, each accompanied by a facilitator from Cognia. Panelists were assigned based on their primary grade-level expertise. Additionally, BIE representatives observed the standards-validation process. Table 1 illustrates how the report is organized into three major sections, describing tasks completed before, during, and after the standards-validation meeting.

Table 1: Standards-Validation Tasks and the Report Layout

Tasks Completed Before the Standards-Validation Meeting	*Tasks Completed During the Standards-Validation Meeting*	*Tasks Completed After the Standards-Validation Meeting*
• Preparation of Materials • Preparation of Instructions for Facilitators • Standards-Based Benchmarks • Preparation of Systems and Materials for Use During the Meeting • Selection of Panelists	• Overview of the ID Matching Method • General Orientation and Panelist Training • Review of Assessment Materials • Review of Performance Level Descriptors • Judgment Rounds and Feedback	• Analysis and Review of Panelists' Feedback • Approval of the Cut Scores • Preparation of Standards-Validation Report

Chapter 2. Tasks Completed Before Standards Validation

Creation of Performance Level Descriptors

In August 2020, Cognia content specialists developed performance level descriptors (PLDs) for science Grades 5, 8, and 11. These descriptors aligned with NGSS content standards and underwent review by the New Mexico Public Education Department and grade-specific committees of New Mexico educators. Final approval was obtained in 2022. The PLDs used for the workshop can be found in Appendix A.

Preparation of Materials

Various materials were compiled for presentation at the standards-validation meeting, including a nondisclosure agreement (Appendix B), PowerPoint presentations (Appendix C), test booklets, PLDs, NGSS content standards, meeting agendas, and the Cognia Standard-Setting Toolkit.

Preparation of Instructions for Facilitators

Facilitators underwent training sessions led by Cognia to ensure consistency in procedures. They were equipped with facilitator scripts embedded in grade-specific PowerPoint slides.

Cut Score Benchmarks

Cut scores set in New Mexico in 2022 were used as benchmarks. A Cognia psychometrician reviewed the Spring 2023 operational test forms for Grades 5, 8, and 11 to establish empirical threshold regions, marked as color-shaded regions in the digital tool, around these cut scores in the ordered item booklets. Appendix D contains Ordered Item Booklets with benchmarks.

Preparation of Materials for Use During the Meeting

The Cognia Standard-Validation Toolkit (Appendix E) was set up before the meeting, featuring a digitally ordered item booklet, items, PLDs, content standards, and judgment forms.

Workshop Surveys

Workshop surveys, including readiness surveys and a final workshop evaluation, were administered via Survey Monkey to gauge panelists' understanding of the process and ensure independent judgment. Appendix F contains the final workshop evaluation survey results.

Selection of Panelists

BIE selected panelists before the standards-validation meeting. The goal for panel selection was to include participants who were primarily general education teachers, with science as their subject of expertise, but also included school administrators and stakeholders from other interest groups. Moreover, to the extent possible, panelists were selected to reflect a balance of gender, race/ethnicity, and geographic location. Finally, panelists were selected who were familiar not only with the subject matter

but also with the grade for which they would be setting standards. A list of the panelists' demographics is included in Table 2. Appendix G contains a list of all panelists with their demographics.

Table 2: Panelists' Demographic Information Summary

Panelist	Demographics	N	Percentage
Assigned Grade-Specific Panel	Grade 5	5	31%
	Grade 8	4	25%
	Grade 11	7	44%
Gender	Female	11	69%
	Male	5	31%
Ethnicity	American Indian or Alaskan Native	4	25%
	Asian or Pacific Islander	4	25%
	Black or African American	1	6%
	Hispanic or Latino	3	19%
	White/Caucasian	4	25%
District Representation	Bureau Operated Schools (BOS)	6	38%
	Navajo Area Schools (NAV)	1	6%
	Tribally Controlled Schools (TCS)	9	56%
Panelist Teaching Experience			
Grade Band	Elementary	6	31%
	Middle	2	13%
	High	9	56%
Role	Teacher	8	50%
	Test Coordinator	4	25%
	Principal/Assistant Principal	2	13%
	Instructional Coach	2	13%
Years of Experience Working with BIE Schools	Less than 1 year	4	25%
	1–5 years	2	13%
	6–10 years	3	19%
	11–15 years	3	19%
	More than 15 years	4	25%

Chapter 3. Tasks Completed During the Standards-Validation Meeting

Plenary Session

The training of the panelists began with a general orientation session at the start of the standards-validation meeting, which included an overview of the BIE Science Summative Assessment. The purpose of the orientation was to ensure that all panelists received the same information about the need for and the goals of standards validation and their part in the process.

In a collaborative effort, BIE and Cognia warmly welcomed standards-validation participants, beginning with a thorough introduction and a brief assessment overview, while also clarifying the workshop's purpose. Once panelists were acquainted with the assessment and standards-validation process, they engaged in two rounds of validation activities over the subsequent two days.

Day 1 Breakout Sessions

Following the general orientation, panelists were divided into grade-specific groups to experience student tests. This step aimed to familiarize the panelists with the assessment and test-taking activities expected of students during administration.

Before undertaking the judgment tasks, panelists reviewed the borderline PLDs. This essential step aimed to guarantee a comprehensive understanding of the knowledge, skills, and abilities (KSAs) required for student classification into the four performance levels (Novice, Nearing Proficiency, Proficient, and Advanced).

Panelists completed a practice round of judgments after familiarizing themselves with the borderline PLDs. This round aimed to acquaint them with the materials and the ID Matching judgments. In the digital tool, they assessed a set of practice items covering various difficulty levels. The tool allowed them to record their observations and judgments, including item-PLD alignment, accompanied by detailed rationales.

At the end of the practice round, panelists completed the round 1 readiness survey. The readiness survey was designed to ascertain whether the panelists were comfortable moving ahead to the judgment task. Once all panelists completed the round 1 readiness survey, Cognia psychometricians reviewed the responses to make sure panelists were ready to undertake the first round of judgments. In the event of any uncertainty (based on the survey responses), the specific information was relayed to the facilitator so that any questions or issues could be addressed before proceeding to the round 1 judgments. The facilitator moved on to the next round of judgment when all panelists indicated "Yes" to all survey questions. By the end of day 1, Grade 5 had finished their first readiness survey, while Grades 8 and 11 were engaged in discussions during the practice round.

Day 2 Breakout Sessions

At the start of the day 2 breakout session, the facilitator for each grade began by debriefing day 1 and reviewing the activities planned for day 2.

During the round 1 judgment process, within each grade-specific group, panelists began with items in the Proficient region, which closely aligns with Proficient cut scores. They evaluated the skills and abilities required for each item by asking two questions: (1) “What are the knowledge, skills, and abilities a student needs to respond to this item?” and (2) “Why is this item more difficult than the previous one?” Panelists assessed each item in sequence, assigning item descriptor matches and discussing their reasoning under the facilitator’s guidance. This process ensured alignment with the judgment task and borderline PLDs while assessing panelists’ comprehension. Panelists progressed through the Proficient, Advanced, and Nearing Proficiency shaded regions in sequence, assessing each ordered item until completion.

By the end of day 2, Grade 5 had finished both the round 1 judgment and discussion and completed the round 2 readiness survey. Meanwhile, Grades 8 and 11 were nearing completion of the round 1 judgment; however, they decided to postpone the round 1 discussion and readiness survey until day 3.

Day 3 Breakout Sessions

On day 3, each group’s facilitator began by debriefing day 2 and outlining the tasks for the round 2 judgment. In this phase, the main objective was to examine the previously set cut placements from another standard setting and determine if they aligned with each panel’s expectations. Utilizing their content expertise, panelists discussed whether the existing cut scores accurately reflected the knowledge and skills students must demonstrate to be classified into specific performance levels. In grade-specific groups, discussions began with the Proficient region, where each panel examined the cut placements from the Proficient, Advanced, and Nearing Proficiency regions.

Following the conclusion of the round 2 judgment, panelists were instructed to complete the final workshop survey. This survey aims to verify that panelists grasp the entirety of the process and that their judgments are made independently. In the final workshop evaluation, panelists expressed generally positive support for the workshop overall, workshop facilitation, training, practice, and the workshop process. More detailed results are presented in Appendix F.

Chapter 4: Standards Validation Results

Tables 3–5 contain the standards-validation panelist-recommended cut scores and associated content-based rationales across Grades 5, 8, and 11 for the BIE Science Assessment. The results include the item-PLD alignment for items most closely aligned with the cut scores, RP50 values of the items, and detailed rationales for the cut placements for all three cuts across three grades.

Table 3: BIE Grade 5 Round 2 Cut Placement Results

Asset Id	RP50	Rationale	Cut Placement
626478	-0.63678	The items below did not require science knowledge to get the answers correct. You can use logic instead of science. In the question above, a student needs to know science concepts to answer the questions. Students needed to at least identify or describe to answer the questions.	Nearing Proficiency Cut
697027	0.5428	Students would have to know how to use a graph and apply it to the information that is being asked. Applying is a Proficient skill. The information is given to the students in the questions below and they have to use data/information instead of explaining or interpreting. The items above the cut have more information for students to read and it would be more difficult for a Nearing Proficiency student. They must compare more information and decide what is relevant, which is language that is used in the Proficient or Advanced level.	Proficient Cut
706847	1.71525	This item requires students to synthesize information and look at multiple solutions. They must understand multiple pieces of data. The items below have more real-life experiences with the context. The items above are more abstract and they will not have exposure to those concepts and ideas.	Advanced Cut

Table 4: BIE Grade 8 Round 2 Cut Placement Results

Asset Id	RP50	Rationale	Cut Placement
637562	-0.91106	The item near the proposed Nearing Proficiency cut aligns closely with the expectations of the Nearing Proficiency PLD. It requires students to utilize a model to recognize the formation of molecules, indicating a partial understanding of all three dimensions, which is characteristic of the Nearing Proficiency level. Conversely, items below this cut tend to align more with the Novice level, lacking the partial understanding expected at the Nearing Proficiency level. Conversely, items above this cut generally align with the Nearing Proficiency PLD, as they demand a partial understanding of all three dimensions not typically met at the Novice level.	Nearing Proficiency Cut
641845	0.54417	The item near the proposed Proficient cut closely aligns with the Proficient PLD as it requires students to demonstrate understanding through connections and explanations, which are characteristics of the Proficient level. Items above this cut generally meet Proficient or Advanced PLD expectations, indicating a thorough understanding. Conversely, items below the proposed cut tend to align more with the Nearing Proficiency PLD, requiring only partial understanding for successful responses.	Proficient Cut
663576	2.7498	The item near the proposed Advanced cut aligns closely with the Advanced level, as it requires students to develop models, a characteristic of the Advanced PLD. Items below this cut tend to align more with the Proficient PLD, requiring a satisfactory understanding for successful responses. Conversely, items above this cut generally meet the Advanced PLD expectations, requiring a thorough understanding for successful responses.	Advanced Cut

Table 5: BIE Grade 11 Round 2 Cut Placement Results

Asset Id	RP50	Rationale	Cut Placement
666236	-0.73215	The item for the proposed Nearing Proficiency cut just barely matches the Nearing Proficiency borderline PLD because the item requires students to use evidence or mathematical representations to describe factors affecting biodiversity or populations in ecosystems. Students must calculate the average population of mummichogs to support claims, and this mathematical representation is described in the Nearing Proficiency PLD but would not describe students in the Novice category. The items above this proposed cut generally meet the expectations of the Nearing Proficiency PLD because the items require students to show a partial understanding of all three dimensions to successfully respond to the items. The items below this proposed cut generally meet the expectations of the Novice PLD because items at this level do not require students to show a partial understanding of all three dimensions to successfully respond to the items.	Nearing Proficiency Cut
637610	0.09313	The item for the proposed Proficient cut barely matches the Proficient borderline PLD because the item requires students to use evidence to explain a barely satisfactory understanding of how DNA sequences for proteins. How proteins conduct the functions of life through specialized cells is described in the Proficient PLD but NOT in the Nearing Proficiency PLD. The items above this proposed cut generally meet the expectations of the Proficient PLD because the items require students to show a satisfactory understanding of all three dimensions to successfully respond to the items. The items below this proposed cut generally meet the expectations of the Nearing Proficiency PLD because the items require students to show a partial understanding of all three dimensions to successfully respond to the items.	Proficient Cut
710876	3.0119	The item for the proposed Advanced cut barely matches the Advanced borderline PLD because the item requires students to refine devices within a model that converts one form of energy into another. Students have to predict how to convert more electrical energy by changing various parts of the model (blade angles, height, blade length, materials, etc.) and how friction is involved. Students refining multiple devices within the model and demonstrating just barely thorough knowledge was described in the Advanced PLD but NOT in the Proficient PLD. The items above this proposed cut generally meet the expectations of the Advanced PLD because the items require students to show a thorough understanding of all three dimensions to successfully respond to the items. The items below this proposed cut generally meet the expectations of the Proficient PLD because the items require students to show a satisfactory understanding of all three dimensions to successfully respond to the items.	Advanced Cut

The panelist-recommended cut scores closely align with those set in the previous standards setting, validating the continued use of the provisional cuts adopted by BIE since 2022 as the official cut scores for future BIE Science Summative Assessments. These cut scores were initially established for the Cognia SSIB in 2022. The cut scores, both on the theta scale and the reporting scale, are provided in Table 6. These cut scores are also utilized for the Spring 2023 BIE Science Summative Assessments.

Table 6. Spring 2023 Cutpoints on the Theta Metric and Reporting Scale by Grade

Theta				Scale Score			
Cut1	Cut2	Cut3	Min	Cut1	Cut2	Cut3	Max
-0.75048	0.51466	1.70117	500	544	560	574	590
-0.96101	0.48988	2.73095	800	845	860	882	890
-0.76114	0.03716	2.91134	1100	1154	1160	1181	1190

The empirical performance level distributions for the Spring 2023 administration of BIE Science Summative Assessments are shown in Table 7.

Table 7. Performance Level Distribution as a Function of Grade*

Grade	Number of Students	Novice	Nearing Proficiency	Proficient	Advanced	% Novice	% Nearing Proficiency	% Proficient	% Advanced
5	1937	999	741	177	20	52%	38%	9%	1%
8	1662	479	928	254	1	29%	56%	15%	0%
11	870	497	267	105	1	57%	31%	12%	0%

**Calculations based on those students attempting 5 or more items.*

Approval of the Cut Scores

After concluding the standards-validation meeting, Cognia psychometricians and content team members held a short debrief session to review the workshop process and results with the BIE representative. Following this, Cognia drafted a memo detailing the workshop process and results and conducted a follow-up conversation to address any additional questions from the BIE. Subsequently, Cognia received written approval from the BIE to finalize the cut scores. Appendix H contains the Science Standards Validation workshop memo.

Preparation of Standard-Setting Report

Following the final compilation of standards-validation results, Cognia prepared this report, which documents the procedures and results of the 2024 science standards-validation meeting that was held to establish performance standards for the assessment.

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Appendices

APPENDIX A
PERFORMANCE LEVEL DESCRIPTORS

Grade 5 BIE Borderline PLD Table

Standards	**Nearing Proficiency** *Students at the borderline of the Nearing Proficiency level in most situations[1] can demonstrate evidence of partial understanding and use of all three dimensions (science and engineering practices, crosscutting concepts, and disciplinary core ideas) to make sense of phenomena and/or to design solutions to problems in the physical, life, and Earth and space sciences. They also sometimes demonstrate the skills and understandings at the Novice level rather than the skills and understandings of the Nearing Proficient level. Students performing at the borderline of the Nearing Proficiency level can be expected in most situations[1] to be able to demonstrate knowledge and skills such as in the following examples, as evidence of just barely partial understanding and use of the NGSS Standards:*	**Proficient** *Students at the borderline of the Proficient level in most situations[1] can demonstrate evidence of satisfactory understanding and use of all three dimensions (science and engineering practices, crosscutting concepts, and disciplinary core ideas) to make sense of phenomena and/or to design solutions to problems in the physical, life, and Earth and space sciences. They also sometimes demonstrate the skills and understandings at the Nearing Proficiency level rather than the skills and understandings of the Proficient level. Students performing at the borderline of the Proficient level can be expected in most situations[1] to be able to demonstrate knowledge and skills such as in the following examples, as evidence of just barely satisfactory understanding and use of the NGSS Standards:*	**Advanced** *Students at the borderline of the Advanced level in most situations[1] can demonstrate evidence of thorough understanding and use of all three dimensions (science and engineering practices, crosscutting concepts, and disciplinary core ideas) to make sense of phenomena and/or to design solutions to problems in the physical, life, and Earth and space sciences. They also sometimes demonstrate the skills and understandings at the Proficient level rather than the skills and understandings of the Advanced level. Students performing at the borderline of the Advanced level can be expected in most situations[1] to be able to demonstrate knowledge and skills such as in the following examples, as evidence of just barely thorough understanding and use of the NGSS Standards:*
PS-1 Matter and Its Interactions •5-PS1-1 •5-PS1-2 •5-PS1-3 •5-PS1-4 SEP •Developing and Using Models •Planning and Carrying Out Investigations •Using Mathematics and Computational Thinking CCC •Cause and Effect •Scale, Proportion, and Quantity	Use a model to describe phenomena using an understanding of matter as tiny particles, graph quantities to describe phenomena using an understanding of conservation of matter during physical or chemical changes, make observations to identify materials based on their properties, and use data to determine whether a new substance with different properties is formed when two substances are mixed.	Develop and use a model to describe phenomena using an understanding of matter as tiny particles, measure and graph quantities to describe phenomena using an understanding of conservation of matter during physical or chemical changes, make observations and measurements to identify materials based on their properties, and conduct an investigation to determine whether a new substance with different properties is formed when two substances are mixed.	Develop, use, and analyze a model to describe and explain phenomena using an understanding of matter as tiny particles, describe quantities that should be measured to explain phenomena using an understanding of conservation of matter during physical and chemical changes, describe observations and measurements that can be used to identify materials based on their properties, and plan and conduct an investigation to determine whether a new substance with different properties is formed when two substances are mixed.

PS-2 Motion and Stability: Forces and Interactions •3-PS2-1 •3-PS2-2 •3-PS2-3 •3-PS2-4 •5-PS2-1 SEP •Asking Questions and Defining Problems •Planning and Carrying Out Investigations •Engaging in Argument from Evidence CCC •Patterns •Cause and Effect	Conduct an investigation to provide one piece of evidence about phenomena using an understanding of the effects of balanced or unbalanced forces on the motion of an object, predict the future motion of an object based on simple patterns in observations and measurements, ask questions using an understanding of cause and effect of electric or magnetic interactions between objects not in contact with each other, partially define a simple design problem that can be solved using magnets, and make a claim about phenomena using an understanding that the gravitational force of Earth on objects is directed down.	Plan and conduct an investigation to provide one piece of evidence about phenomena using an understanding of the effects of balanced and unbalanced forces on the motion of an object, predict the future motion of an object based on patterns in observations and measurements, ask questions to describe phenomena using an understanding of cause and effect of electric or magnetic interactions between objects not in contact with each other, define a simple design problem that can be solved using magnets, and support an argument with one piece of evidence about phenomena using an understanding that the gravitational force of Earth on objects is directed down.	Plan and conduct an investigation to provide multiple pieces of evidence about phenomena using an understanding of the effects of balanced and unbalanced forces on the motion of an object, predict the future motion of an object based on complex patterns in observations and measurements, ask detailed questions to describe phenomena using an understanding of cause and effect of electric and magnetic interactions between objects not in contact with each other, thoroughly define a simple design problem that can be solved using magnets, and support an argument with multiple pieces of evidence about phenomena using an understanding that the gravitational force of Earth on objects is directed down.
PS-3 Energy •4-PS3-1 •4-PS3-2 •4-PS3-3 •4-PS3-4 •5-PS3-1 SEP •Asking Questions and Defining Problems •Developing and Using Models •Planning and Carrying Out Investigations •Constructing Explanations and Designing Solutions CCC •Energy and Matter	Describe phenomena using an understanding of the relationship between the speed and energy of an object, explain that energy can be transferred from place to place, describe the changes in energy that occur when objects collide, describe elements of a device that converts energy from one form to another, and describe phenomena using an understanding that food energy was once energy from the Sun.	Construct an explanation supported by one piece of evidence about phenomena using an understanding of the relationship between the speed and energy of an object; provide evidence that energy can be transferred from place to place; predict outcomes for the changes in energy that occur when objects collide; design, test, and refine a device that converts energy from one form to another; and use models to describe phenomena using an understanding that food energy was once energy from the Sun.	Construct an explanation supported by multiple pieces of evidence about phenomena using an understanding of the relationship between the speed and energy of an object; provide and analyze evidence that energy can be transferred from place to place; predict and explain outcomes for the changes in energy that occur when objects collide; thoroughly design, test, and refine a device that converts energy from one form to another; and use models to explain phenomena using an understanding that food energy was once energy from the Sun.
PS-4 Waves and Their Applications in Technologies for Information Transfer •4-PS4-1 •4-PS4-2 •4-PS4-3 SEP •Developing and Using Models •Constructing Explanations and Designing Solutions CCC •Patterns •Cause and Effect	Use models to describe phenomena using an understanding that waves can cause objects to move or that light allows objects to be seen; and describe a solution that uses patterns to transfer information.	Develop models to describe phenomena using an understanding that waves can cause objects to move, and that light allows objects to be seen; and compare multiple solutions that use patterns to transfer information.	Develop models to explain phenomena using an understanding that waves can cause objects to move, and that light allows objects to be seen; and compare and explain multiple solutions that use patterns to transfer information.

LS-1 From Molecules to Organisms: Structures and Processes •3-LS1-1 •4-LS1-1 •4-LS1-2 •5-LS1-1 SEP • Developing and Using Models •Engaging in Argument from Evidence CCC •Patterns •Systems and System Models •Energy and Matter	Use models to describe phenomena using an understanding of the diversity and commonalities of the life cycles of organisms, make a claim about phenomena using an understanding that plants and animals have internal and external structures that support life functions, describe phenomena using an understanding that animals receive or process or respond to information from their senses, and make a claim about phenomena using an understanding that plants get the materials they need for growth chiefly from air and water.	Develop models to describe phenomena using an understanding of the diversity and commonalities of the life cycles of organisms, construct an argument supported by one piece of evidence about phenomena using an understanding that plants and animals have internal and external structures that support life functions, describe phenomena using an understanding that animals receive, process, and respond to information from their senses, and support an argument with one piece of evidence about phenomena using an understanding that plants get the materials they need for growth chiefly from air and water.	Develop models to explain phenomena using an understanding of the diversity and commonalities of the life cycles of organisms, construct an argument supported by multiple pieces of evidence about phenomena using an understanding that plants and animals have internal and external structures that support life functions, explain phenomena using an understanding that animals receive, process, and respond to information from their senses, and support an argument with multiple pieces of evidence about phenomena using an understanding that plants get the materials they need for growth chiefly from air and water.
LS-2 Ecosystems: Interactions, Energy, and Dynamics •3-LS2-1 •5-LS2-1 SEP • Engaging in Argument from Evidence •Developing and Using Models CCC •Cause and Effect •Systems and System Models	Make a claim about phenomena using an understanding that some animals form groups that help members survive; and use a model to describe phenomena using an understanding of the movement of matter among plants, animals, decomposers, and the environment.	Construct an argument supported by one piece of evidence about phenomena using an understanding that some animals form groups that help members survive; and develop a model to describe phenomena using an understanding of the movement of matter among plants, animals, decomposers, and the environment.	Construct an argument supported by multiple pieces of evidence about phenomena using an understanding that some animals form groups that help members survive; and develop a model to explain phenomena using an understanding of the movement of matter among plants, animals, decomposers, and the environment.
LS-3 Heredity: Inheritance and Variation of Traits •3-LS3-1 •3-LS3-2 SEP • Analyzing and Interpreting Data CCC •Patterns •Cause and Effect	Use data to describe phenomena using an understanding that plants and animals have inherited traits OR that variation of these traits exists in groups of similar organisms; and make a claim about phenomena using an understanding that traits can be influenced by the environment.	Analyze and interpret data to provide one piece of evidence about phenomena using an understanding that plants and animals have inherited traits, and that variation of these traits exists in groups of similar organisms; and support an explanation with one piece of evidence about phenomena using an understanding that traits can be influenced by the environment.	Analyze and interpret data to provide multiple pieces of evidence about phenomena using an understanding that plants and animals have inherited traits, and that variation of these traits exists in groups of similar organisms; and support an explanation with multiple pieces of evidence about phenomena using an understanding that traits can be influenced by the environment.

LS-4 Biological Evolution: Unity and Diversity•3-LS4-1•3-LS4-2•3-LS4-3•3-LS4-4 SEP•Analyzing and Interpreting Data•Constructing Explanations and Designing Solutions•Engaging in Argument from EvidenceCCC•Cause and Effect•Scale, Proportion, and Quantity•Systems and System Models	Use fossil data to describe organisms and the environments in which they lived; describe phenomena using an understanding that variation among individuals of the same species is a survival advantage or that in a particular habitat some organisms survive well, some survive less well, and some cannot survive at all; and describe a solution to a problem caused by changes to the environment and the types of plants and animals that live there.	Analyze and interpret fossil data to provide one piece of evidence of organisms and the environments in which they lived; construct an explanation supported by one piece of evidence of phenomena using an understanding that variation among individuals of the same species is a survival advantage and that in a particular habitat some organisms survive well, some survive less well, and some cannot survive at all; and make a claim supported by one piece of evidence about the merit of a solution to a problem caused by changes to the environment and the types of plants and animals that live there.	Analyze and interpret fossil data to provide multiple pieces of evidence of organisms and the environments in which they lived; construct an explanation supported by multiple pieces of evidence of phenomena using an understanding that variation among individuals of the same species is a survival advantage and that in a particular habitat some organisms survive well, some survive less well, and some cannot survive at all; and make a claim supported by multiple pieces of evidence about the merit of a solution to a problem caused by changes to the environment and the types of plants and animals that live there.
ESS-1 Earth's Place in the Universe •4-ESS1-1 •5-ESS1-1 •5-ESS1-2 SEP • Constructing Explanations and Designing Solutions •Analyzing and Interpreting Data •Engaging in Argument from Evidence CCC •Patterns •Scale, Proportion, and Quantity	Describe phenomena using an understanding that patterns in rock formations or fossils in rock layers provide evidence to support changes in a landscape over time, describe phenomena using an understanding that differences in the apparent brightness of the Sun compared to other stars is due to their relative distances from Earth, and use data in graphical displays to reveal patterns of daily changes in shadows or day and night or the seasonal appearance of stars.	Describe phenomena using an understanding that patterns in rock formations and fossils in rock layers provide evidence to support an explanation for changes in a landscape over time, support an argument about phenomena using one piece of evidence and an understanding that differences in the apparent brightness of the Sun compared to other stars is due to their relative distances from Earth, and represent data in graphical displays to reveal patterns of daily changes in shadows, day and night, and the seasonal appearance of stars.	Explain phenomena using an understanding that patterns in rock formations and fossils in rock layers provide evidence to support an explanation for changes in a landscape over time, support an argument about phenomena using multiple pieces of evidence and an understanding that differences in the apparent brightness of the Sun compared to other stars is due to their relative distances from Earth, and represent and explain data in graphical displays to reveal patterns of daily changes in shadows, day and night, and the seasonal appearance of stars.

ESS-2 Earth's Systems •3-ESS2-1 •3-ESS2-2 •4-ESS2-1 •4-ESS2-2 •5-ESS2-1 •5-ESS2-2 SEP • Analyzing and Interpreting Data •Obtaining, Evaluating, and Communicating Information •Planning and Carrying Out Investigations •Developing and Using Models •Using Mathematical and Computational Thinking CCC •Patterns •Cause and Effect •Scale, Proportion, and Quantity •Systems and Systems Models	Use data to describe typical seasonal weather conditions, describe climates in different regions of the world, describe phenomena using an understanding of the effects of weathering or the rate of erosion, use maps to describe patterns of Earth's features, use a model to describe phenomena using an understanding of how Earth's systems interact, and provide a description of the distribution of water on Earth.	Represent data to describe typical seasonal weather conditions, combine information to describe climates in different regions of the world, provide one piece of evidence for phenomena using an understanding of the effects of weathering or the rate of erosion, analyze and interpret data from maps to describe patterns of Earth's features, develop a model to describe phenomena using an understanding of how Earth's systems interact, and describe and graph the percentages of water to provide one piece of evidence about the distribution of water on Earth.	Represent data to explain typical seasonal weather conditions, combine and synthesize information to describe climates in different regions of the world, provide multiple pieces of evidence for phenomena using an understanding of the effects of weathering and the rate of erosion, analyze and interpret data from maps to explain patterns of Earth's features, develop a model to explain phenomena using an understanding of how multiple systems on Earth interact, and describe and graph the percentages of water to provide multiple pieces of evidence about the distribution of water on Earth.
ESS-3 Earth and Human Activity •3-ESS3-1 •4-ESS3-1 •4-ESS3-2 •5-ESS3-1 SEP • Engaging in Argument from Evidence •Constructing Explanations and Designing Solutions •Obtaining, Evaluating, and Communicating Information CCC •Cause and Effect •Systems and System Models	Describe a design solution or component of a design solution that reduces the impacts of a weather-related hazard, use information to determine that energy and fuels are derived from natural resources or how their uses affect the environment or ways individual communities protect Earth's resources and the environment, and describe a solution or component of a solution to reduce the impacts of natural Earth processes on humans.	Make a claim supported by one piece of evidence about the merit of a design solution that reduces the impacts of a weather-related hazard, combine information to describe how energy and fuels are derived from natural resources, how their uses affect the environment, and ways individual communities protect Earth's resources and the environment, and generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.	Make a claim supported by multiple pieces of evidence about the merit of a design solution that reduces the impacts of a weather-related hazard, combine and synthesize information to explain that energy and fuels are derived from natural resources, how their uses affect the environment, and ways individual communities protect Earth's resources and the environment, and generate and compare multiple solutions to reduce the impacts of several natural Earth processes on humans.

ETS-1 Engineering Design 3-5 ETS1-1 3-5 ETS1-2 3-5 ETS1-3 SEP •Asking Questions and Defining Problems •Planning and Carrying Out Investigations •Constructing Explanations and Designing Solutions CCC Influence of Science, Engineering, and Technology on Society and the Natural World	Define a simple design problem including at least one criterion for success or one constraint; generate a solution to a problem or compare two solutions to a problem; and use results of a fair test to identify one way to improve a model or prototype.	Define a simple design problem including criteria for success and constraints; generate and compare multiple solutions to a problem; and plan and carry out fair tests to identify one way to improve a model or prototype.	Define a simple design problem including detailed criteria for success and constraints; generate and compare multiple detailed solutions to a problem; and plan and carry out fair tests to identify more than one way to improve a model or prototype.

[1]Most situations refer to the following. Students at level X can be expected to be able to demonstrate knowledge and skills for most but not all:

- Combinations of disciplinary core ideas, practices, and crosscutting concepts
- Science phenomena, in which students are required to apply their knowledge of science content and mastery of crosscutting concepts and practices

Grade 8 BIE Borderline PLD Table

Standards	**Nearing Proficiency** *Students at the borderline of the Nearing Proficiency level in most situations[1] can demonstrate evidence of partial understanding and use of all three dimensions (science and engineering practices, crosscutting concepts, and disciplinary core ideas) to make sense of phenomena and/or to design solutions to problems in the physical, life, and Earth and space sciences. They also sometimes demonstrate the skills and understandings at the Novice level rather than the skills and understandings of the Nearing Proficient level. Students performing at the borderline of the Nearing Proficiency level can be expected in most situations[1] to be able to demonstrate knowledge and skills such as in the following examples, as evidence of just barely partial understanding and use of the NGSS Standards:*	**Proficient** *Students at the borderline of the Proficient level in most situations[1] can demonstrate evidence of satisfactory understanding and use of all three dimensions (science and engineering practices, crosscutting concepts, and disciplinary core ideas) to make sense of phenomena and/or to design solutions to problems in the physical, life, and Earth and space sciences. They also sometimes demonstrate the skills and understandings at the Nearing Proficiency level rather than the skills and understandings of the Proficient level. Students performing at the borderline of the Proficient level can be expected in most situations[1] to be able to demonstrate knowledge and skills such as in the following examples, as evidence of just barely satisfactory understanding and use of the NGSS Standards:*	**Advanced** *Students at the borderline of the Advanced level in most situations[1] can demonstrate evidence of thorough understanding and use of all three dimensions (science and engineering practices, crosscutting concepts, and disciplinary core ideas) to make sense of phenomena and/or to design solutions to problems in the physical, life, and Earth and space sciences. They also sometimes demonstrate the skills and understandings at the Proficient level rather than the skills and understandings of the Advanced level. Students performing at the borderline of the Advanced level can be expected in most situations[1] to be able to demonstrate knowledge and skills such as in the following examples, as evidence of just barely thorough understanding and use of the NGSS Standards:*
PS-1 Matter and Its Interactions • MS-PS1-1 • MS-PS1-2 • MS-PS1-3 • MS-PS1-4 • MS-PS1-5 • MS-PS1-6 SEP • Developing and Using Models • Analyzing and Interpreting Data • Constructing Explanations and Designing Solutions • Obtaining, Evaluating, and Communicating Information CCC • Patterns • Cause and Effect • Scale, Proportion, and Quantity • Energy and Matter • Structure and Function	Use models to identify the structure of matter as it relates to phenomena; to describe basic phenomena using an understanding of changes in particle motion and state; and to identify that mass is conserved during physical or chemical changes that take place in various phenomena.	Develop and use models to describe phenomena using an understanding of the structure of matter; to predict and describe phenomena using an understanding of changes in particle motion and state; and to describe phenomena using an understanding of conservation of mass during one or two physical and chemical changes.	Develop, use, and analyze models to describe or explain phenomena using an understanding of the structure of matter; to predict, describe, and explain phenomena using an understanding of changes in particle motion and state; and to provide evidence for and describe phenomena using an understanding of conservation of mass during multiple physical and chemical changes.

PS-2 Motion and Stability: Forces and Interactions • MS-PS2-1 •MS-PS2-2 •MS-PS2-3 •MS-PS2-4 •MS-PS2-5 SEP •Asking Questions and Defining Problems •Planning and Carrying Out Investigations •Constructing Explanations and Designing Solutions •Engaging in Argument from Evidence CCC •Cause and Effect •Systems and System Models •Stability and Change	Identify or describe parts of investigations about phenomena using an understanding of the effects of forces, interactions, and mass on the motion of objects, describe aspects of phenomena using one or two pieces of data and an understanding of one gravitational interaction in a system, and identify a design or elements of a solution to a problem related to colliding objects.	Plan and carry out investigations to produce data and/or provide evidence about phenomena using an understanding of the effects of forces, interactions, and mass on the motion of objects, as well as use direct data to support claims about phenomena using an understanding of gravitational interactions in systems and to design a solution to a problem using an understanding of systems of colliding objects.	Plan, carry out, and refine investigations to provide evidence to explain phenomena using an understanding of the effects of forces, interactions, and mass on the motion of objects, as well as analyze various data to evaluate claims about phenomena using an understanding of gravitational interactions in systems, and to design and/or compare multiple solutions to a problem using an understanding of systems of colliding objects.
PS-3 Energy •MS-PS3-1 •MS-PS3-2 •MS-PS3-3 •MS-PS3-4 •MS-PS3-5 SEP •Developing and Using Models •Planning and Carrying Out Investigations •Analyzing and Interpreting Data •Constructing Explanations and Designing Solutions •Engaging in Argument from Evidence CCC •Scale, Proportion, and Quantity •Systems and System Models •Energy and Matter	Describe parts of investigations, use data, and use models to describe aspects of phenomena using an understanding of some relationships involving kinetic energy in systems; design and test a device for problems related to energy transfer; and identify principles that support claims about energy transfer in phenomena.	Plan investigations, use data, and develop or use models to describe phenomena using an understanding of relationships involving kinetic and potential energy in systems, as well as apply such understanding to design and test devices to solve problems related to energy transfer and to support claims about phenomena related to energy transfer.	Plan, carry out, and refine investigations, use and analyze data, and develop, use, and analyze models to explain phenomena using an understanding of various relationships involving kinetic and potential energy in systems, as well as apply such understanding to design, test, and evaluate devices to solve problems related to energy transfer and to support and/or evaluate claims about phenomena related to energy transfer.

PS-4 Waves and Their Applications in Technologies for Information Transfer •MS-PS4-1 •MS-PS4-2 •MS-PS4-3 SEP •Developing and Using Models •Using Mathematics and Computational Thinking •Obtaining, Evaluating, and Communicating Information CCC •Patterns •Structure and Function	Use mathematical representations, patterns, and models to identify wave properties and wave interactions with various materials as they relate to phenomena and use one or two sources of information to identify that digital signals are more reliable than analog signals as demonstrated in various phenomena.	Use mathematical representations and patterns, and develop and use models, to describe phenomena using an understanding of wave properties and relationships and wave interactions with various materials and use multiple sources of information and an understanding of signal types to support claims about phenomena related to reliability of digital and analog signals.	Develop, use, and apply mathematical representations, patterns, and models to explain phenomena using an understanding of wave properties and relationships and wave interactions with various materials, and synthesize multiple sources of information using an understanding of signal types to evaluate claims about phenomena related to reliability of digital and analog signals.
LS-1 From Molecules to Organisms: Structures and Processes •MS-LS1-1 •MS-LS1-2 •MS-LS1-3 •MS-LS1-4 •MS-LS1-5 •MS-LS1-6 •MS-LS1-7 •MS-LS1-8 SEP • Planning and Carrying Out Investigations •Developing and Using Models •Engaging in Argument from Evidence •Constructing Explanations and Designing Solutions •Obtaining, Evaluating, and Communicating Information CCC •Scale, Proportion, and Quantity •Structure and Function •Systems and System Models •Cause and Effect •Energy and Matter	Use evidence from an investigation of a phenomenon to explain that living things are made of cells, use models of phenomena to describe the function of a cell and some of its parts and to describe that food is rearranged in organisms into new substances to support growth or to release energy, make claims about phenomena using evidence and a partial understanding that the body is a system of interacting subsystems composed of cells, describe some animal behaviors or specialized plant structures that may affect reproductive success, use evidence and a partial understanding of environmental or genetic factors to describe phenomena about how those factors influence the growth of organisms, construct an explanation based on one piece of evidence to describe the role of photosynthesis in the cycling of matter or flow of energy into and out of organisms, and use information about phenomena to describe that organisms use their senses to respond to stimuli immediately or to store information as memories.	Use one or two pieces of evidence from investigations of phenomena to explain that living things are made of cells, develop and use models of phenomena to describe the function of a cell and its parts and to describe how food is rearranged in organisms through chemical reactions to support growth and/or release energy, support arguments about phenomena using one or two pieces of evidence and an understanding that the body is a system of interacting subsystems composed of cells, support an explanation for how some animal behaviors and some specialized plant structures affect the probability of reproductive success, use one or two pieces of evidence and an understanding of environmental and genetic factors to explain phenomena about how those factors influence the growth of organisms, construct an explanation based on one or two pieces of evidence to explain the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms, use information about phenomena and an understanding of behaviors of organisms to determine that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or for storage as memories.	Use multiple pieces of evidence from investigations of phenomena to explain that living things are made of cells; develop and use models of phenomena to describe the function of a cell and its parts and to describe how food is rearranged in organisms through chemical reactions to support growth and/or release energy; support arguments about phenomena using multiple pieces of evidence and an understanding that the body is a system of interacting subsystems composed of cells; support an explanation for how several animal behaviors and several specialized plant structures affect the probability of reproductive success; use multiple pieces of evidence and an understanding of environmental and genetic factors to explain phenomena about how those factors influence the growth of organisms; construct an explanation using multiple pieces of evidence to explain the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms; synthesize multiple sources of information about phenomena and an understanding of behaviors of organisms to determine that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or for storage as memories.

LS-2 Ecosystems: Interactions, Energy, and Dynamics •MS-LS2-1 •MS-LS2-2 •MS-LS2-3 •MS-LS2-4 •MS-LS2-5 SEP • Analyzing and Interpreting Data •Constructing Explanations and Designing Solutions •Developing and Using Models •Engaging in Argument from Evidence CCC •Cause and Effect •Patterns •Energy and Matter •Stability and Change	Use data about phenomena to describe one way resource availability affects populations, make a claim supported by evidence that populations are affected by changing components of an ecosystem, use models to describe phenomena about the cycling of matter or energy in an ecosystem, use a partial understanding of interactions among organisms to describe one interaction between organisms, and describe a design solution or components of a solution for phenomena that involve maintaining biodiversity in ecosystems.	Analyze and interpret data about phenomena to provide evidence to explain one or two ways that resource availability affects populations, construct an argument supported by one or two pieces of evidence that populations are affected by changing physical or biological components of an ecosystem, develop models to describe phenomena using an understanding of the cycling of matter and energy in an ecosystem, describe phenomena using an understanding of interactions among organisms and predict one or two patterns of interactions among organisms across multiple ecosystems, and evaluate two competing design solutions for phenomena that involve maintaining biodiversity in ecosystems.	Analyze and interpret data about phenomena to provide evidence to explain multiple ways that resource availability affects populations, construct an argument supported by multiple pieces of evidence that populations are affected by changing physical and biological components of an ecosystem, develop and revise models to explain phenomena using an understanding of the cycling of matter and energy in an ecosystem, describe phenomena using an understanding of interactions among organisms and predict multiple patterns of interactions among organisms across multiple ecosystems, and evaluate multiple competing design solutions for phenomena that involve maintaining biodiversity in ecosystems.
LS-3 Heredity: Inheritance and Variation of Traits •MS-LS3-1 •MS-LS3-2 SEP • Developing and Using Models CCC •Structure and Function •Cause and Effect	Use models to partially explain phenomena using an understanding of one way that genetic mutations affect organisms and to describe phenomena using an understanding of asexual reproduction resulting in offspring with identical genetic information, or about sexual reproduction resulting in offspring with genetic variation.	Develop and use one or two models to explain phenomena using an understanding of how genetic mutations affect proteins resulting in harmful, beneficial, or neutral effects on an organism and to explain phenomena using an understanding of how asexual reproduction results in offspring with identical genetic information and how sexual reproduction results in offspring with genetic variation.	Develop and use multiple models to explain phenomena using an understanding of how genetic mutations affect proteins resulting in harmful, beneficial, or neutral effects on an organism, and to explain phenomena using an understanding of how asexual reproduction results in offspring with identical genetic information and to explain how sexual reproduction results in offspring with genetic variation.

LS-4 Biological Evolution: Unity and Diversity •MS-LS4-1 •MS-LS4-2 •MS-LS4-3 •MS-LS4-4 •MS-LS4-5 •MS-LS4-6 SEP •Analyzing and Interpreting Data •Constructing Explanations and Designing Solutions •Obtaining, Evaluating, and Communicating Information •Using Mathematical and Computational Thinking CCC •Patterns •Cause and Effect	Use data about phenomena using a partial understanding of the fossil record and modern organisms to show patterns in the change of life forms over time, apply a scientific idea about phenomena to describe an anatomical similarity or difference between modern and fossil organisms, use pictorial data to describe similarities in embryological development across multiple species, use evidence or one mathematical representation to describe phenomena using a partial understanding of variation in genetic traits among individuals within a population or to describe increases and decreases in specific traits over time, and describe phenomena using a partial understanding about technologies that have changed the way humans influence the inheritance of desired traits in organisms.	Analyze and interpret one or two pieces of data about phenomena using an understanding of the fossil record and modern organisms to show patterns in the change of life forms over time, apply one or two scientific ideas about phenomena to construct an explanation for the anatomical similarities and differences among modern and fossil organisms to infer evolutionary relationships, analyze pictorial data to compare similarities in embryological development across multiple familiar species to identify evolutionary relationships, use one or two pieces of evidence or mathematical representations to explain phenomena using an understanding of how variation in genetic traits provides advantages to some individuals within a population and to support explanations of increases and decreases in specific traits over time, and explain phenomena by synthesizing one or two pieces of information about technologies that have changed the way humans influence the inheritance of desired traits in organisms.	Analyze and interpret multiple pieces of data about phenomena using an understanding of the fossil record and modern organisms to show patterns in the change of life forms over time, apply multiple scientific ideas about phenomena to construct an explanation for the anatomical similarities and differences among modern and fossil organisms to infer evolutionary relationships, analyze pictorial data to compare similarities in embryological development across multiple familiar and unfamiliar species to identify evolutionary relationships, use multiple pieces of evidence and mathematical representations to explain phenomena using an understanding of how variation in genetic traits provides advantages to some individuals within a population and to support explanations of increases and decreases in specific traits over time, and explain phenomena by synthesizing multiple pieces of information about ways technologies have changed the way humans influence the inheritance of desired traits in organisms.
ESS-1 Earth's Place in the Universe •MS-ESS1-1 •MS-ESS1-2 •MS-ESS1-3 •MS-ESS1-4 SEP •Developing and Using models •Analyzing and Interpreting Data •Constructing Explanations and Designing Solutions CCC •Patterns •Systems and System Models •Scale, Proportion, and Quantity	Use a model of the Earth-Sun-Moon system to describe phenomena using a partial understanding of the cyclic pattern of the seasons and to describe phenomena using a partial understanding of the role of gravity in the motions within the solar system or galaxies, use data on phenomena related to the scale properties of objects in the solar system, and use evidence and a partial understanding of rock strata to describe some aspects about how the geologic time scale is related to Earth's history.	Develop and use a model of the Earth-Sun-Moon system to describe phenomena using an understanding of the cyclic pattern of the seasons and to describe phenomena using an understanding of the role of gravity in the motions within the solar system and galaxies, analyze and interpret data on one or two phenomena related to the scale properties of objects in the solar system, and use one or two pieces of evidence and an understanding of rock strata to explain phenomena about how the geologic time scale is used to organize Earth's history.	Develop, use, and revise a model of the Earth-Sun-Moon system to describe phenomena using an understanding of the cyclic pattern of the seasons and to describe phenomena using an understanding of the role of gravity in the motions within the solar system and galaxies, analyze and interpret data on multiple phenomena related to the scale properties of objects in the solar system, and use multiple pieces of evidence and an understanding of rock strata to explain phenomena about how the geologic time scale is used to organize Earth's history.

ESS-2 Earth's Systems •MS-ESS2-1 •MS-ESS2-2 •MS-ESS2-3 •MS-ESS2-4 •MS-ESS2-5 •MS-ESS2-6 SEP •Developing and Using models •Constructing Explanations and Designing Solutions •Analyzing and Interpreting Data •Planning and Carrying Out Investigations CCC •Stability and Change •Scale, Proportion, and Quantity •Patterns •Energy and Matter •Cause and Effect •Systems and System Models	Use a model to describe phenomena using a partial understanding of the flow of energy that drives the cycling of Earth's materials, use evidence to explain phenomena using a partial understanding of how geoscience processes have changed Earth's surface, use data to explain phenomena using a partial understanding of the evidence that supports past plate motions on Earth, use a model to describe phenomena using an understanding of the water cycle, describe weather phenomena using evidence and a partial understanding of the interactions of air masses, and use a model to describe phenomena using an understanding of how unequal heating and Earth's rotation result in some climate, atmospheric, or ocean circulation patterns.	Develop a model to describe phenomena using an understanding of the flow of energy that drives cycling of Earth's materials, use one or two pieces of evidence to explain phenomena using an understanding of how geoscience processes have changed Earth's surface at varying time and spatial scales, analyze and interpret one or two pieces of data to explain phenomena using an understanding of the evidence that supports past plate motions on Earth, develop a model to describe phenomena using an understanding of the water cycle including energy and gravity, explain weather phenomena using evidence and an understanding of the interactions of air masses, and develop and use a model to describe phenomena using an understanding of how unequal heating and Earth's rotation result in climate, atmospheric, or ocean circulation patterns.	Develop models to describe phenomena using an understanding of the flow of energy that drives the cycling of Earth's materials, use multiple pieces of evidence to explain phenomena using an understanding of how geoscience processes have changed Earth's surface at varying time and spatial scales, analyze and interpret multiple pieces of data to explain phenomena using an understanding of the evidence that supports past plate motions on Earth, develop models to describe phenomena using an understanding of the water cycle including energy and gravity, explain weather phenomena synthesizing and using evidence and an understanding of the interactions of air masses, and develop and use models to describe phenomena using an understanding of how unequal heating and Earth's rotation result in climate, atmospheric, and ocean circulation patterns.
ESS-3 Earth and Human Activity •MS-ESS3-1 •MS-ESS3-2 •MS-ESS3-3 •MS-ESS3-4 •MS-ESS3-5 SEP •Constructing Explanations and Designing Solutions •Analyzing and Interpreting Data •Engaging in Argument from Evidence •Asking Questions and Defining Problems CCC •Cause and Effect •Patterns •Stability and Change	Use evidence to explain a phenomenon using a partial understanding of how geoscience processes have resulted in uneven distribution of some of Earth's natural resources, use data on natural hazard phenomena to forecast future catastrophic events or to inform the development of one technology that could be used to mitigate their effects, identify human impacts on the environment or design parts of a solution for monitoring or minimizing the human impacts, use evidence to make a claim about phenomena using a partial understanding of how increases in human population impact Earth's systems, and ask one question about a phenomenon to clarify evidence of one factor that has caused the rise in global temperatures.	Use evidence to explain one or two phenomena using an understanding of how geoscience processes have resulted in uneven distribution of Earth's natural resources, analyze and interpret one or two pieces of data on natural hazard phenomena to forecast future catastrophic events and to inform the development of technologies to mitigate their effects, apply scientific principles to design a solution for monitoring and minimizing human impacts on the environment, use one or two pieces of evidence to support an argument about phenomena using an understanding of how increases in human population impact Earth's systems, and ask one or two questions about phenomena to clarify evidence of one or two factors that have caused the rise in global temperatures.	Use evidence to explain multiple phenomena using an understanding of how geoscience processes have resulted in uneven distribution of Earth's natural resources, analyze and interpret multiple pieces of data on natural hazard phenomena to forecast future catastrophic events and to inform the development of technologies to mitigate their effects, apply scientific principles to design a successful solution for monitoring and minimizing the human impacts on the environment, use multiple pieces of evidence to support an argument about phenomena using an understanding of how increases in human population impact Earth's systems, and ask multiple questions about phenomena to clarify evidence of multiple factors that have caused the rise in global temperatures.

ETS-1 Engineering Design •MS-ETS1-1 •MS-ETS1-2 •MS-ETS1-3 •MS-ETS1-4 SEP •Developing and Using Models •Analyzing and Interpreting Data •Engaging in Argument from Evidence •Asking Questions and Defining Problems CCC •Influence of Science Engineering, and Technology on Society and the Natural World	Define one criterion or constraint of a design problem using an understanding of scientific principles and/or potential impacts on people and the environment and identify one way those impacts may limit possible solutions, use a systematic process to evaluate how well a design solution meets required criteria or constraints, analyze data from tests of a design solution to identify a characteristic of the solution that is necessary to meet the criteria for success, and develop a partial model of a proposed object, tool, or process that can be tested and modified.	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution and using an understanding of scientific principles and potential impacts on people and the environment and an understanding of how those impacts may limit possible solutions, use a systematic process to evaluate how well two competing design solutions meet required criteria and constraints, analyze data from tests of two different design solutions to identify the best characteristics of each solution that can be combined into a new solution that will better meet criteria for success, and develop a model of a proposed object, tool, or process that generates data while it is repeatedly tested and modified until an optimal design is achieved.	Define the criteria and constraints of a design problem with sufficient precision to ensure an optimal solution and using an understanding of scientific principles and potential impacts on people and the environment and an understanding of how those impacts may limit possible solutions, use a systematic process to evaluate how well multiple competing design solutions meet required criteria and constraints, analyze data from tests of multiple different design solutions to identify the best characteristics of each solution that can be combined into a new solution that will better meet criteria for success, and develop a realistic model of a proposed object, tool, or process that generates data while it is repeatedly tested and modified until an optimal design is achieved.

[1]Most situations refer to the following. Students at level X can be expected to be able to demonstrate knowledge and skills for most but not all:
• Combinations of disciplinary core ideas, practices, and crosscutting concepts
• Science phenomena, in which students are required to apply their knowledge of science content and mastery of crosscutting concepts and practices

Grade 11 BIE Borderline PLD Table

Standards	Nearing Proficiency *Students at the borderline of the Nearing Proficiency level in most situations[1] can demonstrate evidence of partial understanding and use of all three dimensions (science and engineering practices, crosscutting concepts, and disciplinary core ideas) to make sense of phenomena and/or to design solutions to problems in the physical, life, and Earth and space sciences. They also sometimes demonstrate the skills and understandings at the Novice level rather than the skills and understandings of the Nearing Proficient level. Students performing at the borderline of the Nearing Proficiency level can be expected in most situations[1] to be able to demonstrate knowledge and skills such as in the following examples, as evidence of just barely partial understanding and use of the NGSS Standards:*	Proficient *Students at the borderline of the Proficient level in most situations[1] can demonstrate evidence of satisfactory understanding and use of all three dimensions (science and engineering practices, crosscutting concepts, and disciplinary core ideas) to make sense of phenomena and/or to design solutions to problems in the physical, life, and Earth and space sciences. They also sometimes demonstrate the skills and understandings at the Nearing Proficiency level rather than the skills and understandings of the Proficient level. Students performing at the borderline of the Proficient level can be expected in most situations[1] to be able to demonstrate knowledge and skills such as in the following examples, as evidence of just barely satisfactory understanding and use of the NGSS Standards:*	Advanced *Students at the borderline of the Advanced level in most situations[1] can demonstrate evidence of thorough understanding and use of all three dimensions (science and engineering practices, crosscutting concepts, and disciplinary core ideas) to make sense of phenomena and/or to design solutions to problems in the physical, life, and Earth and space sciences. They also sometimes demonstrate the skills and understandings at the Proficient level rather than the skills and understandings of the Advanced level. Students performing at the borderline of the Advanced level can be expected in most situations[1] to be able to demonstrate knowledge and skills such as in the following examples, as evidence of just barely thorough understanding and use of the NGSS Standards:*
PS-1 Matter and Its Interactions •HS-PS1-1 •HS-PS1-2 •HS-PS1-3 •HS-PS1-4 •HS-PS1-5 •HS-PS1-6 •HS-PS1-7 •HS-PS1-8 SEP •Developing and Using Models •Constructing Explanations and Designing Solutions •Planning and Carrying Out Investigations •Using Mathematics and Computational Thinking CCC •Patterns •Energy and Matter •Stability and Change	Use a partial understanding of the periodic table to predict one relative property of elements, conduct an investigation of phenomena related to bulk scale properties of substances or construct a partial explanation of how these relate to the strength of electrical forces between particles, describe phenomena about the release or absorption of energy by a chemical system, explain phenomena using a partial understanding of how changes in temperature or concentration affect reaction rate, explain phenomena about chemical systems at equilibrium using a partial understanding of how one condition on the system could be changed to produce more products, use a mathematical representation to support a claim that mass is conserved during a chemical reaction, and use models to describe phenomena using a partial understanding of the changes in the nucleus of an atom or the energy released during fission, fusion, or radioactive decay.	Use an understanding of the periodic table to predict one or two relative properties of elements, plan and conduct an investigation of phenomena related to one or two bulk scale properties of substances and explain how these relate to the strength of electrical forces between particles, explain phenomena about the release or absorption of energy by a chemical system by developing a model to show changes in total bond energy, use one or two pieces of evidence to explain phenomena using an understanding of how changes in temperature or concentration affect reaction rate, explain phenomena about chemical systems at equilibrium using an understanding of how one or two of the conditions on the system could be changed to produce more products, use one or two mathematical representations to support claims that mass is conserved during a chemical reaction, and develop one or two models to describe phenomena using an understanding of the changes in the nucleus of an atom and the energy released during fission, fusion, and radioactive decay.	Use an understanding of the periodic table to predict multiple relative properties of elements, plan and conduct an investigation of phenomena related to multiple bulk scale properties of substances and explain how these relate to the strength of electrical forces between particles, explain phenomena about the release or absorption of energy by a chemical system by developing models to show changes in total bond energy, use multiple pieces of evidence to explain phenomena using an understanding of how changes in temperature and concentration affect reaction rate, explain phenomena about chemical systems at equilibrium using an understanding of how multiple conditions on the system could be changed to produce more or fewer products or more or fewer reactants, use multiple mathematical representations to support claims that mass is conserved during a chemical reaction, and develop multiple models to describe phenomena using an understanding of the changes in the nucleus of an atom and the energy released during fission, fusion, and radioactive decay.

PS-2 Motion and Stability: Forces and Interactions •HS-PS2-1 •HS-PS2-2 •HS-PS2-3 •HS-PS2-4 •HS-PS2-5 •HS-PS2-6 SEP •Analyzing and Interpreting Data •Using Mathematics and Computational Thinking •Constructing Explanations and Designing Solutions •Planning and Carrying Out Investigations •Obtaining, Evaluating, and Communicating Information CCC •Cause and Effect •Systems and System Models •Patterns •Structure and Function	Use data from phenomena to show that *f* = *ma*, use a mathematical representation of a phenomenon and a partial understanding of momentum to support the claim that the total momentum of a system is conserved, apply a scientific or an engineering idea to design a device that minimizes force on an object during a collision, use mathematical representations of Newton's law of gravitation or Coulomb's law to describe phenomena using a partial understanding of gravitational and electrostatic forces between objects, conduct an investigation of phenomena to produce evidence that an electric current produces a magnetic field or that a changing magnetic field produces electric current, and communicate information about phenomena using a partial understanding of how the molecular structure of a material relates to its macroscopic properties or makes the material well suited for particular uses.	Analyze and use one or two pieces of data from phenomena to show that *f* = *ma*; use one or two mathematical representations of phenomena and an understanding of momentum to support the claim that the total momentum of a system is conserved when there is no net force on the system; apply one or two scientific and engineering ideas to design, evaluate, and refine a device that minimizes force on an object during a collision; use mathematical representations of Newton's law of gravitation and Coulomb's law to describe and make predictions about familiar phenomena using an understanding of gravitational and electrostatic forces between objects; plan and conduct an investigation of phenomena to produce one or two pieces of evidence that prove an electric current produces a magnetic field and that a changing magnetic field produces electric current; and communicate one or two pieces of information about phenomena using an understanding of how the molecular structure of a material relates to its macroscopic properties and makes the material well suited for particular uses.	Analyze and use multiple pieces of data from phenomena to show that *f* = *ma*; use multiple mathematical representations of phenomena and an understanding of momentum to support the claim that the total momentum of a system is conserved when there is no net force on the system; apply multiple scientific and engineering ideas to design, evaluate, and refine multiple devices that minimize force on an object during a collision; use mathematical representations of Newton's law of gravitation and Coulomb's law to describe and make predictions about familiar and unfamiliar phenomena using an understanding of gravitational and electrostatic forces between objects; plan and conduct an investigation of phenomena to produce multiple pieces of evidence that prove an electric current produces a magnetic field and that a changing magnetic field produces electric current; and communicate multiple pieces of information about phenomena using an understanding of how the molecular structure of a material relates to its macroscopic properties and makes the material well suited for particular uses.

PS-3 Energy •HS-PS3-1 •HS-PS3-2 •HS-PS3-3 •HS-PS3-4 •HS-PS3-5 SEP •Using Mathematics and Computational Thinking •Developing and Using Models •Constructing Explanations and Designing Solutions •Planning and Carrying Out Investigations CCC •Systems and System Models •Energy and Matter •Cause and Effect	Use a computational model of phenomena to calculate changes in energy of a system when energy flows into and out of the system is known; use models to explain phenomena using a partial understanding of how energy at the macroscopic scale can be accounted for at the microscopic scale in energy associated with particle motion or relative position; design a device that converts one form of energy into another; conduct an investigation of phenomena that provides evidence using a partial understanding that when two components of different temperatures are combined within a closed system, both components eventually have the same temperature; and use a model to explain phenomena related to the forces or the changes in energy between two objects interacting through electric or magnetic fields.	Create a computational model of phenomena to calculate changes in energy of a system when energy flows into and out of the system is known; develop and use one or two models to explain phenomena using an understanding of how energy at the macroscopic scale can be accounted for at the microscopic scale in energy associated with particle motion and relative position; design, build, and refine a device that converts one form of energy into another; plan and conduct an investigation of phenomena to provide one or two pieces of evidence using an understanding that when two components of different temperatures are combined within a closed system, both components eventually have the same temperature; and develop and use a model to explain phenomena related to the forces and the changes in energy between two objects interacting through electric or magnetic fields.	Create multiple computational models of phenomena to calculate changes in energy of a system when energy flows into and out of the system is known; develop and use multiple models to explain phenomena using an understanding of how energy at the macroscopic scale can be accounted for at the microscopic scale in energy associated with particle motion and relative position; design, build, and refine devices that convert one form of energy into another; plan and conduct an investigation of phenomena to provide multiple pieces of evidence using an understanding that when two components of different temperatures are combined within a closed system, both components eventually have the same temperature; and develop and use a model to explain phenomena related to the forces and the changes in energy between two objects interacting through electric fields and magnetic fields.

PS-4 Waves and Their Applications in Technologies for Information Transfer • HS-PS4-1 • HS-PS4-2 • HS-PS4-3 • HS-PS4-4 • HS-PS4-5 SEP • Using Mathematics and Computational Thinking • Asking Questions and Defining Problems • Engaging in Argument from Evidence • Obtaining, Evaluating, and Communicating Information CCC • Cause and Effect • Stability and Change • Systems and System Models	Explain phenomena using an understanding of a mathematical representation regarding one relationship among frequency, wavelength, and speed of waves in various media; ask questions about phenomena using a partial understanding of the advantages of using digital transmission and storage of information; use one phenomenon to support a claim that electromagnetic radiation may be described using a wave or particle model; make a claim about phenomena related to the effects that different frequencies of electromagnetic radiation have on matter; and communicate information about phenomena using a partial understanding of how specific technological devices use the principles of wave behavior or wave interactions to transmit or capture information and energy.	Explain phenomena using an understanding of one or two mathematical representations regarding relationships among frequency, wavelength, and speed of waves in various media; evaluate one or two questions about phenomena using an understanding of the advantages of using digital transmission and storage of information; use one or two phenomena to evaluate claims that electromagnetic radiation can be described using a wave or particle model; in the context of phenomena, evaluate one or two claims about the effects that different frequencies of electromagnetic radiation have on matter; and communicate technical information about phenomena using an understanding of how one or two specific technological devices use the principles of wave behavior and wave interactions to transmit and capture information and energy.	Explain phenomena using an understanding of multiple mathematical representations regarding relationships among frequency, wavelength, and speed of waves in various media; evaluate multiple questions about phenomena using an understanding of the advantages of using digital transmission and storage of information; use multiple phenomena to evaluate claims that electromagnetic radiation can be described using a wave or particle model; in the context of phenomena, evaluate multiple claims about the effects that different frequencies of electromagnetic radiation have on matter; and communicate technical information about phenomena using an understanding of how multiple specific technological devices use the principles of wave behavior and wave interactions to transmit and capture information and energy.

LS-1 From Molecules to Organisms: Structures and Processes • HS-LS1-1 • HS-LS1-2 • HS-LS1-3 • HS-LS1-4 • HS-LS1-5 • HS-LS1-6 • HS-LS1-7 SEP • Constructing Explanations and Designing Solutions • Developing and Using Models • Planning and Carrying Out Investigations CCC • Structure and Function • Systems and System Models • Stability and Change • Energy and Matter	Use evidence to explain phenomena using a partial understanding of how the structure of DNA determines the structure of proteins; use a model to describe phenomena using a partial understanding of the organization of interacting systems within multicellular organisms; conduct an investigation to provide evidence about phenomena that show that some feedback mechanisms maintain homeostasis; use a model to describe phenomena using a partial understanding of how cell division or differentiation helps produce or maintain a complex organism; use a model to describe phenomena using a partial understanding of how photosynthesis transforms light energy into stored chemical energy; describe that carbon, hydrogen, and oxygen from sugar molecules combine with other elements to form amino acids or other large carbon-based molecules; and use a model to describe phenomena using a partial understanding that cellular respiration is a chemical process that breaks the bonds in food or oxygen molecules, forms bonds in new compounds, or results in a net transfer of energy.	Use evidence to explain phenomena using an understanding of how the structure of DNA determines the structure of proteins and how proteins carry out the functions of life through specialized cells; develop and use a model to describe phenomena using an understanding of the organization of interacting systems within multicellular organisms; plan and conduct an investigation to provide evidence about phenomena that show that feedback mechanisms maintain homeostasis; use a model to describe phenomena using an understanding of how cell division and differentiation help produce and maintain complex organisms; use a model to describe phenomena using an understanding of how photosynthesis transforms light energy into stored chemical energy; use evidence to construct and revise an explanation about phenomena using an understanding of how carbon, hydrogen, and oxygen from sugar molecules combine with other elements to form amino acids and/or other large carbon-based molecules; and use a model to describe phenomena using an understanding that cellular respiration is a chemical process that breaks the bonds in food and oxygen molecules and forms bonds in new compounds, which results in a net transfer of energy.	Use multiple pieces of evidence to explain phenomena using an understanding of how the structure of DNA determines the structure of proteins and how proteins carry out the functions of life through specialized cells; develop and use a complex model to describe phenomena using an understanding of the organization of interacting systems within multicellular organisms; plan and conduct an investigation to provide multiple pieces of evidence about phenomena that show that feedback mechanisms maintain homeostasis; use a complex model to describe phenomena using an understanding of how cell division and differentiation help produce and maintain complex organisms; use a complex model to describe phenomena using an understanding of how photosynthesis transforms light energy into stored chemical energy; use multiple pieces of evidence to construct and revise an explanation about phenomena using an understanding of how carbon, hydrogen, and oxygen from sugar molecules combine with other elements to form amino acids and other large carbon-based molecules; and use a complex model to describe phenomena using an understanding that cellular respiration is a chemical process that breaks the bonds in food and oxygen molecules and forms bonds in new compounds, which results in a net transfer of energy.

LS-2 Ecosystems: Interactions, Energy, and Dynamics • HS-LS2-1 • HS-LS2-2 • HS-LS2-3 • HS-LS2-4 • HS-LS2-5 • HS-LS2-6 • HS-LS2-7 • HS-LS2-8 SEP • Using Mathematical and Computational Thinking • Constructing Explanations and Designing Solutions • Developing and Using Models • Engaging in Argument from Evidence CCC • Scale, Proportion, and Quantity • Energy and Matter • Systems and System Models • Stability and Change • Cause and Effect	Use mathematical or computational representations to support explanations of phenomena using a partial understanding of factors that affect carrying capacity of ecosystems; use evidence or mathematical representations to describe factors affecting biodiversity or populations in ecosystems and to support a claim for the cycling of matter or flow of energy among organisms in an ecosystem; use evidence to construct an explanation of phenomena using a partial understanding of the cycling of matter and flow of energy in aerobic or anaerobic conditions; use a model to describe phenomena using an understanding of the role of photosynthesis or cellular respiration in the cycling of carbon; evaluate a claim about a phenomenon involving interactions in ecosystems using a partial understanding that these interactions maintain relatively consistent numbers and types of organisms under stable conditions, but changing conditions may result in a new ecosystem; identify a solution for reducing impacts of human activities on the environment or biodiversity; and use evidence to describe the role of group behavior on individual and species' chances to survive and reproduce.	Use mathematical or computational representations to support explanations of phenomena using an understanding of factors that affect carrying capacity of ecosystems at different scales; use one or two pieces of evidence and one or two mathematical representations to support and revise explanations of phenomena using an understanding of factors affecting biodiversity and populations in ecosystems of different scales and to support claims for the cycling of matter and flow of energy among organisms in an ecosystem; use evidence to construct or revise an explanation of phenomena using an understanding of the cycling of matter and flow of energy in aerobic and anaerobic conditions; develop a model to describe phenomena using an understanding of the role of photosynthesis and cellular respiration in the cycling of carbon among Earth's spheres; evaluate one or two claims, pieces of evidence, and reasoning about phenomena involving complex interactions in ecosystems using an understanding that these interactions maintain relatively consistent numbers and types of organisms under stable conditions, but changing conditions may result in a new ecosystem; design, evaluate, and refine a solution for reducing impacts of human activities on the environment or biodiversity; and evaluate one or two pieces of evidence about phenomena using an understanding of the role of group behavior on individual and species' chances to survive and reproduce.	Use mathematical and computational representations to support explanations of phenomena using an understanding of factors that affect carrying capacity of ecosystems at different scales; use multiple pieces of evidence and mathematical representations to support and revise explanations of phenomena using an understanding of factors affecting biodiversity and populations in ecosystems of different scales and to support claims for the cycling of matter and flow of energy among organisms in an ecosystem; use evidence to construct and revise an explanation of phenomena using an understanding of the cycling of matter and flow of energy in aerobic and anaerobic conditions; develop models to describe phenomena using an understanding of the role of photosynthesis and cellular respiration in the cycling of carbon among Earth's spheres; evaluate multiple claims, pieces of evidence, and reasoning about phenomena involving complex interactions in ecosystems using an understanding that these interactions maintain relatively consistent numbers and types of organisms under stable conditions, but changing conditions may result in a new ecosystem; design, evaluate, and refine solutions for reducing impacts of human activities on the environment or biodiversity; and evaluate multiple pieces of evidence about phenomena using an understanding of the role of group behavior on individual and species' chances to survive and reproduce.

LS-3 Heredity: Inheritance and Variation of Traits • HS-LS3-1 • HS-LS3-2 • HS-LS3-3 SEP • Asking Questions and Defining Problems • Engaging in Argument from Evidence • Analyzing and Interpreting Data CCC • Cause and Effect • Scale, Proportion, and Quantity	Ask a question about a phenomenon to clarify relationships about the role of DNA in chromosomes in coding the instructions for traits passed from parents to offspring; make a claim about phenomena using a partial understanding that inheritable genetic variations may result from new genetic combinations through meiosis, viable errors during replication, or mutations caused by environmental factors; and describe phenomena using an understanding of the variation and distribution of expressed traits in a population.	Ask one or two questions about phenomena to clarify relationships about the role of DNA in chromosomes in coding the instructions for traits passed from parents to offspring; use one or two pieces of evidence to make and defend a claim about phenomena using an understanding that inheritable genetic variations may result from new genetic combinations through meiosis, viable errors during replication, and/or mutations caused by environmental factors; and apply one or two concepts of statistics and probability to explain phenomena using an understanding of the variation and distribution of expressed traits in a population.	Ask multiple questions about phenomena to clarify relationships surrounding the role of DNA in chromosomes in coding the instructions for traits passed from parents to offspring; use multiple pieces of evidence to make and defend a claim about phenomena using an understanding that inheritable genetic variations may result from new genetic combinations through meiosis, viable errors during replication, and/or mutations caused by environmental factors; and apply multiple concepts of statistics and probability to explain phenomena using an understanding of the variation and distribution of expressed traits in a population.
LS-4 Biological Evolution: Unity and Diversity • HS-LS4-1 • HS-LS4-2 • HS-LS4-3 • HS-LS4-4 • HS-LS4-5 • HS-LS4-6 SEP • Obtaining, Evaluating, and Communicating Information • Constructing Explanations and Designing Solutions • Analyzing and Interpreting Data • Engaging in Argument from Evidence • Using Mathematics and Computational Thinking CCC • Patterns • Cause and Effect	Communicate scientific information about phenomena using a partial understanding that common ancestry and biological evolution are supported by empirical evidence; use evidence to construct an explanation about phenomena using a partial understanding that the process of evolution primarily results from one or two of the following factors: the potential for a species to increase in number, the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, competition for limited resources, and the proliferation of those organisms that are better able to survive and reproduce in the environment; apply concepts of statistics or probability to explain phenomena using a partial understanding that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking the trait; explain phenomena using a partial understanding of how natural selection leads to adaptation of populations; use evidence to support claims about phenomena using a partial understanding that changes in environmental conditions may result in one or two of the following: increases in numbers of individuals of some species, the emergence of new species over time, or the extinction of other species; and use a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.	Communicate one or two pieces of scientific information about phenomena using an understanding that common ancestry and biological evolution are supported by multiple lines of empirical evidence; use one or two pieces of evidence to construct an explanation about phenomena using an understanding that the process of evolution primarily results from four factors: the potential for a species to increase in number, the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, competition for limited resources, and the proliferation of those organisms that are better able to survive and reproduce in the environment; apply one or two concepts of statistics and probability to support explanations of phenomena using an understanding that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking the trait; use one or two pieces of evidence to construct an explanation of phenomena using an understanding of how natural selection leads to adaptation of populations; evaluate one or two pieces of evidence supporting claims about phenomena using an understanding that changes in environmental conditions may result in: increases in numbers of individuals of some species, the emergence of new species over time, and the extinction of other species; and create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.	Communicate multiple pieces of scientific information about phenomena using an understanding that common ancestry and biological evolution are supported by multiple lines of empirical evidence; use multiple pieces of evidence to construct an explanation about phenomena using an understanding that the process of evolution primarily results from four factors: the potential for a species to increase in number, the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, competition for limited resources, and the proliferation of those organisms that are better able to survive and reproduce in the environment; apply multiple concepts of statistics and probability to support explanations of phenomena using an understanding that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking the trait; use multiple pieces of evidence to construct an explanation of phenomena using an understanding of how natural selection leads to adaptation of populations; evaluate multiple pieces of evidence supporting claims about phenomena using an understanding that changes in environmental conditions may result in: increases in numbers of individuals of some species, the emergence of new species over time, and the extinction of other species; and create and revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

ESS-1 Earth's Place in the Universe • HS-ESS1-1 • HS-ESS1-2 • HS-ESS1-3 • HS-ESS1-4 • HS-ESS1-5 • HS-ESS1-6 SEP • Developing and Using Models • Constructing Explanations and Designing Solutions • Obtaining, Evaluating, and Communicating Information • Using Mathematical and Computational Thinking • Engaging in Argument from Evidence CCC • Scale, Proportion, and Quantity • Energy and Matter • Patterns • Stability and Change	Use evidence to develop a model to describe phenomena using a partial understanding of the life span of the Sun or the role of nuclear fusion in the Sun's core to release energy that reaches Earth in the form of radiation; use evidence and a partial understanding of the phenomena of light spectra, motion of distant galaxies, or composition of matter in the universe to construct an explanation of the big bang theory; communicate a scientific idea about a phenomenon using a partial understanding of the way stars produce different elements over their life cycles; use a mathematical or computational representation of phenomena to predict the motion of orbiting objects in the solar system; use evidence of phenomena using a partial understanding of past and current movements of continental and oceanic crust or the theory of plate tectonics to explain the ages of crustal rocks; and apply scientific reasoning or a partial understanding of evidence from ancient Earth materials, meteorites, and other planetary surfaces to describe phenomena about Earth's formation and early history.	Use one or two pieces of evidence to develop a model to describe phenomena using an understanding of the life span of the Sun and the role of nuclear fusion in the Sun's core to release energy that reaches Earth in the form of radiation; use one or two pieces of evidence and an understanding of the phenomena of light spectra, motion of distant galaxies, and composition of matter in the universe to construct an explanation of the big bang theory; communicate one or two scientific ideas about phenomena using an understanding of the way stars produce different elements over their life cycles; use mathematical or computational representations of phenomena to predict the motion of orbiting objects in the solar system; evaluate one or two pieces of evidence of phenomena using an understanding of past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks; and apply scientific reasoning and an understanding of one or two pieces of evidence from ancient Earth materials, meteorites, and other planetary surfaces to describe phenomena about Earth's formation and early history.	Use multiple pieces of evidence to develop a model to describe phenomena using an understanding of the life span of the Sun and the role of nuclear fusion in the Sun's core to release energy that reaches Earth in the form of radiation; use multiple pieces of evidence and an understanding of the phenomena of light spectra, motion of distant galaxies, and composition of matter in the universe to construct an explanation of the big bang theory; communicate multiple scientific ideas about phenomena using an understanding of the way stars produce different elements over their life cycles; use mathematical and computational representations of phenomena to predict the motion of orbiting objects in the solar system; evaluate multiple pieces of evidence of phenomena using an understanding of past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks; and apply scientific reasoning and an understanding of multiple pieces of evidence from ancient Earth materials, meteorites, and other planetary surfaces to describe phenomena about Earth's formation and early history.

ESS-2 Earth's Systems • HS-ESS2-1 • HS-ESS2-2 • HS-ESS2-3 • HS-ESS2-4 • HS-ESS2-5 • HS-ESS2-6 • HS-ESS2-7 SEP • Developing and Using Models • Analyzing and Interpreting Data • Planning and Carrying Out Investigations • Engaging in Argument from Evidence CCC • Stability and Change • Energy and Matter • Cause and Effect • Structure and Function	Use a model to describe phenomena using a partial understanding of how Earth's internal and surface processes operate to form continental and ocean floor features; use geoscience data about phenomena to make a claim that one change to Earth's surface can create feedback that causes changes to other Earth systems; develop a model of Earth's interior to describe phenomena using an understanding of the cycling of matter by thermal convection; use a model to describe phenomena using a partial understanding of how variations in the flow of energy into and out of Earth's systems result in changes in climate; conduct an investigation of phenomena related to the properties of water using a partial understanding of water's effects on Earth materials or surface processes; use a quantitative model to describe phenomena using a partial understanding of the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere; and use evidence to make a claim about phenomena using a partial understanding of the simultaneous coevolution of Earth's systems and life on Earth.	Develop a model to describe phenomena using an understanding of how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean floor features; analyze one type of geoscience data about phenomena to make a claim that one change to Earth's surface can create feedback that causes changes to other Earth systems; use one or two pieces of evidence to develop a model of Earth's interior to describe phenomena using an understanding of the cycling of matter by thermal convection; use a model to describe phenomena using an understanding of how variations in the flow of energy into and out of Earth's systems result in changes in climate; plan and conduct an investigation of phenomena related to the properties of water using an understanding of water's effects on Earth materials and surface processes; develop a quantitative model to describe phenomena using an understanding of the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere; and use one or two pieces of evidence to construct an argument about phenomena using an understanding of the simultaneous coevolution of Earth's systems and life on Earth.	Develop models to describe phenomena using an understanding of how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean floor features; analyze multiple types of geoscience data about phenomena to make a claim that one change to Earth's surface can create feedback that causes changes to other Earth systems; use multiple pieces of evidence to develop a model of Earth's interior to describe phenomena using an understanding of the cycling of matter by thermal convection; use models to describe phenomena using an understanding of how variations in the flow of energy into and out of Earth's systems result in changes in climate; plan and conduct investigations of phenomena related to the properties of water using an understanding of water's effects on Earth materials and surface processes; develop quantitative models to describe phenomena using an understanding of the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere; and use multiple pieces of evidence to construct an argument about phenomena using an understanding of the simultaneous coevolution of Earth's systems and life on Earth.

ESS-3 Earth and Human Activity • HS-ESS3-1 • HS-ESS3-2 • HS-ESS3-3 • HS-ESS3-4 • HS-ESS3-5 • HS-ESS3-6 SEP • Constructing Explanations and Designing Solutions • Engaging in Argument from Evidence • Using Mathematics and Computational Thinking • Analyzing and Interpreting Data CCC • Cause and Effect • Stability and Change • Systems and System Models	Use evidence to construct an explanation about phenomena using a partial understanding of how the availability of natural resources, occurrence of natural hazards, or changes in climate have influenced human activity; using a partial understanding of cost-benefit ratios, evaluate a design solution for developing, managing, or utilizing energy or mineral resources; use a computational simulation of phenomena to show some of the relationships among management of natural resources, the sustainability of human populations, and biodiversity; using a partial understanding of human impacts on natural systems, describe a technological solution that reduces these impacts; use geoscience data or global climate models of phenomena to make a forecast of the current rate of climate change or associated future impacts to Earth systems; and use a computational representation to describe phenomena using a partial understanding of the relationships among Earth systems or how those relationships are modified due to human activity.	Use one or two pieces of evidence to construct an explanation about phenomena using an understanding of how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity; using an understanding of cost-benefit ratios, evaluate two competing design solutions for developing, managing, and utilizing energy and mineral resources; create a computational simulation of phenomena to show the relationships among management of natural resources, the sustainability of human populations, and biodiversity; using an understanding of human impacts on natural systems, evaluate or refine a technological solution that reduces these impacts; analyze one or two pieces of geoscience data and one or two global climate models of phenomena to make a forecast of the current rate of climate change and associated future impacts to Earth systems; and use a computational representation to describe phenomena using an understanding of the relationships among Earth systems and how those relationships are modified due to human activity.	Use multiple pieces of evidence to construct an explanation about phenomena using an understanding of how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity; using an understanding of cost-benefit ratios, evaluate multiple competing design solutions for developing, managing, and utilizing energy and mineral resources; create computational simulations of phenomena to show the relationships among management of natural resources, the sustainability of human populations, and biodiversity; using an understanding of human impacts on natural systems, evaluate and refine a technological solution that reduces these impacts; analyze multiple pieces of geoscience data and multiple global climate models of phenomena to make a forecast of the current rate of climate change and associated future impacts to Earth systems; and use computational representations to describe phenomena using an understanding of the relationships among Earth systems and how those relationships are modified due to human activity.

HS-ETS-1 Engineering Design • HS-ETS1-1 • HS-ETS1-2 • HS-ETS1-3 • HS-ETS1-4 SEP • Constructing Explanations and Designing Solutions • Asking Questions and Defining Problems • Using Mathematics and Computational Thinking CCC • Systems and System Models • Influence of Science, Engineering, and Technology on Society and the Natural World	Analyze a major global challenge to specify a qualitative or quantitative criterion or constraint for a solution that accounts for a societal need or want; describe one or two ways a complex real-world problem could be broken down into smaller, more manageable problems that could be solved through engineering; explain how a solution to a complex real-world problem meets required criteria or explain one or two trade-offs of the solution; and use a computer simulation to model the impact of a proposed solution to a complex real-world problem with two or three criteria and constraints on interactions within or between systems relevant to the problem.	Analyze a major global challenge to specify one or two qualitative and quantitative criteria and constraints for solutions that account for one or two societal needs and wants; design an engineering solution to a complex real-world problem by breaking it down into smaller, more manageable problems; evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as social, cultural, and environmental impacts; and use a computer simulation to model the impact of two proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.	Analyze a major global challenge to specify multiple qualitative and quantitative criteria and constraints for solutions that account for multiple societal needs and wants; design an engineering solution to multiple complex real-world problems by breaking them down into smaller, more manageable problems; evaluate and refine a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as social, cultural, and environmental impacts; and use a computer simulation to model the impact of multiple proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

[1]Most situations refer to the following. Students at level X can be expected to be able to demonstrate knowledge and skills for most but not all:
• Combinations of disciplinary core ideas, practices, and crosscutting concepts
• Science phenomena, in which students are required to apply their knowledge of science content and mastery of crosscutting concepts and practices

APPENDIX B
NONDISCLOSURE AGREEMENT

Bureau of Indian Education
Science Assessment
Standards Validation Meeting
Nondisclosure Agreement

The design of Cognia's assessment programs requires that the test questions remain secure. To maintain the security of the tests, only authorized persons are permitted to view the test questions. With the exception of materials released by the Bureau of Indian Education (BIE) for informational purposes, all test questions (draft or final) and associated materials must be regarded as secure instruments. As a result, such materials may not be reproduced, discussed, or in any way released or distributed to unauthorized persons.

As a committee member, or person otherwise authorized to view secure materials for the BIE Science Assessment, I hereby agree to be bound to the terms of this agreement prohibiting the disclosure of said materials.

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Name (printed)

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Name (signature)

_____

Date

APPENDIX C
POWERPOINT PRESENTATIONS &
STANDARDS VALIDATION MEETING AGENDA

BIE Science Standards Validation

Panelist Meeting Agenda

Day 1: Tuesday, April 30

Eastern Time	Mountain Time	Agenda Item
11:30-12:00	9:30-10:00	Plenary Session
12:00-12:05	10:00-10:05	Break & transition to grade-specific breakout rooms
12:05-2:00	10:05-12:00	Breakout Session
2:00-3:00	12:00-1:00	Lunch
3:00-5:00	1:00-3:00	Training and Practice
5:00	3:00	Adjourn for the day

Day 2: Wednesday, May 1

Eastern Time	Mountain Time	Agenda Item
11:30-12:00	9:30-10:00	Debrief for Day 1
12:05-2:00	10:05-12:00	Round 1
2:00-3:00	12:00-1:00	Lunch
3:00-5:00	1:00-3:00	Continue with Round 1/Begin Round 2
5:00	3:00	Adjourn for the day

Day 3: Thursday, May 2

Eastern Time	Mountain Time	Agenda Item
11:30-12:00	9:30-10:00	Debrief for Day 2
12:05-2:00	10:05-12:00	Round 2 and Workshop Evaluation
2:00	12:00	Adjourn for the day

BIE Science Standards Validation Breakout Session

Grade 5

Facilitator: Katie Schmidt

Agenda

- Welcome and Introductions – Panelists
- Meeting Norms and Process Overview
- Experience the Test Activity
- Familiarization with Content Standards and PLDs
- Training on the Item-Descriptor (ID) Matching Method
- Modeling and Practice
- Readiness Survey
- Standards Validation Activities (Two Rounds)
- Workshop Evaluation Survey

Welcome & Introductions - Panelists

- Introduce yourself
  - Your name, district, what you teach
- Experience on assessment program committees
  - Item Reviews
  - Alignment Studies
  - Standard Setting

Meeting Norms

- All conversations are confidential
- What happens here stays here.
- Outside of this meeting, please DO talk about the process we undertake, but DO NOT disclose the specifics.
- Standards Validation is a consensus process
  - We will try our best to reach agreement
  - To do so, everyone needs to participate/engage in the process
  - Please remain on camera when we are actively participating in the process

Why we're here

- Validate proposed cut scores for the BIE grade 5 Science assessments
  - Nearing Proficient, Proficient, and Advanced cut scores
- Review items and make associated item-PLD matches in regions around the proposed cut scores
- Recommend retaining or adjusting the proposed cut scores
- Write content-based rationales for your recommendations

Overview

- Our shared goals
  - Collect your recommendations on performance standards for the BIE Science Grade 5 assessment that provide meaningful and actionable information.
- Your goals as panelists
  - Learn concepts and procedures following the Item-Descriptor (ID) Matching method
  - Follow the procedures to complete the standards validation activities
  - Recommend retaining or adjusting proposed cut scores for the Nearing Proficient, Proficient, and Advanced performance levels
  - Rely on your expertise about the content standards and student learning throughout the process

Experience the Test

- You will experience the BIE Science test in a format that is similar to student experience.
  - Briefly examine the tests in the test platform.
  - Try not to linger on any one item; this session is scheduled for a duration of **30 mins**.
- Purpose:
  - Get familiar with the items as they appeared to students.
  - Items sets will appear together in the testing platform but will not appear together when you work with them during the standards validation.
  - You will see most of the items from the testing platform when you engage in the standards validation activities

Experience the Test

https://biepracticetest.cognia.org/student/login

- Duration: **30 mins** only.

Key concepts and procedures

- Content standards and Borderline PLDs
- Ordered Item Booklet (OIB)
- Item-Descriptor (ID) Matching method
  - Reviewing items
  - Matching items to descriptors
- Proposed cut scores
  - Retain or adjust
- Content-based rationales

Review Content Standards & PLDs

- Review subject-specific content standards
- Obtain an understanding of the performance level descriptors (PLDs) in relation to content standards.
  - This activity is critical because you will make judgements based on your understanding of PLDs.
  - The standards and PLD documents will be used throughout the workshop as you engage in the standards validation process.

Discuss Performance Level Descriptors

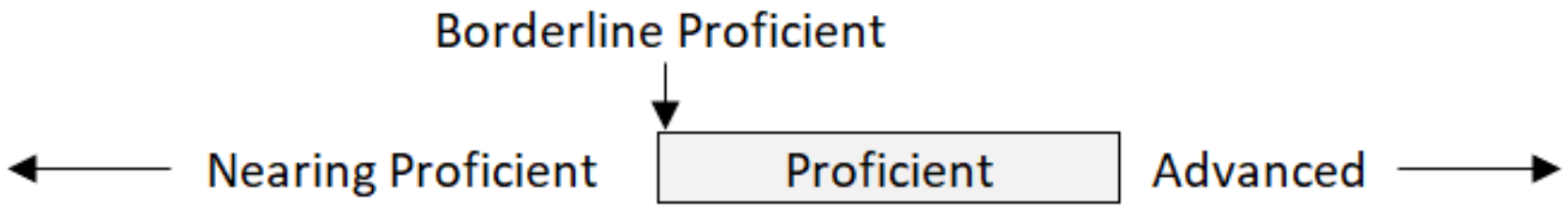
- Collegial discussion to clarify questions
- Reach common understanding of what it means to be in each performance level.
- Overview of performance level descriptors (PLDs)
- In-depth review/discussion of borderline PLDs

Performance Level Descriptors

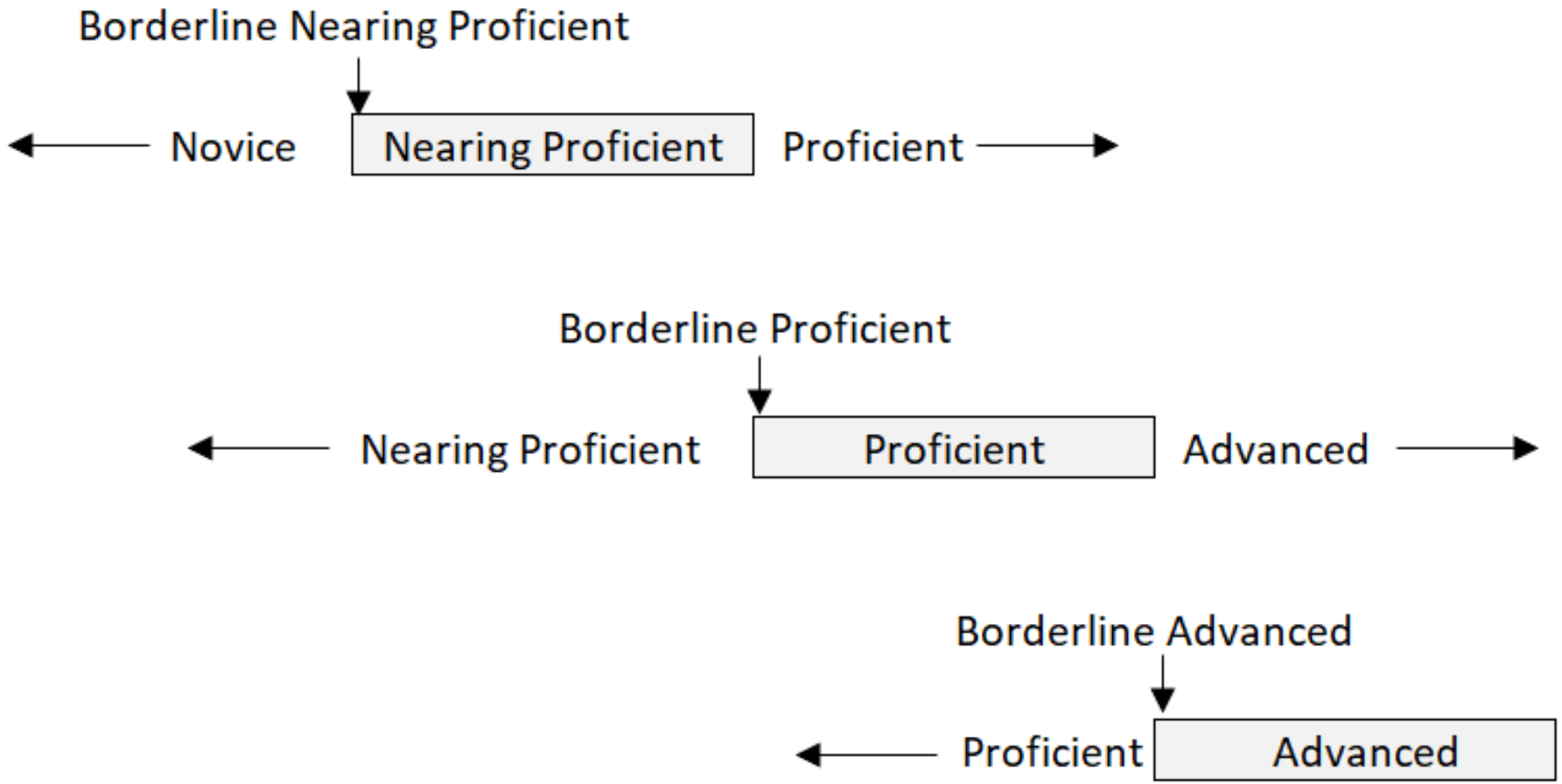
- Performance Levels
  - Novice
  - Nearing Proficiency
  - Proficient
  - Advanced
- Performance Level Descriptors (PLDs) represent intended interpretations of solid student achievement on the assessment at each.
- Development of the PLDs began with the assumption that the grade-level content standards represent what students should know and be able to do at the end of a given grade level. Prior research on learning, cognition, and development in the subject areas, a variety of resources, and teaching experiences of content experts informed the development of definitions for solid achievement at each level.

Borderline PLDs

- Borderline Performance Level Descriptors define what a student who is just barely into a given performance level knows and can do.
- Example: The Borderline Proficient PLD defines what a student who is just barely into the Proficient level (as opposed to in the Nearing Proficient level) knows and can do.



Borderline PLDs



Understanding the Borderline PLDs (MS)

Advanced

Students at the borderline of the **Advanced** level in most situations can demonstrate evidence of thorough understanding and use of all three dimensions (science and engineering practices, crosscutting concepts, and disciplinary core ideas) to make sense of phenomena and/or to design solutions to problems in the physical, life, and Earth and space sciences. They also sometimes *demonstrate the skills and understandings at the Proficient level rather than the skills and understandings of the Advanced level.* Students performing at the borderline of the Advanced level can be expected in most situations[1] to be able to demonstrate knowledge and skills such as in the following examples, as **evidence of just barely thorough understanding and use of the NGSS Standards**:

Understanding the Borderline PLDs (MS)

Proficient

Students at the borderline of the **Proficient** level in most situations can demonstrate evidence of satisfactory understanding and use of all three dimensions …They also sometimes *demonstrate the skills and understandings at the Nearing Proficiency level rather than … of the Proficient level…*as evidence of just barely satisfactory understanding and use of the NGSS Standards:

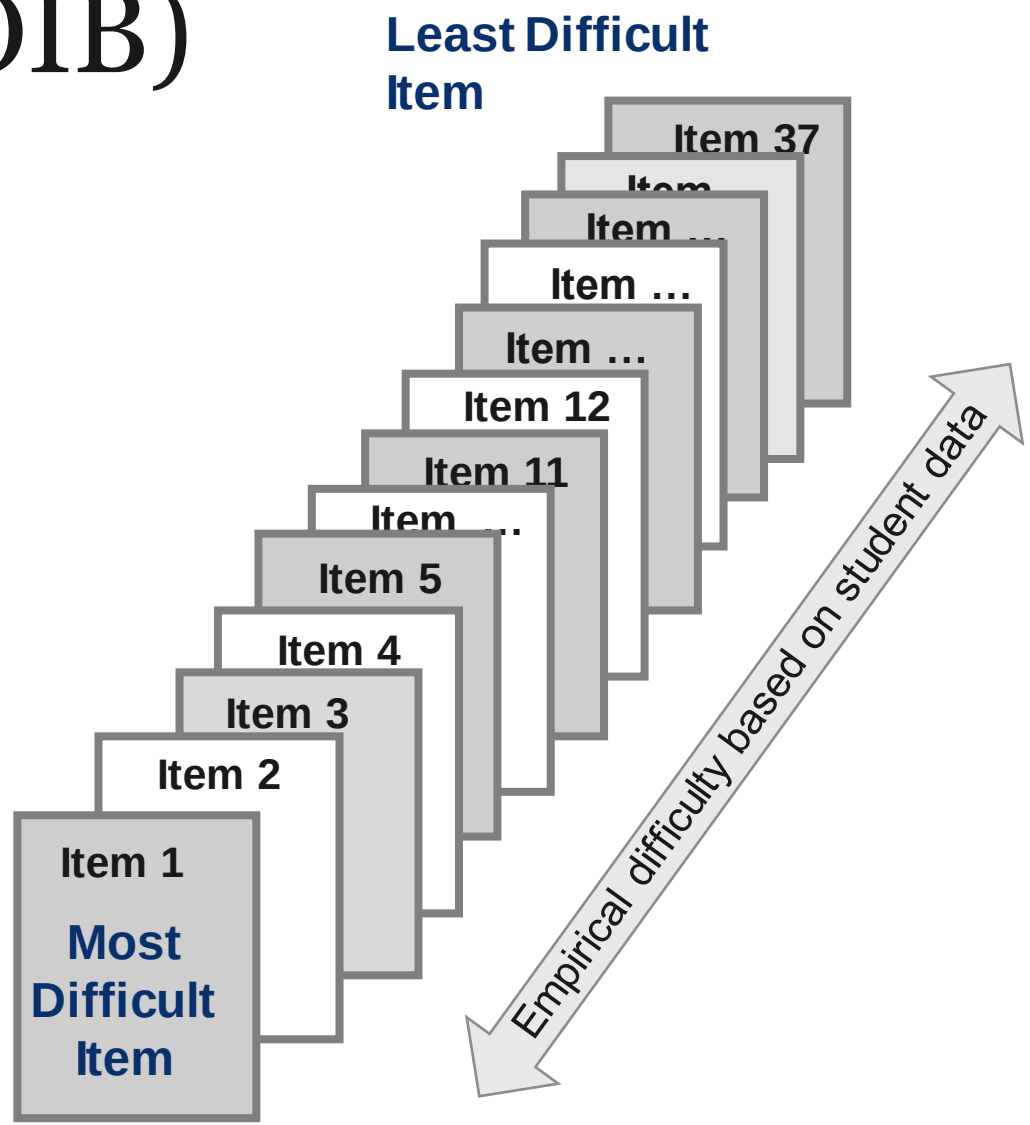
Understanding the Borderline PLDs (MS)

Nearing Proficiency

Students at the borderline of the **Nearing Proficiency** level in most situations can demonstrate evidence of partial understanding and use of all three dimensions …They also sometimes *demonstrate the skills and understandings at the Novice level rather than … the Nearing Proficient level …* as evidence of just barely partial understanding and use of the NGSS Standards:

Ordered Item Booklet (OIB)

- OIB contains test items ordered by difficulty.
  - Most difficult item appears first
  - Least difficult item appears last
- Each OIB page represents an item.
- The difference in difficulty is not exactly the same between each pair of neighboring items.
- The order of the OIB items is based on their empirical difficulties and not the order in which they appear for students during the test.



Ordered Item Booklet (OIB)

- Items with multiple scoring points will appear separately for each score point
  - For example: A 2-point item will appear once for the first score point, and again for the second score point
  - The first score point might appear later in the OIB while the second appears earlier based on the difficulty of attaining that score point
- Shaded items in the OIB
  - Although the full list of items are included in the OIB, we will focus mostly on the shaded items as these shaded regions represent the area where the proposed cut scores are located

OIB in the Standard Setting Toolkit

cognia Standard Setting Toolkit Home Admin sstksetup@cognia.org Logout

Item Review

BIE Science 5 Step 1 Practice Round

Hide Documents | Standards | Range PLDs | Borderline PLDs

Position	Asset ID	Description	Point Value	Relevant KSAs	Why More Difficult Than Previous	Rationale	Item Descriptor Match Level	Cut Placement Level	
105	706726	4LS11_MCMC2_LunaMothLifeCycle	2				--	--	Detail
104	697158	4PS34_CBT_ICOR2-spl_EnergyConversion_731996	2				--	--	Detail
103	697063	3LS32_OE4-spl_Orchids	4				--	--	Detail
102	632570	3PS24_MCMC2_MagneticNameTag	2				--	--	Detail
101	632426	5ESS21_MCMC2-spl_CrackedRock	2				--	--	Detail

Item-Descriptor (ID) Matching Method for Standards Validation

Item-centered Method

Content-based Judgment

Consensus Process

Overview of ID Matching Method

- Review shaded items in the Ordered Item Booklet (OIB).
  - Identify the knowledge, skills, and abilities (KSAs) required to answer the item correctly.
- Make the following judgment for each item:
  - Match the knowledge, skills, and abilities (KSAs) required by the item with the descriptions in one of the performance level descriptors (PLDs).
- Recommend retaining or adjusting the proposed cut scores.
  - Develop content-based rationales for your recommendations
- Judgements are made in a consensus process.

Content-based Judgment - Overview

Useful

- Based on Content
- Links items to PLDs
- Refers to specific knowledge, skills, and abilities (KSAs)

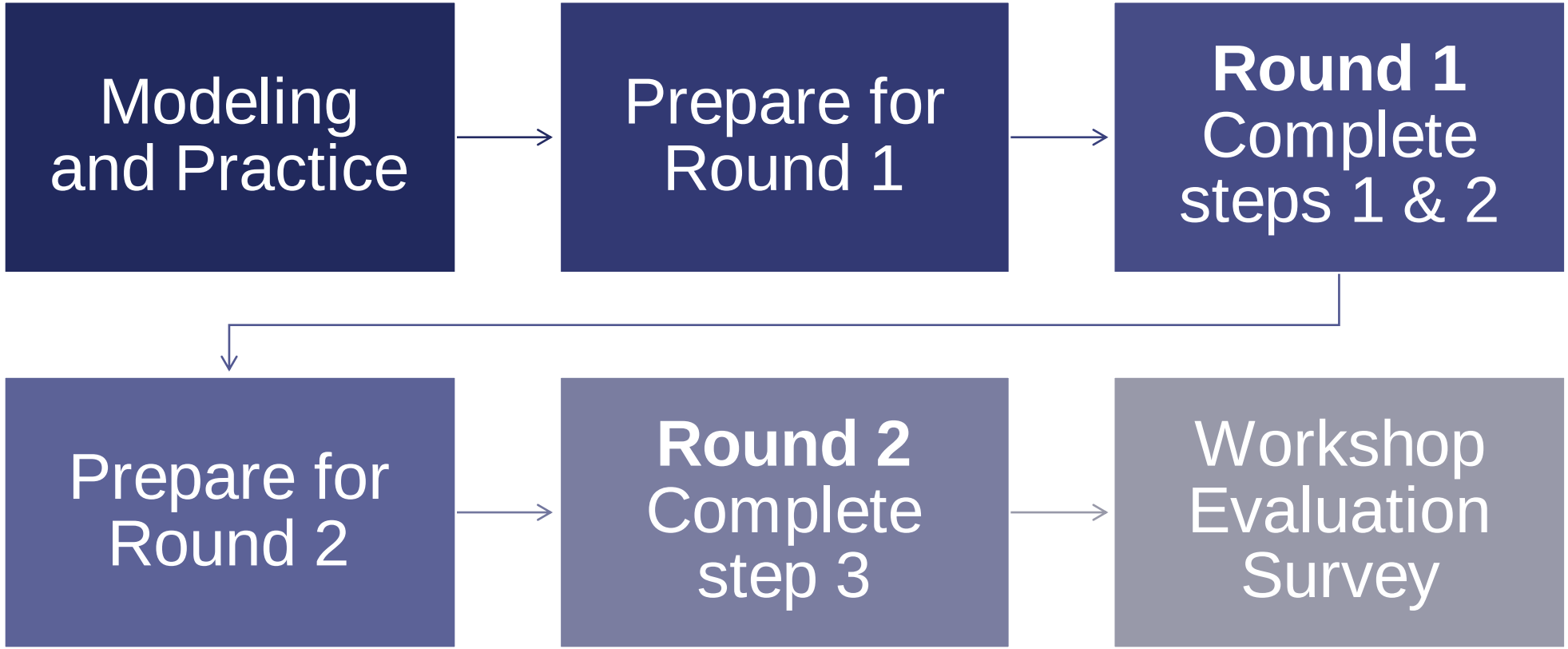
Not Useful

- Based on something other than the content
- Too general
- Based on a specific student or class

Item-Descriptor (ID) Matching Method

- **Step 1:** Review each shaded item and answer two questions.
  1. What does a student need to know and be able to do to respond successfully to this item?
  2. What makes this item more difficult than previous items?
- **Step 2:** Match the item to one of the PLDs
  - Match the knowledge, skills, and abilities (KSAs) required by the item with the descriptions to one of the performance level descriptors (PLDs).
- **Step 3:** Review proposed cut scores
  - Decide to retain or adjust the proposed cut scores.
  - Develop content-based rationales for your recommendations

ID Matching Process over 2 rounds:



Modeling & Practice of the ID-Matching Judgmental Task

We will look at sample items. For each item:

- **Step 1: Answer the two questions**
  - What does a student need to know/be able to do to respond to this item/at this score level?
  - What makes this item more difficult than all previous items?

- **Step 2:** Match the items to a PLD
  - Explain how the item response demands align with PLD expectations

Your answers identify the item's knowledge and skill response demands

ID-Matching Judgmental Task

We will look at sample items. For each item:

- **Step 1:** Answer the two questions
- **Step 2:** Match items to PLDs
- **Step 3:** Review three cut scores
  - This step comes later (Round 2)
- Work as a group in a consensus process

1. What does a student need to know or be able to do to respond to this item?
2. What makes this item more difficult than the preceding items?

Which PLD most closely matches the knowledge, skills, and abilities (KSAs) required by the item?

Practice round process

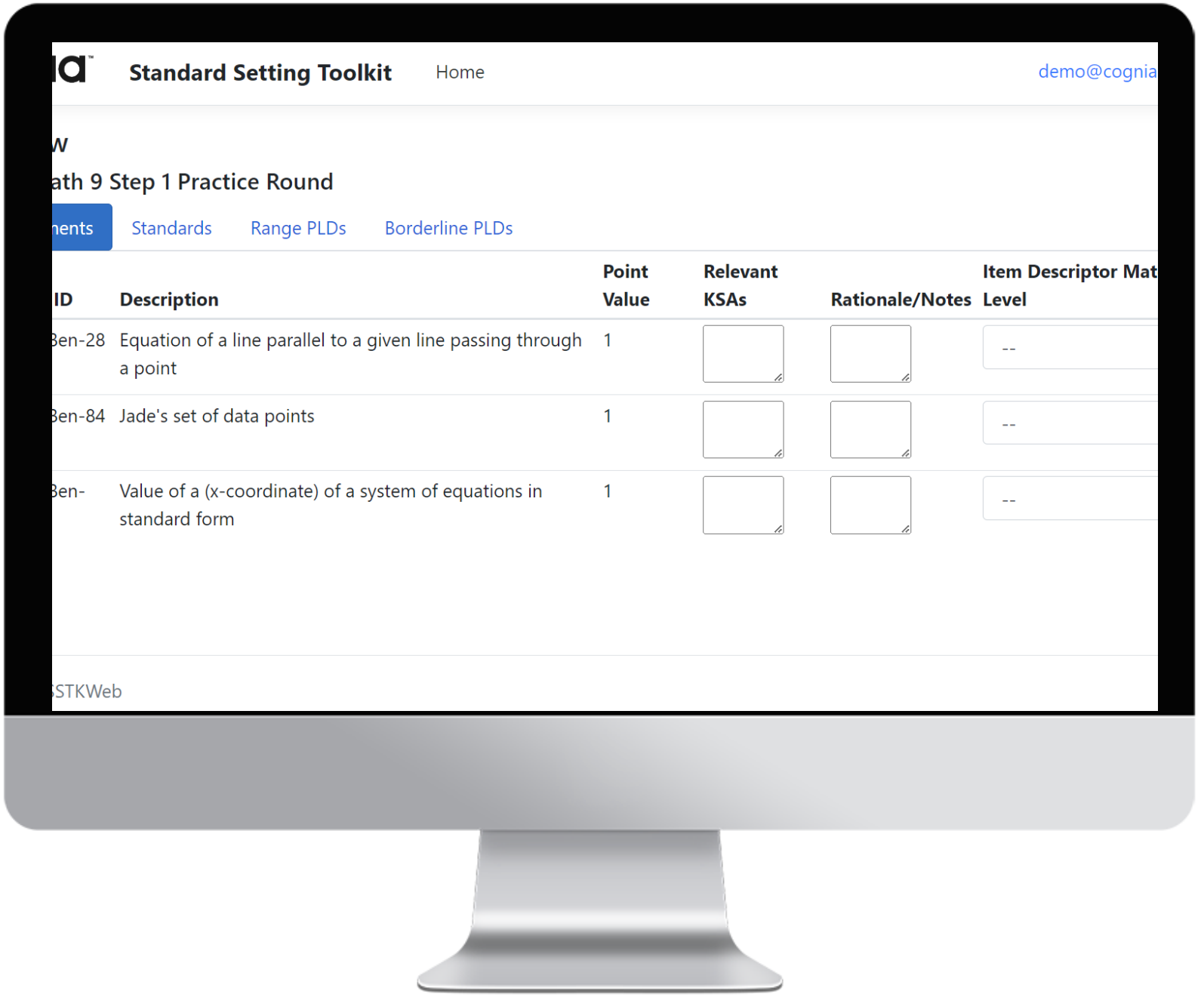
Complete steps 1 and 2 for sample items.

Discuss matches

Discuss and clarify PLDs.

Practice - Round 1

- Facilitator will screen share and capture notes
- You will need the standards and PLDs
- Reminder: Consensus process



Practice (Continued)

- Completed step 1 and 2 for the sample items.
  - Answered two questions for each item
  - Matched the item to one of the PLDs
- Considerations.
  - You may judge that an item seems out of difficulty order
    - Challenge: shift in your thinking
    - There are no right or wrong answers—only your best professional judgments
  - You may judge that an item falls between two adjacent PLDs
    - Select the PLD that most closely matches the item
    - Record notes about the differing opinions

Modeling & Practice of the ID-Matching Judgmental Task

- **Step 3: Review proposed cut scores**
  - In round 2, the proposed cut scores will be indicated in the OIB
  - Review the location of each cut score in relation to the item-PLD matches you made in round 1
  - Recommend retaining or adjusting each cut score
  - Write content-based rationales for your recommendations.

We will practice this based on the 5 items we just work with.

Does the group agree with the proposed cut score location?

Reminder: Content-based Judgment

Useful

- Based on Content
- Links items to PLDs
- Refers to specific knowledge, skills, and abilities (KSAs)

Not Useful

- Based on something other than the content
- Too general
- Based on a specific student or class

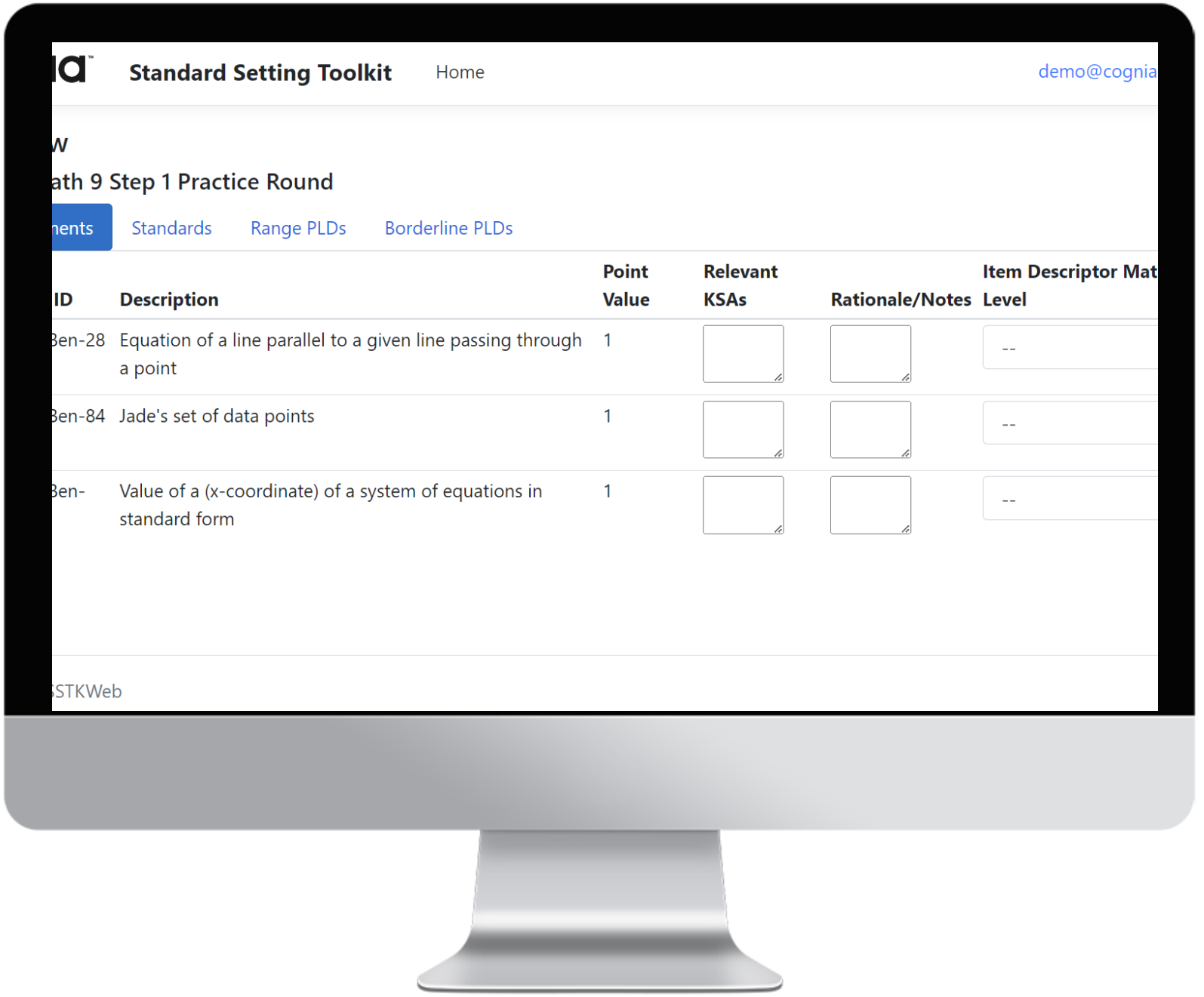
Content-based Rationale

- Useful example:
  - The item requires students to understand that population size is being affected and to be able to read and understand a graph to respond how the population is changing; “describe how a factor affects population size” and “interpreting data” are described in the Proficient PLD and not in the Nearing Proficient PLD.

- Not useful example:
  - The item matches the Proficient PLD and does not match the Nearing Proficient PLD.

Practice – Round 2

- Facilitator will screen share and capture notes
- You will need the standards and PLDs
- Reminder: Consensus process



Validation Process and Shaded Regions

- Reminder: Our goal is to validate proposed cut scores by completing the standards validation activities
- We will focus on items around the proposed cut scores
- These items will be indicated as shaded rows in the OIB
  - Blue shaded for the Advanced Region
  - Green shaded for the Proficient Region
  - Yellow shaded for the Nearing Proficient Region
- The shaded regions indicate the general area where the proposed cut is located

Shaded Regions: Visual Presentation

35	638658	4ESS11_MC1_MountainFossils	1				--	--	Detail
34	638526	4ESS11_CBT_HSMC2_MountainFossils_784830	2				--	--	Detail
33	744445	3LS21_MC1_LifeintheAntarctic	1				--	--	Detail
32	661177	3LS42_OE4-spl_PocketMice	2				--	--	Detail
31	697027	3ESS21_CBT_GRMC2-spl_PhoenixClimate_784847	2				--	--	Detail
30	637951	4LS11_MC1_TheFlowerGarden	1				--	--	Detail
29	633906	4PS43_MSMC2-spl_CodedMessage	1				--	--	Detail
28	706801	4ESS31_CBT_DD1_Energy_784744	1				--	--	Detail
27	635879	3LS43_MCMC2-spl_CactiAndWater	2				--	--	Detail
26	666120	5PS11_OE4-spl_RockCandy	1				--	--	Detail

Preparation for Round 1

- In a few minutes we will proceed with round 1 of the standards validation process
- As a reminder, during round 1 you will
  - Work as a group in a consensus-based process
  - Review items in the shaded regions of the OIB starting with the Proficient region
  - Answer two questions for each item
  - Match the items to PLDs
  - The facilitator will screen share and capture notes for the group
- Before starting round 1, everyone will complete a readiness survey

1. What does a student need to know or be able to do to respond to this item?
2. What makes this item more difficult than the preceding items?

Which PLD most closely matches the knowledge, skills, and abilities (KSAs) required by the item?

Readiness Survey

- The purpose of the survey is to determine if everyone in the group feels they are ready to undertake the standards validation activities.
- The survey consists a few questions with Yes/No response options.
- The survey is anonymous
  - We are not concerned with individual responses and will just look at a summary of all responses to determine if the group is ready.
- Please be thoughtful and honest in your responses.

Link to Readiness Survey

- https://www.surveymonkey.com/r/BIE24SVGR5Readiness1

Adjourn

BIE Science Standards Validation Breakout Session – Day 2

Grade 5

Facilitator: Katie Schmidt

Breakout Session – Agenda (day 2)

- Debrief Day 1
- Complete Round 1
- Discussion and Preparation for Round 2
- Complete Round 2
- Workshop Evaluation Survey

Continue Round 1

- In a few minutes we will continue with round 1 of the standards validation process
- As a reminder, during round 1 you will
  - Work as a group in a consensus-based process
  - Review items in the shaded regions of the OIB starting with the Proficient region
  - Answer two questions for each item
  - Match the items to PLDs
  - The facilitator will screen share and capture notes for the group

1. What does a student need to know or be able to do to respond to this item?
2. What makes this item more difficult than the preceding items?

Which PLD most closely matches the knowledge, skills, and abilities (KSAs) required by the item?

Preparation for Round 2

- In a few minutes we will proceed with round 2 of the standards validation process
- As a reminder, during round 2:
  - The proposed cut scores will be indicated in the OIB
  - Taking into consideration the work you all did in round 1, Review proposed cut scores in the OIB starting with the Proficient cut score
  - Recommend retaining or adjusting the proposed cut scores
  - Write content-based rationales for your recommendations
- Continue working as a group in a consensus-based process

Does the group agree with the proposed cut score location?

A Reminder: Content-based Judgment

Useful

- Based on Content
- Links items to PLDs
- Refers to specific knowledge, skills, and abilities (KSAs)

Not Useful

- Based on something other than the content
- Too general
- Based on a specific student or class

Link to Readiness Survey 2

- https://www.surveymonkey.com/r/BIE24SVGR5Readiness2

Workshop Evaluation Survey

- Thank you for your attention and engagement as we completed the standards validation activities.
- We have one last thing to do which is a workshop evaluation survey.
- You can access the survey here: https://www.surveymonkey.com/r/BIE24SVEval

- Please complete the survey thoughtfully and honestly.

Adjourn

BIE Science Standards Validation Workshop

Grade 5, 8 and 11

April 30- May 2, 2024

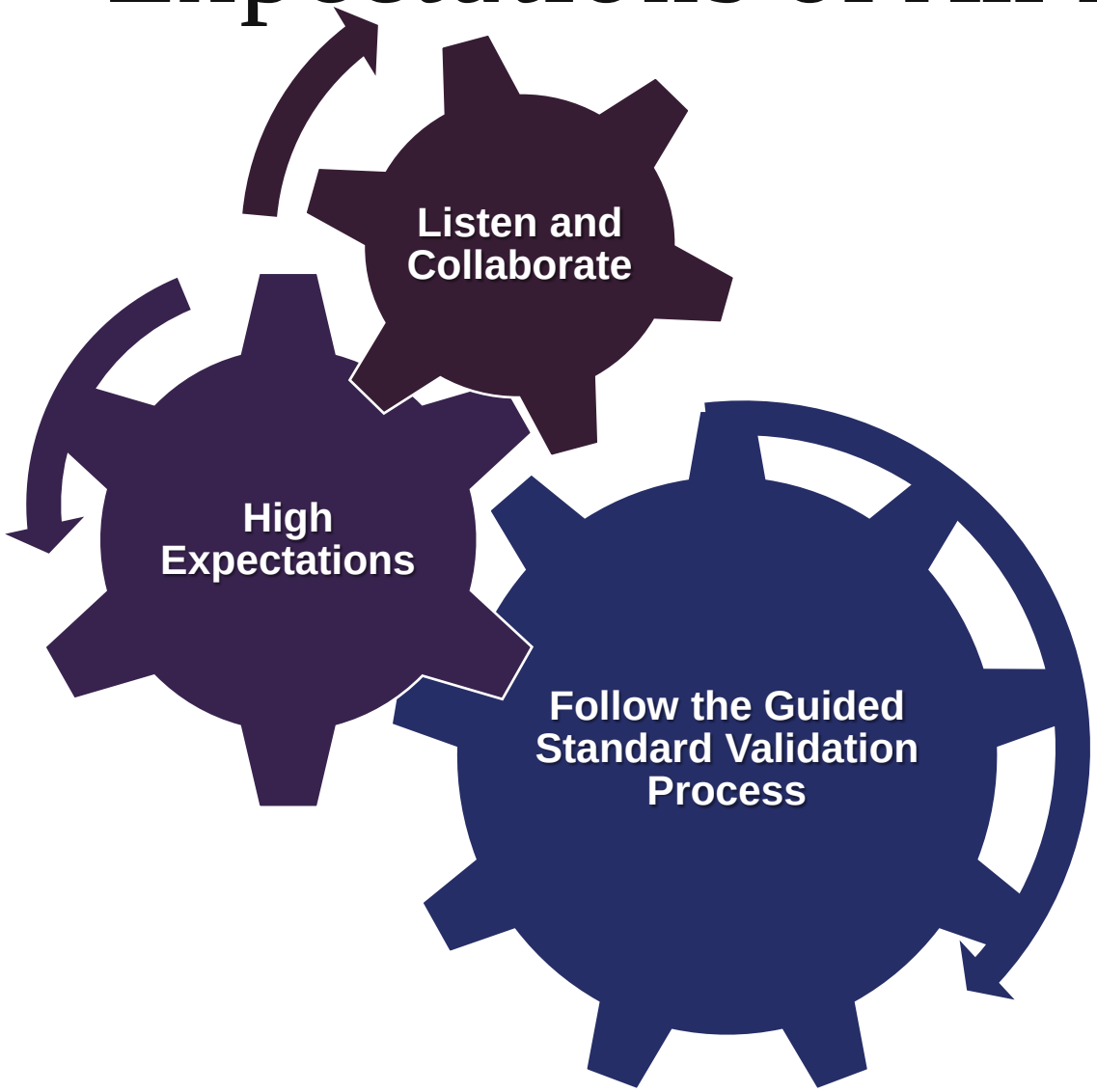
Welcome

- BIE representative open remark
- We’re here to review proposed cut scores for BIE
  - Cuts originated from an SSIB standard setting in 2022.
  - Following a standards validation process and the Item-Descriptor (ID) Matching method judgment
- Introductions
  - BIE
  - Cognia

Standards Validation Goals Overview

- Our shared goals
  - Collect your recommendations on performance standards for the BIE Science assessment that provide meaningful and actionable information.
- Your goals as panelists
  - Learn concepts and procedures following the Item-Descriptor (ID) Matching method
  - Follow the procedures to complete the standards validation activities
  - Recommend retaining or adjusting proposed cut scores for the Nearing Proficiency, Proficient, and Advanced performance levels
  - Rely on your expertise about the content standards and student learning throughout the process

Expectations of All Panelists



- Security is of the utmost importance
  - You can discuss the process in general terms
- You may NOT
  - Share details about the items or specific details about the process (e.g., results or cut scores)

Why we're here

- Validate proposed cut scores for the BIE Science assessments
  - Nearing Proficiency, Proficient, and Advanced cut scores
- Review items and make associated item-PLD matches in regions around the proposed cut scores
- Recommend retaining or adjusting the proposed cut scores
- Write content-based rationales for your recommendations as a group.

BIE Science Assessments

- Next Generation Science Standards
- Computer-Based Test (CBT) and Paper-Based Test (PBT)
  - CBT Forms
    - 2022-23 fixed form
  - PBT Forms (all fixed forms)
    - Paper
    - Large print
    - Braille
- Three Sessions

BIE Science Assessment Items

- Operational and Field Test Items
- Grade 5,8 and 11
- Item Types
  - Cluster (1- and 2-point items)
  - Standalone (2 points)
  - Open-ended item (4 points)

Grade 5 Science Blueprint

Reporting Categories, Grade 5 BIE Science Assessment					
Reporting Category	**Typical Number of Clusters**	**Typical Number of Standalone MS-2**	**Typical Number of Standalone OE**	**Number of Core Points**	**Percent of Core Points (+/- 4%)**
Practices and Crosscutting Concepts in Physical Sciences	*2*	*4-6*	*1*	*24-28*	40%
Practices and Crosscutting Concepts in Life Sciences	*2*	*1-3*	*1*	*18-22*	30%
Practices and Crosscutting Concepts in Earth and Space Sciences	*2*	*1-3*	*1*	*18-22*	30%

Grade 8 Science Blueprint

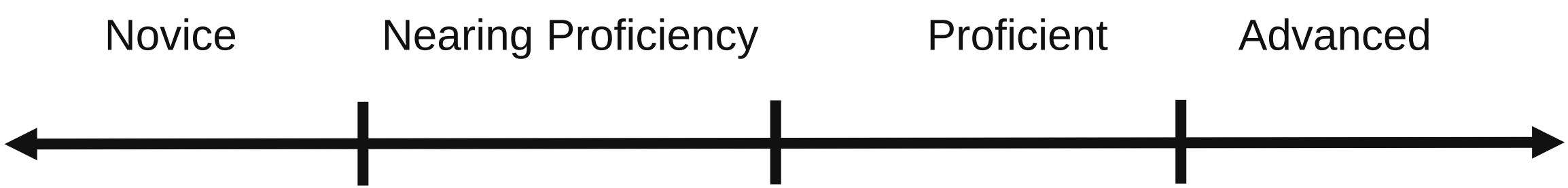
Reporting Categories, Grade 8 BIE Science Assessment					
Reporting Category	**Typical Number of Clusters**	**Typical Number of Standalone MS-2**	**Typical Number of Standalone OE**	**Number of Core Points**	**Percent of Core Points (+/- 4%)**
Practices and Crosscutting Concepts in Physical Sciences	*2*	*2-4*	*1*	*20-24*	35%
Practices and Crosscutting Concepts in Life Sciences	*2*	*2-4*	*1*	*20-24*	35%
Practices and Crosscutting Concepts in Earth and Space Sciences	*2*	*1-3*	*1*	*18-22*	30%

Grade 11 Science Blueprint

Reporting Categories, Grade 11 BIE Science Assessment					
Reporting Category	**Typical Number of Clusters**	**Typical Number of Standalone MS-2**	**Typical Number of Standalone OE**	**Number of Core Points**	**Percent of Core Points (+/- 4%)**
Practices and Crosscutting Concepts in Physical Sciences	*2*	*3-5*	*1*	*22-26*	35%
Practices and Crosscutting Concepts in Life Sciences	*2*	*3-5*	*1*	*22-26*	35%
Practices and Crosscutting Concepts in Earth and Space Sciences	*2*	*1-3*	*1*	*18-22*	30%

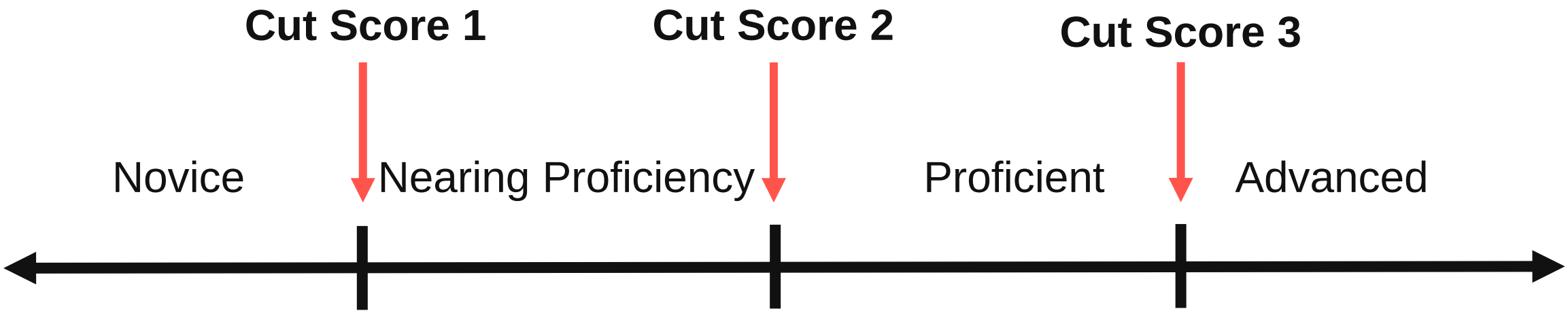
Performance levels

- Performance Levels reflect the specific knowledge and skills that a student should be able to demonstrate based on their performance on the test.



Cut Scores

- A cut score is the minimum test score a student must earn to be considered at a specific performance level.
- Three cut scores result in four levels of performance.



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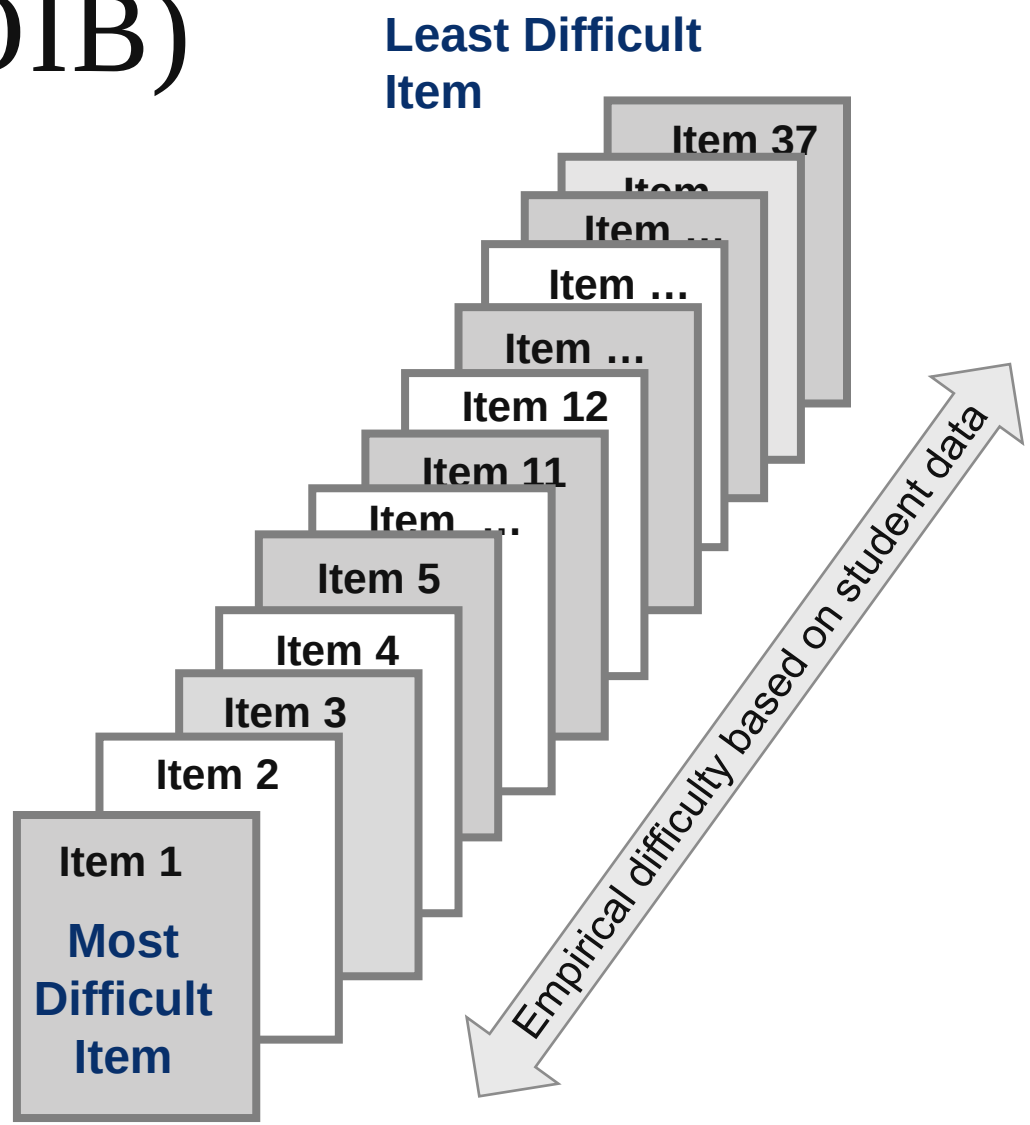

Ordered Item Booklet (OIB)

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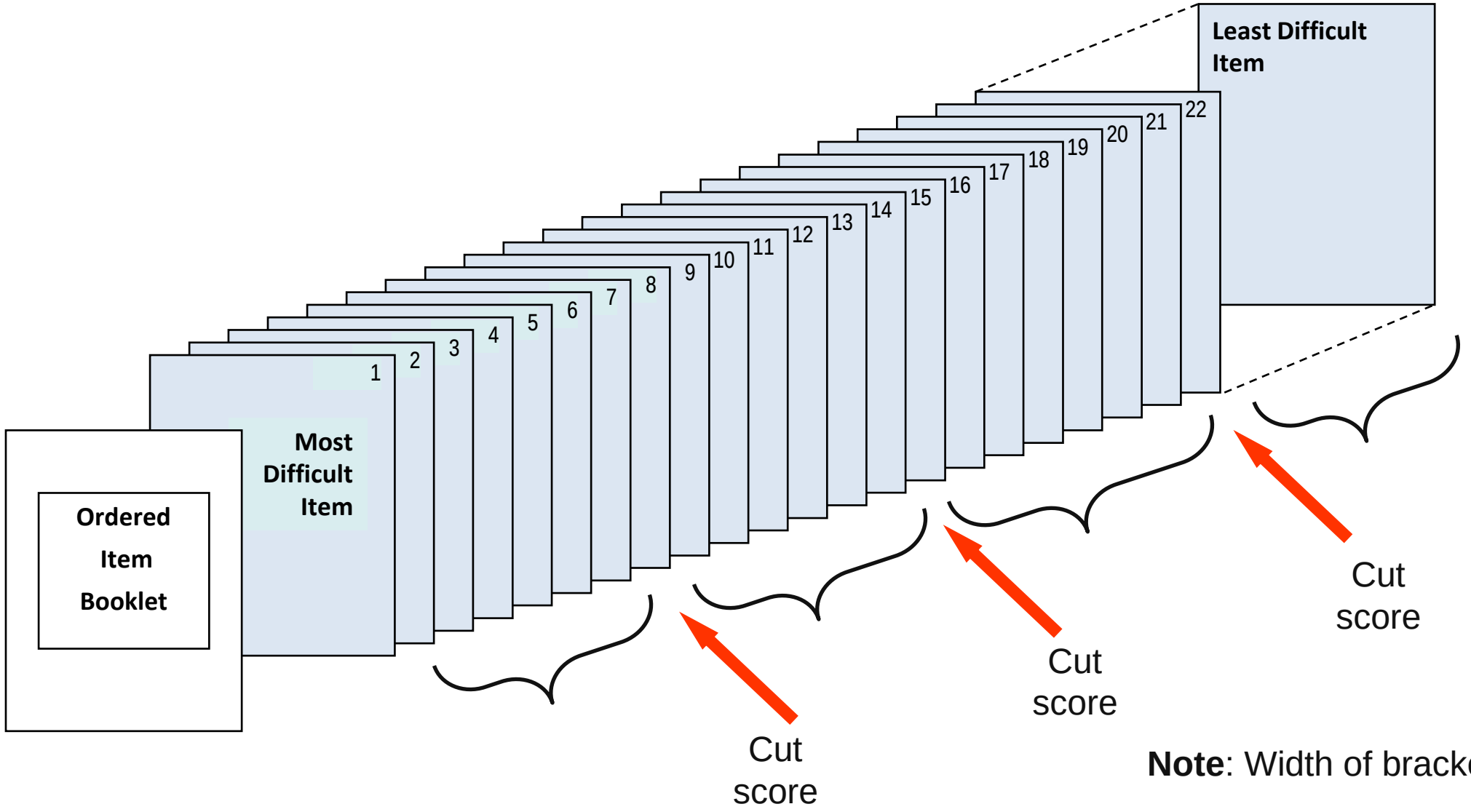
- Shaded items in the OIB
  - Although the full list of items are included in the OIB, we will focus mostly on the shaded items as these shaded regions represent the area where the proposed cut scores are located

The outcome we're pursuing together



Note: Width of brackets irrelevant

Item-Descriptor (ID) Matching Method for Standards Validation

Item-centered Method

Content-based Judgment

Consensus Process

Content-based Judgment - Overview

Useful

- Based on Content
- Links items to PLDs
- Refers to specific knowledge, skills, and abilities (KSAs)

Not Useful

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Overview of ID Matching Method

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  - Match the knowledge, skills, and abilities (KSAs) required by the item with the descriptions in one of the performance level descriptors (PLDs).
- Recommend retaining or adjusting the proposed cut scores.
  - Develop content-based rationales for your recommendations
- Judgements are made in a consensus process.

Meeting Schedule

Day 1: Tuesday, April 30

Eastern Time	Mountain Time	Agenda Item
11:30-12:00	9:30-10:00	Plenary Session
12:00-12:05	10:00-10:05	Break & transition to grade-specific breakout rooms
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Day 2: Wednesday, May 1

Eastern Time	Mountain Time	Agenda Item
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12:05-2:00	10:05-12:00	Round 1
2:00-3:00	12:00-1:00	Lunch
3:00-5:00	1:00-3:00	Continue with Round 1/Begin Round 2
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Day 3: Thursday, May 2

Eastern Time	Mountain Time	Agenda Item
11:30-12:00	9:30-10:00	Debrief for Day 2
12:05-2:00	10:05-12:00	Round 2 and Workshop Evaluation
2:00	12:00	Adjourn for the day

APPENDIX D
ORDERED ITEM BOOKLETS

Science Grade 5—Form BIA1

AssetID	RP50	OIB_page	Benchmark
744455	-1.81585	1	
626442	-1.53302	2	
638639	-1.40519	3	
697027	-1.3907	4	
637807	-1.35588	5	
706119	-1.20613	6	
638558	-1.05427	7	
632837	-0.94917	8	L2 Benchmark
636211	-0.87813	9	L2 Benchmark
638526	-0.86601	10	L2 Benchmark
661177	-0.81287	11	L2 Benchmark
706765	-0.79876	12	L2 Benchmark
626478	-0.63678	13	L2 Benchmark
635879	-0.63092	14	L2 Benchmark
697164	-0.51995	15	L2 Benchmark
706135	-0.50157	16	L2 Benchmark
638354	-0.42729	17	L2 Benchmark
762758	-0.37471	18	L2 Benchmark
632454	-0.30687	19	
639510	-0.30297	20	
706847	-0.25905	21	
744455	-0.20509	22	
706149	-0.19523	23	
626442	-0.1706	24	
638558	0.14913	25	
666120	0.16095	26	L3 Benchmark
635879	0.16684	27	L3 Benchmark
706801	0.32987	28	L3 Benchmark
633906	0.34311	29	L3 Benchmark
637951	0.396408257	30	L3 Benchmark
697027	0.5428	31	L3 Benchmark
661177	0.55243	32	L3 Benchmark
744445	0.565146718	33	L3 Benchmark
638526	0.59741	34	L3 Benchmark
638658	0.598576345	35	L3 Benchmark
638354	0.63309	36	L3 Benchmark
706765	0.6366	37	
756457	0.65986	38	
636189	0.7085	39	
697164	0.73096	40	
706792	0.847421541	41	
706119	0.86363	42	
636211	1.00453	43	
706138	1.116449139	44	
638639	1.25121	45	L4 Benchmark
744451	1.26637	46	L4 Benchmark
706135	1.52213	47	L4 Benchmark
632724	1.61621207	48	L4 Benchmark
639510	1.64477	49	L4 Benchmark
706847	1.71525	50	L4 Benchmark
697164	1.88953	51	L4 Benchmark
638656	2.05346356	52	L4 Benchmark
666120	2.15194	53	L4 Benchmark
762758	2.15367	54	L4 Benchmark
626478	2.20496	55	L4 Benchmark
661177	2.36911	56	
632454	2.43071	57	
756457	3.05438	58	
697164	3.41583	59	
633906	4.00741	60	
661177	4.03909	61	
636189	4.17572	62	
666120	4.25932	63	
666120	6.59032	64	

Science Grade 8—Form BIA1

AssetID	RP50	OIB_Page	Benchmark
709604	5.47748	64	
709294	5.27724	63	
697245	4.44706	62	
663576	4.18448	61	
642091	3.96906	60	
641845	3.96609	59	
717529	3.79367	58	
713388	3.11986	57	L4 Benchmark
707172	3.10318	56	L4 Benchmark
697245	3.0536	55	L4 Benchmark
640163	2.8031	54	L4 Benchmark
709306	2.77656	53	L4 Benchmark
663576	2.7498	52	L4 Benchmark
717529	2.38776	51	L4 Benchmark
758919	2.31794	50	L4 Benchmark
763243	1.82576	49	L4 Benchmark
636852	1.7756	48	L4 Benchmark
712986	1.68655	47	L4 Benchmark
697245	1.638	46	
663576	1.52712	45	
641894	1.46677	44	
709309	1.46619	43	
709292	1.424226777	42	
713386	1.36181	41	
709604	1.24764	40	
709609	1.206599797	39	
631831	1.1767	38	
709294	1.16026	37	
713695	1.1572	36	
717529	1.12566	35	
641873	1.000654138	34	
716040	0.91062	33	
636830	0.83454	32	
637562	0.79776	31	
636843	0.733228868	30	
640740	0.72077	29	L3 Benchmark
637622	0.66482	28	L3 Benchmark
636837	0.646797625	27	L3 Benchmark
709622	0.58201	26	L3 Benchmark
709617	0.54659	25	L3 Benchmark
641845	0.54417	24	L3 Benchmark
758938	0.447844388	23	L3 Benchmark
663576	0.21191	22	L3 Benchmark
642091	0.1252	21	L3 Benchmark
697245	0.11338	20	L3 Benchmark
713686	0.11082	19	L3 Benchmark
758880	0.04384	18	
758919	-0.16952	17	
717529	-0.34893	16	L2 Benchmark
636852	-0.51744	15	L2 Benchmark
713386	-0.62029	14	L2 Benchmark
709309	-0.64357	13	L2 Benchmark
640163	-0.79136	12	L2 Benchmark
637562	-0.91106	11	L2 Benchmark
640740	-0.97661	10	L2 Benchmark
709622	-1.00679	9	L2 Benchmark
637622	-1.01256	8	L2 Benchmark
763243	-1.09104	7	L2 Benchmark
712986	-1.11767	6	L2 Benchmark
707172	-1.15978	5	

continued

AssetID	RP50	OIB_Page	Benchmark
713388	-1.34618	4	
636830	-1.40274	3	
716040	-1.55024	2	
631831	-1.68902	1	

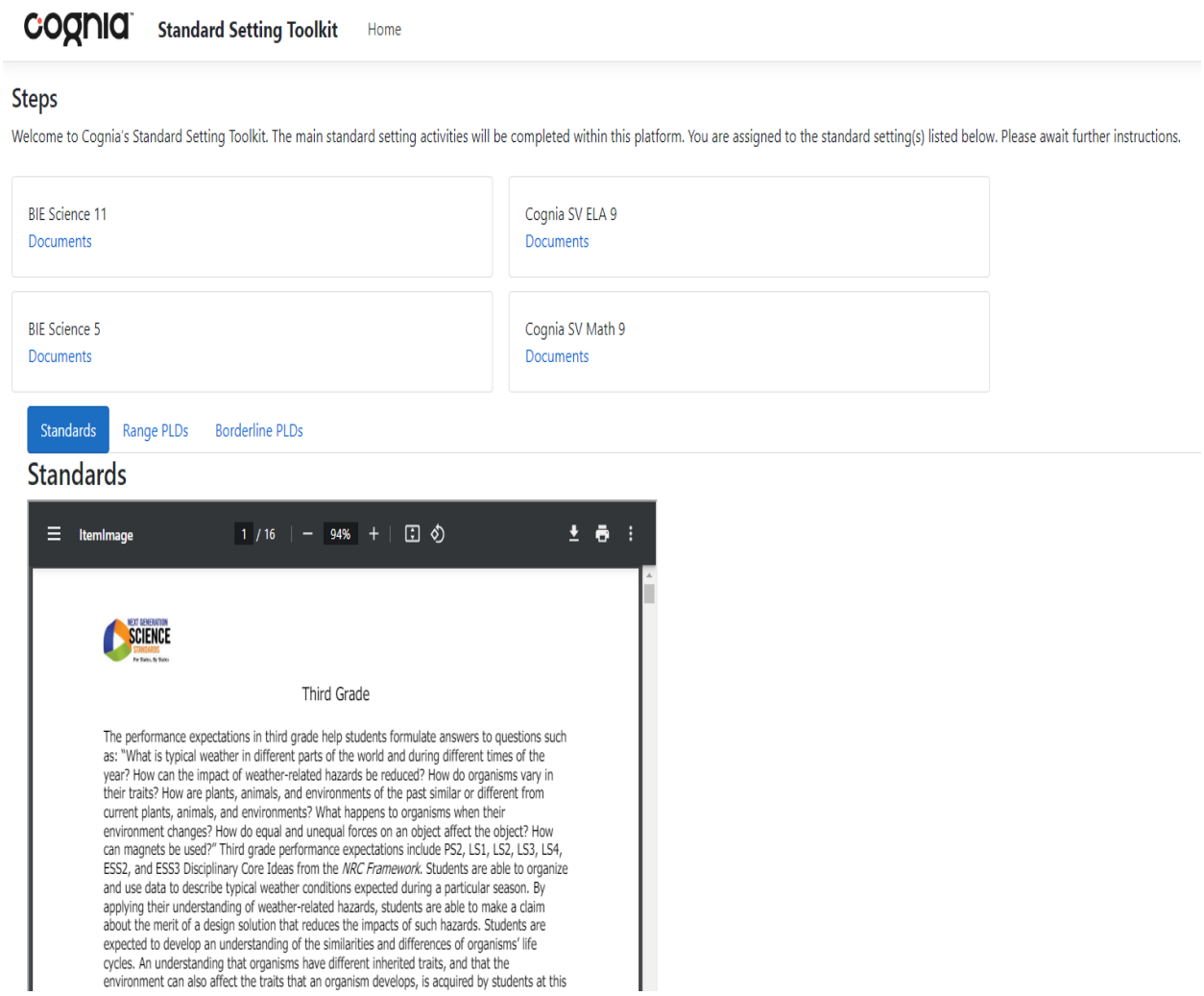
Science Grade 11—Form BIA1

AssetID	RP50	OIB_Page	Benchmark
639344	-1.72909	1	
748109	-1.16911	2	
628033	-1.07028	3	
762012	-1.05576	4	
706468	-1.04856	5	L2 Benchmark
762916	-0.99152	6	L2 Benchmark
642533	-0.95355	7	L2 Benchmark
626027	-0.94695	8	L2 Benchmark
705807	-0.83602	9	L2 Benchmark
666236	-0.73215	10	L2 Benchmark
633116	-0.64501	11	L2 Benchmark
706123	-0.63281	12	L2 Benchmark
633246	-0.546092998	13	L2 Benchmark
710876	-0.50463	14	L2 Benchmark
762922	-0.45921	15	L2 Benchmark
633266	-0.45832	16	
632730	-0.44719	17	
643598	-0.437515418	18	
735374	-0.38502	19	
640447	-0.27755	20	
640641	-0.24285	21	
706583	-0.22539	22	
753774	-0.216655915	23	L3 Benchmark
627081	-0.20146	24	L3 Benchmark
642454	-0.19015	25	L3 Benchmark
639319	-0.144084872	26	L3 Benchmark
639346	-0.07106	27	L3 Benchmark
637610	0.09313	28	L3 Benchmark
633315	0.307925652	29	L3 Benchmark
706670	0.33302	30	L3 Benchmark
666236	0.38983	31	L3 Benchmark
628033	0.45704	32	L3 Benchmark
710876	0.75432	33	L3 Benchmark
705815	0.882558849	34	
626027	1.01449	35	
642634	1.027786907	36	
706468	1.05056	37	
639344	1.06045	38	
762012	1.0842	39	
735374	1.14808	40	
642533	1.16729	41	
637994	1.196547897	42	
705738	1.43035	43	
642454	1.48185	44	
748109	1.54941	45	
633116	1.70765	46	
735374	1.8233	47	
705787	1.891727082	48	
710876	1.89395	49	
632730	1.94235	50	
753780	1.943187671	51	
666236	1.95266	52	
762916	2.05808	53	

continued

AssetID	RP50	OIB_Page	Benchmark
627081	2.06198	54	
706534	2.10731	55	L4 Benchmark
639346	2.16066	56	L4 Benchmark
633266	2.29154	57	L4 Benchmark
706123	2.33157	58	L4 Benchmark
640641	2.37171	59	L4 Benchmark
710876	3.0119	60	L4 Benchmark
706583	3.25803	61	L4 Benchmark
735374	3.82104	62	L4 Benchmark
705807	3.98356	63	L4 Benchmark
640447	4.02831	64	L4 Benchmark
637610	4.05365	65	L4 Benchmark
666236	4.19895	66	
762922	5.12835	67	
705738	8.02635	68	

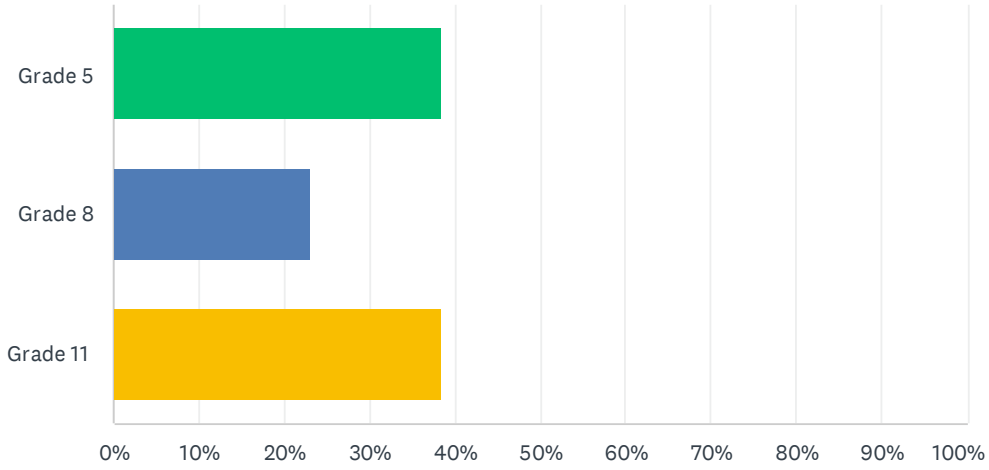
APPENDIX E
STANDARD-SETTING TOOLKIT


Standard Setting Toolkit
Home
Steps
Welcome to Cognia's Standard Setting Toolkit. The main standard setting activities will be completed within this platform. You are assigned to the standard setting(s) listed below. Please await further instructions.
BIE Science 11
Documents
Cognia SV ELA 9
Documents
BIE Science 5
Documents
Cognia SV Math 9
Documents
Standards
Range PLDs
Borderline PLDs
Standards
ItemImage
1 / 16
94%
Third Grade
The performance expectations in third grade help students formulate answers to questions such as: "What is typical weather in different parts of the world and during different times of the year? How can the impact of weather-related hazards be reduced? How do organisms vary in their traits? How are plants, animals, and environments of the past similar or different from current plants, animals, and environments? What happens to organisms when their environment changes? How do equal and unequal forces on an object affect the object? How can magnets be used?" Third grade performance expectations include PS2, LS1, LS2, LS3, LS4, ESS2, and ESS3 Disciplinary Core Ideas from the NRC Framework. Students are able to organize and use data to describe typical weather conditions expected during a particular season. By applying their understanding of weather-related hazards, students are able to make a claim about the merit of a design solution that reduces the impacts of such hazards. Students are expected to develop an understanding of the similarities and differences of organisms' life cycles. An understanding that organisms have different inherited traits, and that the environment can also affect the traits that an organism develops, is acquired by students at this

APPENDIX F
WORKSHOP EVALUATION SURVEY AND RESULTS

Q1 In which grade level did you participate in the BIE standards validation process?

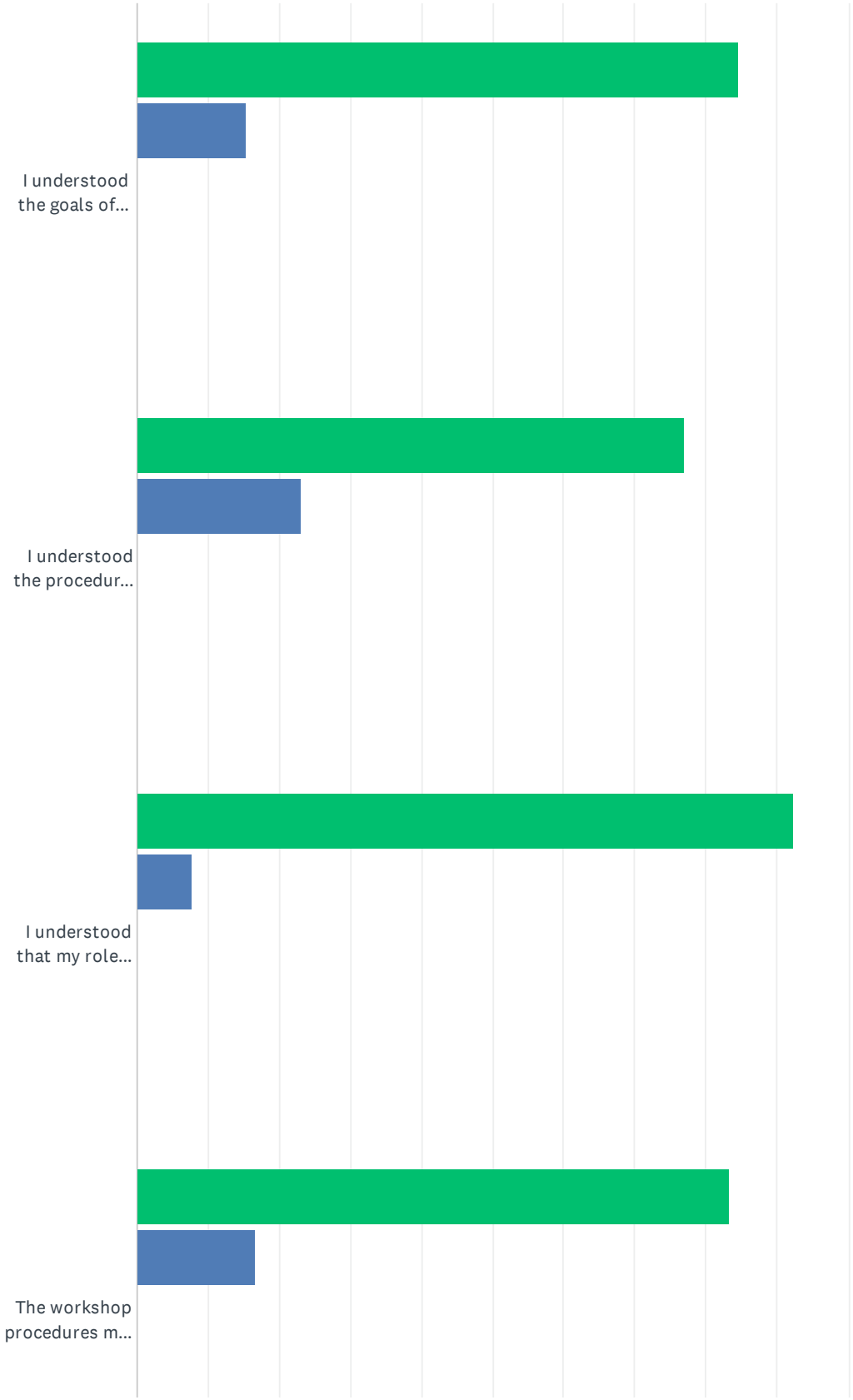
Answered: 13 Skipped: 0



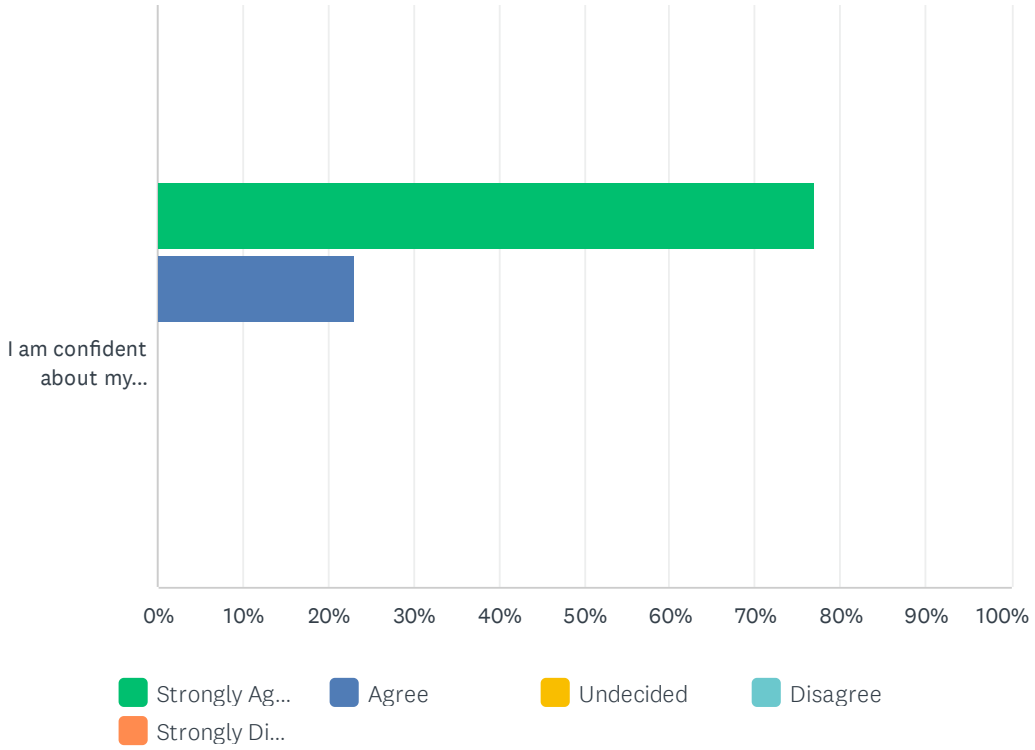
ANSWER CHOICES	RESPONSES	
Grade 5	38.46%	5
Grade 8	23.08%	3
Grade 11	38.46%	5
TOTAL		13

Q2 The Standards Validation Workshop Overall

Answered: 13 Skipped: 0



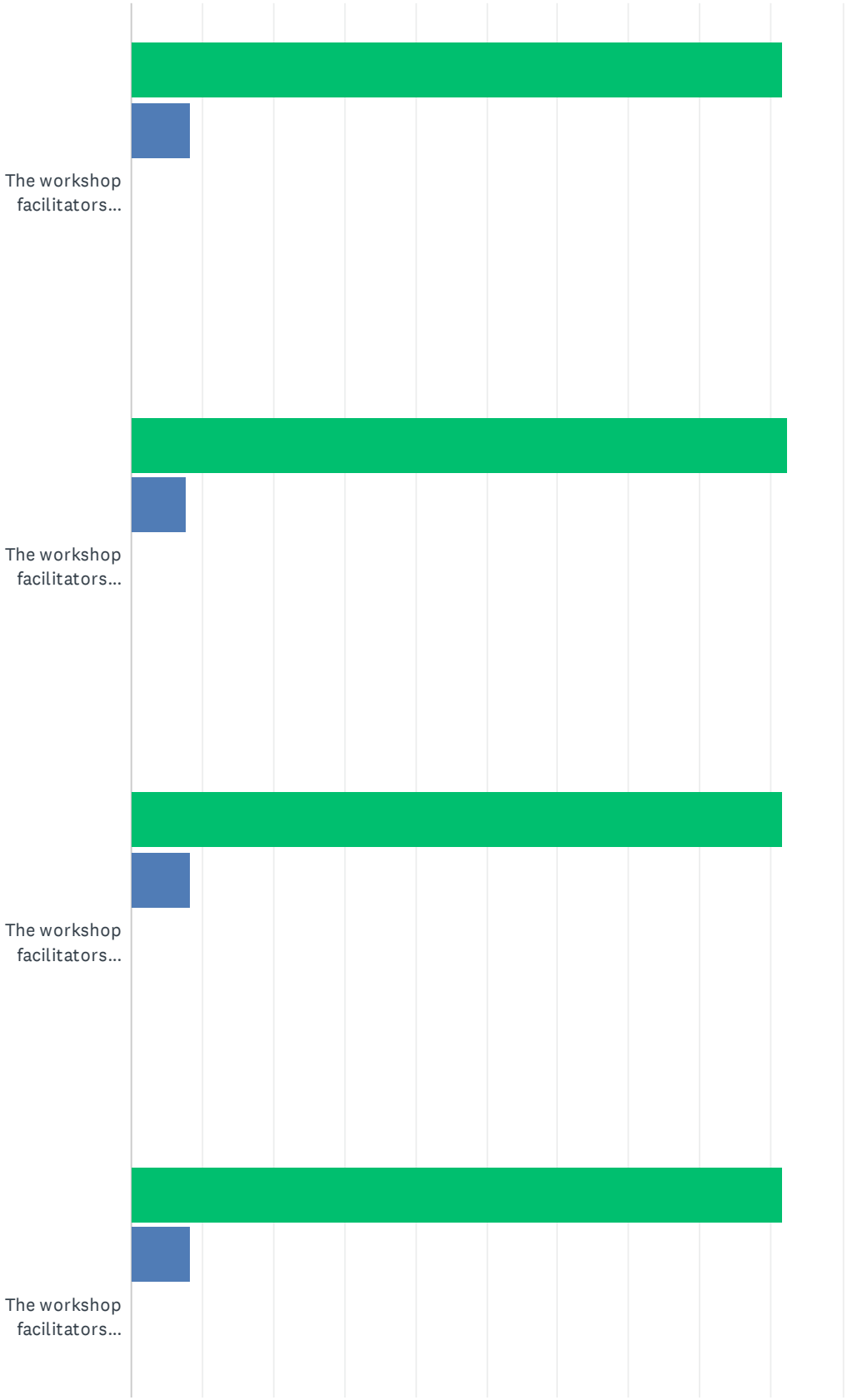
BIE Science Standards Validation Final Workshop Evaluation



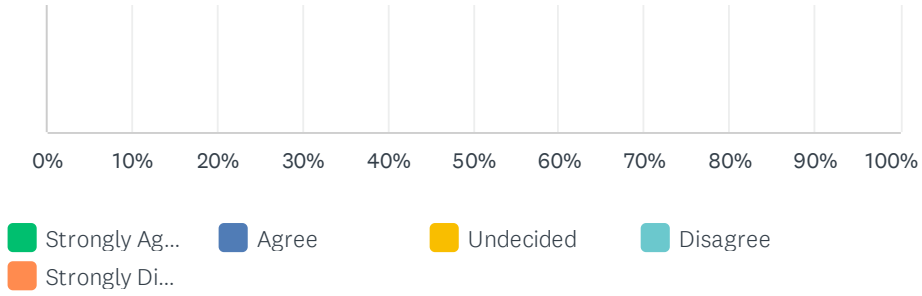
	STRONGLY AGREE	AGREE	UNDECIDED	DISAGREE	STRONGLY DISAGREE	TOTAL
I understood the goals of the standards validation workshop.	84.62% 11	15.38% 2	0.00% 0	0.00% 0	0.00% 0	13
I understood the procedures we followed to recommend cut scores for the different performance levels on the assessment.	76.92% 10	23.08% 3	0.00% 0	0.00% 0	0.00% 0	13
I understood that my role was to recommend cut scores to the Bureau of Indian Education.	92.31% 12	7.69% 1	0.00% 0	0.00% 0	0.00% 0	13
The workshop procedures made sense to me, and I learned how to apply them efficiently.	83.33% 10	16.67% 2	0.00% 0	0.00% 0	0.00% 0	12
I am confident about my understanding of this standards validation process.	76.92% 10	23.08% 3	0.00% 0	0.00% 0	0.00% 0	13

Q3 Workshop Facilitation

Answered: 13 Skipped: 0



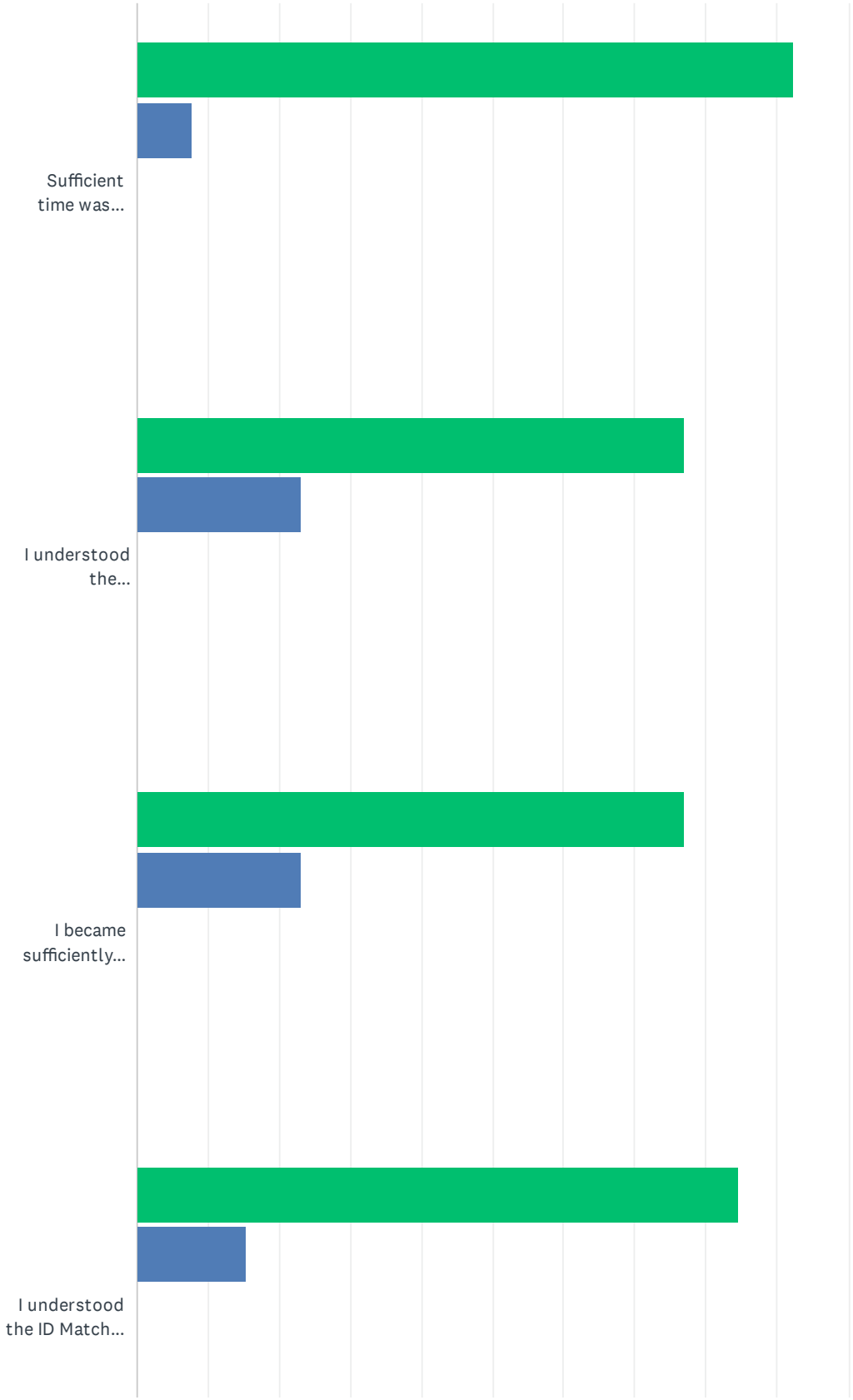
BIE Science Standards Validation Final Workshop Evaluation



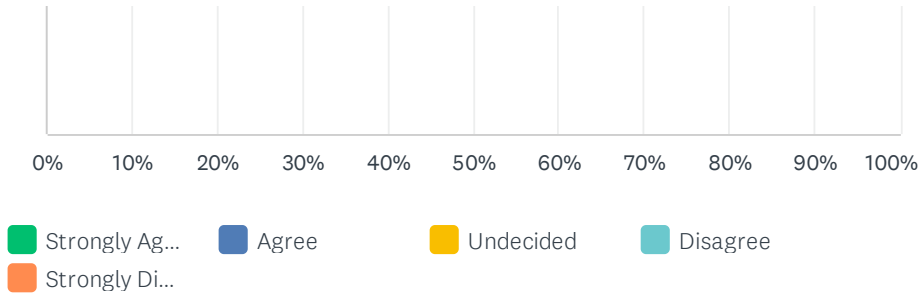
	STRONGLY AGREE	AGREE	UNDECIDED	DISAGREE	STRONGLY DISAGREE	TOTAL
The workshop facilitators explained and demonstrated things clearly to us.	91.67% 11	8.33% 1	0.00% 0	0.00% 0	0.00% 0	12
The workshop facilitators encouraged us to raise questions and put our understandings into our own words.	92.31% 12	7.69% 1	0.00% 0	0.00% 0	0.00% 0	13
The workshop facilitators provided clear and helpful responses to my questions and other requests for clarification.	91.67% 11	8.33% 1	0.00% 0	0.00% 0	0.00% 0	12
The workshop facilitators took steps to help the standards validation process run smoothly.	91.67% 11	8.33% 1	0.00% 0	0.00% 0	0.00% 0	12

Q4 Training, Practice, and the Standards Validation Workshop Process

Answered: 13 Skipped: 0



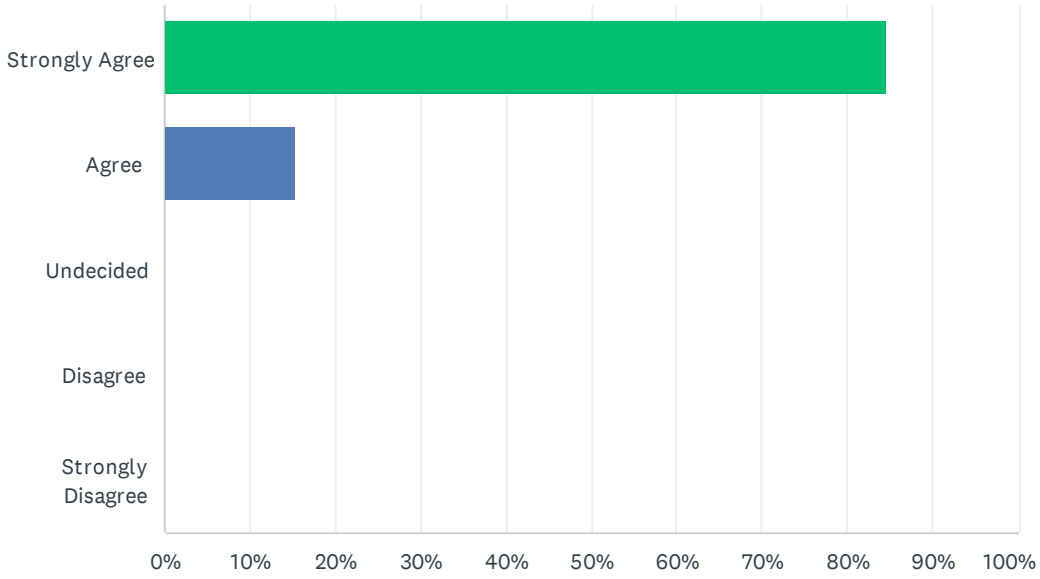
BIE Science Standards Validation Final Workshop Evaluation



	STRONGLY AGREE	AGREE	UNDECIDED	DISAGREE	STRONGLY DISAGREE	TOTAL
Sufficient time was allotted for training and practice on the standards validation concepts, tasks, and procedures.	92.31% 12	7.69% 1	0.00% 0	0.00% 0	0.00% 0	13
I understood the progressions in expectations across the performance levels as defined by the borderline Performance Level Descriptors.	76.92% 10	23.08% 3	0.00% 0	0.00% 0	0.00% 0	13
I became sufficiently familiar with the subject and grade-specific items to recommend cut scores, based on answering the two questions about items.	76.92% 10	23.08% 3	0.00% 0	0.00% 0	0.00% 0	13
I understood the ID Matching task, including answering the two questions about each item, matching those item response demands to PLDs, and how to recommend the performance level cut scores.	84.62% 11	15.38% 2	0.00% 0	0.00% 0	0.00% 0	13

Q5 I’m satisfied with the final group cut scores for all the performance levels. I would not recommend changing any of the group cut scores.

Answered: 13 Skipped: 0



ANSWER CHOICES	RESPONSES	
Strongly Agree	84.62%	11
Agree	15.38%	2
Undecided	0.00%	0
Disagree	0.00%	0
Strongly Disagree	0.00%	0
TOTAL		13

Q6 If you answered Strongly Disagree, Disagree, or Undecided on the previous question, please note the specific performance level cut score(s) you feel should be different. Would you recommend moving these cut score up or down in the ordered item booklet (OIB), and by how many pages?

Answered: 2 Skipped: 11

#	RESPONSES	DATE
1	I am satisfied with the divisions we made	5/2/2024 1:43 PM
2	NA	5/2/2024 1:42 PM

Q7 Please indicate any parts of the standards validation training and process that we should improve.

Answered: 7 Skipped: 6

#	RESPONSES	DATE
1	The training was great.	5/2/2024 1:52 PM
2	N/A	5/2/2024 1:51 PM
3	It was difficult at times to back and forth between items to review.	5/2/2024 1:51 PM
4	I'm not sure if it could be made any easier. It's a difficult process and there is no way to get around that. But not so difficult as to be confounding	5/2/2024 1:43 PM
5	Good training	5/2/2024 1:42 PM
6	None	5/2/2024 12:38 PM
7	Good job!	5/2/2024 12:38 PM

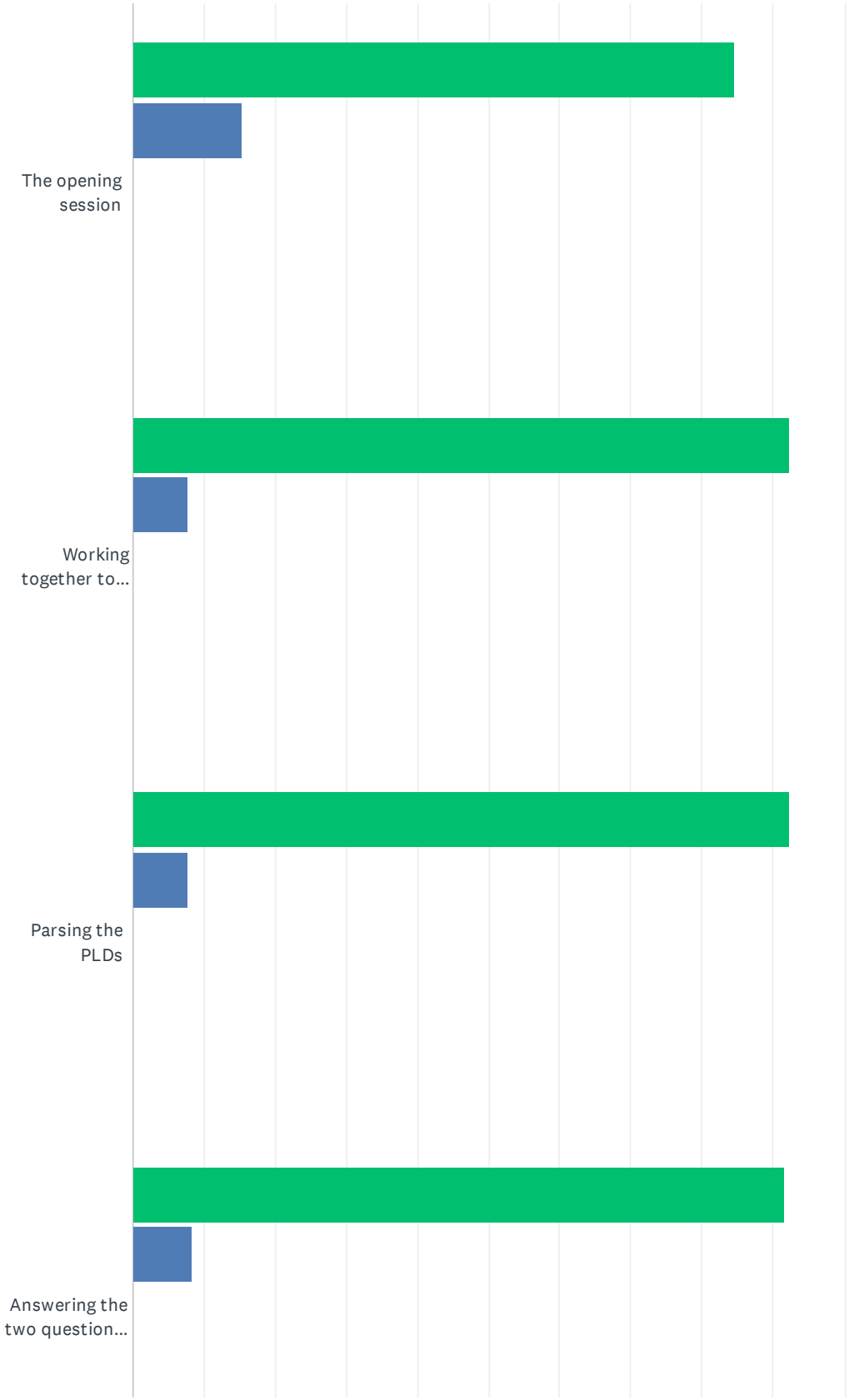
Q8 Please indicate any concerns you may have about the workshop process and the final recommended cut scores.

Answered: 7 Skipped: 6

#	RESPONSES	DATE
1	I think temporarily sharing the test questions to the teachers/panel allows freedom and smooth transition between screens they need to read through and evaluate. It also allows quicker responses from everyone. I also recommend a better technical check with the panelist. I know this has been a part of the process, but these seems to be a lot of issues with some teachers not able to fully participate due to tech issues. I also believe that some of the panelists are not fully aware of what they got into due to their inability to provide prompt and substantial responses which dragged the thought process. Saying this might be too harsh, but I think we should choose the panelist more strictly.	5/2/2024 1:56 PM
2	None	5/2/2024 1:52 PM
3	no concerns	5/2/2024 1:43 PM
4	None	5/2/2024 1:42 PM
5	None	5/2/2024 12:38 PM
6	No concerns, just praise. The workshop was great! Very organized and the facilitator was knowledgeable!	5/2/2024 12:38 PM
7	None	5/2/2024 12:38 PM

Q9 Please rate the usefulness of each section

Answered: 13 Skipped: 0



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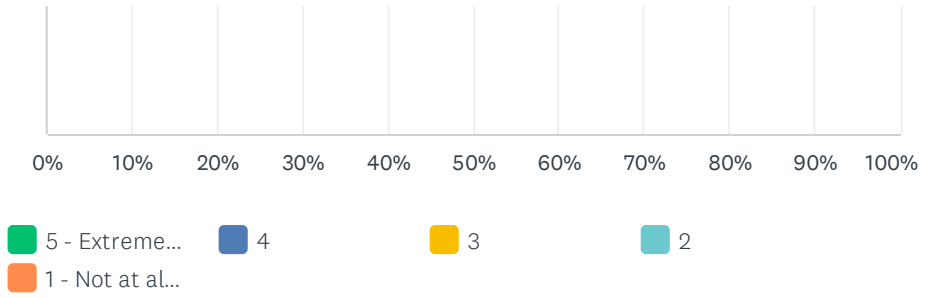
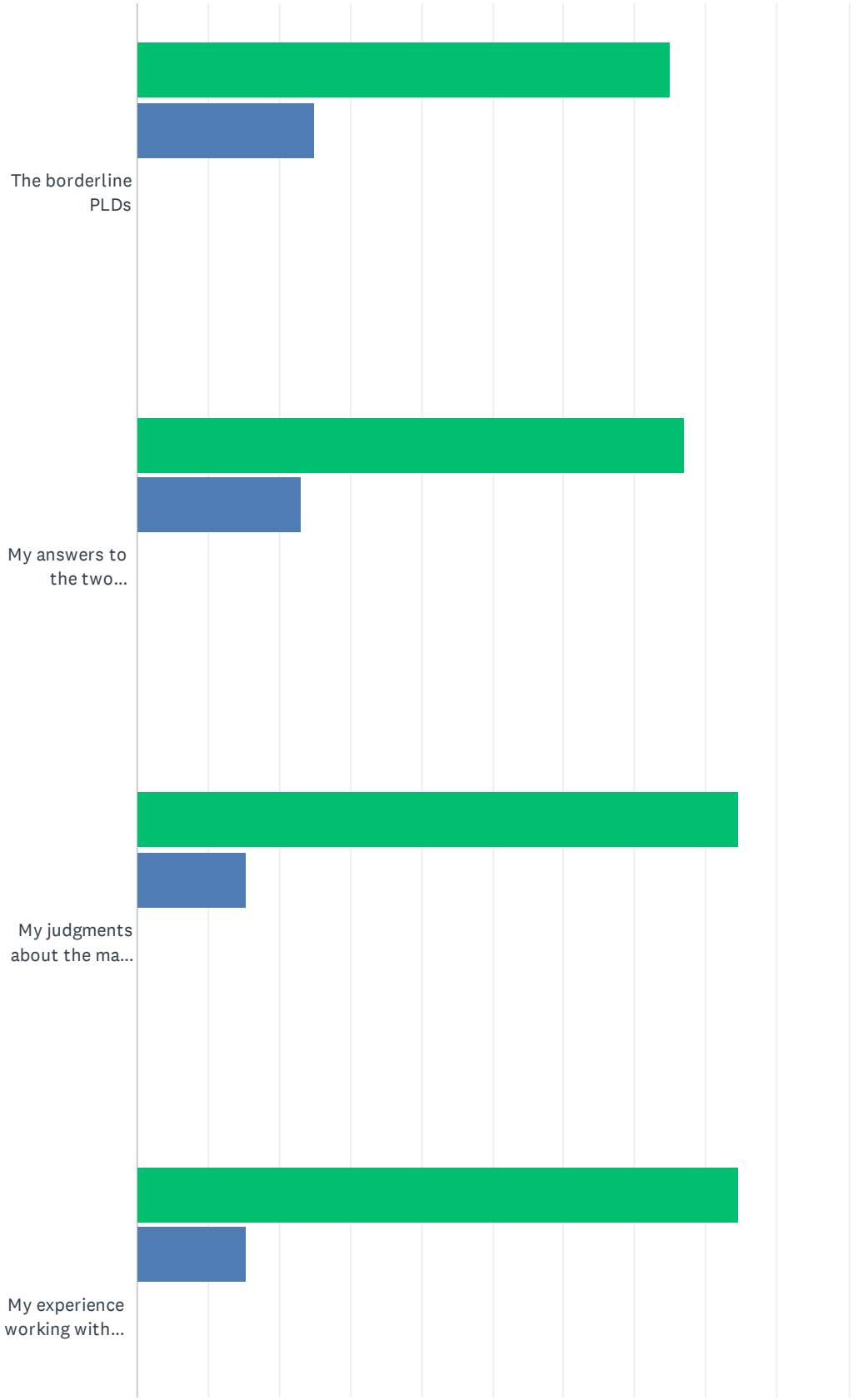
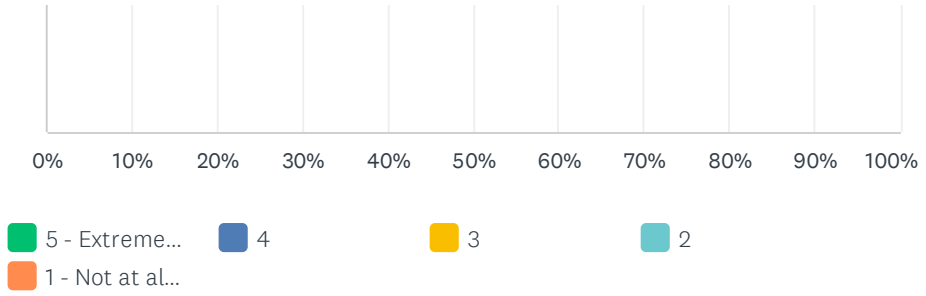


	5 - EXTREMELY USEFUL	4	3	2	1 - NOT AT ALL USEFUL	TOTAL
The opening session	84.62% 11	15.38% 2	0.00% 0	0.00% 0	0.00% 0	13
Working together to achieve consensus	92.31% 12	7.69% 1	0.00% 0	0.00% 0	0.00% 0	13
Parsing the PLDs	92.31% 12	7.69% 1	0.00% 0	0.00% 0	0.00% 0	13
Answering the two questions about each item	91.67% 11	8.33% 1	0.00% 0	0.00% 0	0.00% 0	12

Q10 Please rate the influence of the following when validating standards.

Answered: 13 Skipped: 0





	5 - EXTREMELY INFLUENTIAL	4	3	2	1 - NOT AT ALL INFLUENTIAL	TOTAL
The borderline PLDs	75.00% 9	25.00% 3	0.00% 0	0.00% 0	0.00% 0	12
My answers to the two questions about each item	76.92% 10	23.08% 3	0.00% 0	0.00% 0	0.00% 0	13
My judgments about the match of items to PLDs	84.62% 11	15.38% 2	0.00% 0	0.00% 0	0.00% 0	13
My experience working with students	84.62% 11	15.38% 2	0.00% 0	0.00% 0	0.00% 0	13

Q11 What materials, information, or procedures were most influential in your placement of the cut scores? In what ways?

Answered: 6 Skipped: 7

#	RESPONSES	DATE
1	The PLD's, how the questions were stated, and how the options are not too elaborate, confusing or distracting, the length and usefulness of the stimuli.	5/2/2024 1:58 PM
2	It gave me a new appreciation of how the test and the cut scores are determined. A new way to think about developing my own assessment questions	5/2/2024 1:44 PM
3	Great explanations of concepts	5/2/2024 1:44 PM
4	The items and the PLC's.	5/2/2024 12:39 PM
5	Keeping in mind what we want our students to do and how they apply certain knowledge to answer questions.	5/2/2024 12:39 PM
6	I liked the community feeling. We worked well together and everyone had their own opinion.	5/2/2024 12:38 PM

Q12 Please provide any additional comments you would like us to consider.

Answered: 3 Skipped: 10

#	RESPONSES	DATE
1	The facilitator was excellent!	5/2/2024 1:43 PM
2	None	5/2/2024 12:39 PM
3	Thank you for the opportunity.	5/2/2024 12:39 PM

APPENDIX G
PANELIST DEMOGRAPHICS

	First Name	Last Name	Email Address	District	School	Role	Grade level(s) you currently work with	Years worked in BIE schools	Administer the BIE Science Assessment in 2022 or 2023?	Gender	What is your ethnicity? (Please select all that apply)
Grade 5	Darlene	Archuleta	darlene.archuleta@bie.edu	Bureau Operated Schools (BOS)	Taos Day School	Test Coordinator	5	6–10	Yes	Female	Hispanic or Latino
	Helen	Fall	helen.fall@bie.edu	Bureau Operated Schools (BOS)	John F Kennedy day School	Test Coordinator/ 5th Grade Teacher	5	11–15	Yes	Female	White/Caucasian
	Rizalyn	Fontanilla	rizalynf@naneelzhiin.org	Tribally Controlled Schools (TCS)	Na' Neelzhiin Ji Olta	Testing Coordinator	5	Less than 1	No	Female	Asian or Pacific Islander
	Francelia	Tom	f.tom@fmesschool.com	Tribally Controlled Schools (TCS)	First Mesa Elementary School	Lead Teacher	5	11–15	Yes	Female	American Indian of Alaskan Native
	Katie	Van Dam	katie.vandam@bwcs.k12.az.us	Tribally Controlled Schools (TCS)	Blackwater Community School	Instructional Coach	5	Less than 1	No	Female	White/Caucasian
Grade 8	Linda	Bimberg	linda.bimberg@bie.edu	Bureau Operated Schools (BOS)	Riverside Indian School	High School Biology and 8th Grade Science Teacher	8, 11	1–5	Yes	Female	Hispanic or Latino
	Dr. Robert	Torrez	r.torrez@haakuca.org	Tribally Controlled Schools (TCS)	Haak'u Community Academy	Principal	5, 8	6–10	No	Male	Hispanic or Latino
	Tyler	Bangert	tyler.bangert@dishchiibikoh.org	Tribally Controlled Schools (TCS)	Dishchiibikoh Community School	Instructional Coach	11	More than 15	No	Male	White/Caucasian
	Terrill	Nickerson	terrill.nickeson@bie.edu	Navajo Area Schools (NAV)	Wingate High School	Science Teacher	11	More than 15	Yes	Male	White/Caucasian
Grade 11	Gemmalyn	Bautista	glumague@tzts.us	Tribally Controlled Schools (TCS)	Tiospa Zina Tribal School	HS Science Teacher	9, 10, 11, 12	Less than 1	No	Female	Asian or Pacific Islander
	DIANA	CHUA	dianchua27@gmail.com	Tribally Controlled Schools (TCS)	White Shield School	Science High School Teacher	11	1–5	Yes	Female	Asian or Pacific Islander
	Rolanda	Morris	Rolanda.morris@bie.edu	Bureau Operated Schools (BOS)	Wingate High School	Science Teacher	11	6–10	Yes	Female	American Indian of Alaskan Native
	Nate	Raynor	nate.raynor@mescalero.org	Tribally Controlled Schools (TCS)	Mescalero Apache School	Science Teacher	11	11–15	Yes	Male	Black or African American
	Meshielle	Salise	msalise@sfisk12.org	Tribally Controlled Schools (TCS)	Saint Francis Indian School	HS Science Teacher	11	Less than 1	No	Female	Asian or Pacific Islander
	Leslie	Logg	Leslie.Logg@bie.edu	Bureau Operated Schools (BOS)	Cheyenne-Eagle Butte High School	Assistant High School Principal	9, 10, 11, 12	More than 15	No	Male	American Indian of Alaskan Native
	Zonya	Tantype	zonya.tantype@bie.edu	Bureau Operated Schools (BOS)	Flandreau Indian School	School Counselor/Test Coordinator	11	More than 15	Yes	Female	American Indian of Alaskan Native

APPENDIX H
STANDARDS-VALIDATION MEMO

Bureau of Indian Education (BIE) Science Assessments

Standards Validation Memo

Science grades 5, 8, and 11

April 30–May 2, 2024

Overview

This report outlines the standards-validation process for the Bureau of Indian Education (BIE). In 2022, a standard-setting process took place in another state utilizing the same secure science item bank. BIE subsequently adopted assessments based on this science item bank. The goal of the standards validation is to ensure that the performance standards set in 2022 are appropriate for BIE's student population. The primary goal is to validate the knowledge, skills, and abilities (KSAs) necessary for categorizing BIE students into the four performance levels: Novice, Near Proficiency, Proficient, and Advanced, ensuring alignment with their educational outcomes.

The standards validation meeting took place from April 30th to May 2nd, 2024. It involved 16 panelists recruited from BIE educators, grouped into three teams: 5 for Grade 5, 4 for Grade 8, and 7 for Grade 11, each accompanied by a facilitator from Cognia. Panelists were assigned based on their primary grade-level expertise. Additionally, BIE representatives observed the standard validation process. Table 1-1 illustrates how the report is organized into three major sections, describing tasks completed before, during, and after the standard validation meeting.

Table 1-1: Standards Validation Tasks and the Report Layout

Tasks Completed Before the Standard Validation Meeting	*Tasks Completed During the Standard Validation Meeting*	*Tasks Completed After the Standard Validation Meeting*
• Preparation of Materials • Preparation of Instructions for Facilitators • Standards-based benchmarks • Preparation of Systems and Materials for Use During the Meeting • Selection of Panelists	• Overview of the ID Matching Method • General Orientation and Panelist Training • Review of Assessment Materials • Review of Performance Level Descriptors • Judgment Rounds and Feedback	• Analysis and Review of Panelists' Feedback • Approval of the Cut Scores • Preparation of Standards-Validation Report

Methods

The standard validation process used was the Item-Descriptor (ID) Matching method (Ferrara & Lewis, 2012; Cizek & Bunch, 2007). The ID Matching method was selected because it reduces the cognitive burden on panelists as compared to other standard-setting or standard validation methods that require probability judgments about hypothetical high- and low-performing students, and it most clearly translates

content standards into performance categories as compared to other methods of standard setting (Cizek, Bunch, & Koons, 2004).

Tasks Completed Before Standards Validation

Creation of Performance Level Descriptors: In August 2020, Cognia content specialists developed performance level descriptors (PLDs) for science grades 5, 8, and 11. These descriptors aligned with NGSS content standards and underwent review by the New Mexico Public Education Department and grade-specific committees of New Mexico educators. Final approval was obtained in 2022.

Preparation of Materials: Various materials were compiled for presentation at the standards-validation meeting, including PowerPoint presentations, meeting agendas, test booklets, PLDs, NGSS content standards, and the Cognia Standard-Setting Toolkit.

Preparation of Instructions for Facilitators: Facilitators underwent training sessions led by Cognia to ensure consistency in procedures. They were equipped with facilitator scripts embedded in grade-specific PowerPoint slides.

Cut Score Benchmarks: Cut scores set in New Mexico in 2022 were used as benchmarks. A Cognia psychometrician reviewed the Spring 2023 operational test forms for Grades 5, 8, and 11 to establish empirical threshold regions, marked as color-shaded regions in the digital tool, around these cut scores in the ordered item booklets.

Preparation of Materials for Use During the Meeting: The Cognia Standard-Validation Toolkit was set up before the meeting, featuring a digitally ordered item booklet, items, PLDs, content standards, and judgment forms.

Workshop Surveys: Workshop surveys, including readiness surveys and a final workshop evaluation, were administered via Survey Monkey to gauge panelists' understanding of the process and ensure independent judgment.

Selection of Panelists: BIE selected panelists before the standards validation meeting. The goal for panel selection was to include participants who were primarily general education teachers but also included school administrators, and stakeholders from other interest groups. Moreover, to the extent possible, panelists were selected to reflect a balance of gender, race/ethnicity, and geographic location. Finally, panelists were selected who were familiar not only with the subject matter but also with the grade for which they would be setting standards. A list of the panelists is included in Table 1.

Table 1: Panelists Demographic Information Summary

Panelist	Demographics	N	Percentage
Assigned Grade-specific panel	Grade 5	5	31%
	Grade 8	4	25%
	Grade 11	7	44%
Gender	Female	11	69%
	Male	5	31%
Ethnicity	American Indian or Alaskan Native	4	25%
	Asian or Pacific Islander	4	25%
	Black or African American	1	6%
	Hispanic or Latino	3	19%
	White/Caucasian	4	25%
District Representation	Bureau Operated Schools (BOS)	6	38%
	Navajo Area Schools (NAV)	1	6%
	Tribally Controlled Schools (TCS)	9	56%
Panelist Teaching Experience			
Grade Band	Elementary	6	31%
	Middle	2	13%
	High	9	56%
Role	Teacher	8	50%
	Test Coordinator	4	25%
	Principal/Assistant Principal	2	13%
	Instructional Coach	2	13%
Years of Experience working with BIE Schools	Less than 1 year	4	25%
	1–5 years	2	13%
	6–10 years	3	19%
	11–15 years	3	19%
	More than 15 years	4	25%

Tasks Completed During Standards Validation

Plenary Session

The training of the panelists began with a general orientation session at the start of the standards validation meeting which included an overview of the BIE Science assessment. The purpose of the orientation was to ensure that all panelists received the same information about the need for and the goals of standards validation, and their part in the process.

In a collaborative effort, BIE and Cognia warmly welcomed standards validation participants, beginning with a thorough introduction and a brief assessment overview, while also clarifying the workshop's purpose. Once panelists were acquainted with the assessment and standards validation process, they engaged in two rounds of validation activities over the subsequent two days.

Day 1 Breakout Sessions

Following the general orientation, panelists were divided into grade-specific groups for experience student tests. This step aimed to familiarize the panelists with the assessment and test-taking activities expected of students during administration.

Before undertaking the judgment tasks, panelists reviewed the borderline PLDs. This essential step aimed to guarantee a comprehensive understanding of the knowledge, skills, and abilities (KSAs) required for student classification into the four performance levels (Novice, Nearing Proficiency, Proficient, and Advanced).

Panelists completed a practice round of judgments after familiarizing themselves with PLDs. This round aimed to acquaint them with the materials and the ID Matching judgments. In the digital tool, they assessed a set of practice items covering various difficulty levels. The tool allowed them to record their observations and judgments, including item-PLD alignment, accompanied by detailed rationales.

At the end of the practice round, panelists completed the Round 1 Readiness Survey. The readiness survey was designed to ascertain whether the panelists were comfortable moving ahead to the judgment task. Once all panelists completed the Round 1 Readiness Survey, Cognia psychometricians reviewed the responses to make sure panelists were ready to undertake the first round of judgments. In the event of any uncertainty (based on the survey responses), the specific information was relayed to the facilitator so that any questions or issues could be addressed before proceeding to the Round 1 judgments. The facilitator moved on to the next round of judgement when all panelists indicated “Yes” to all survey questions. By the end of day 1, Grade 5 had finished their first readiness survey, while Grades 8 and 11 were engaged in discussions during the practice round.

Day 2 Breakout Sessions

At the start of the day 2 breakout session, the facilitator for each grade began by debriefing day 1 and reviewing the activities planned for day 2.

During the round 1 judgment process, within each grade-specific group, panelists began with items in the proficient region, which closely aligns with proficient cut scores. They evaluated the skills and abilities required for each item by asking two questions: (1) “What are the knowledge, skills, and abilities a student needs to respond to this item?” and (2) “Why is this item more difficult than the previous one?” Panelists assessed each item in sequence, assigning item descriptor matches and discussing their reasoning under the facilitator's guidance. This process ensured alignment with the judgment task and borderline PLDs while assessing panelists' comprehension. Panelists progressed through the proficient, advanced, and nearing proficient shaded regions in sequence, assessing each ordered item until completion.

By the end of day 2, Grade 5 had finished both the round 1 judgment and discussion and completed the round 2 readiness survey. Meanwhile, Grades 8 and 11 were nearing completion of the round 1 judgment; however, they decided to postpone the round 1 discussion and readiness survey until day 3.

Day 3 Breakout Sessions

On day 3, each group's facilitator begins by debriefing day 2 and outlining the tasks for the round 2 judgment. In this phase, the main objective is to examine the previously set cut placements from another standards-setting and determine if they align with each panel's expectations. Utilizing their content expertise, panelists discuss whether the existing cut scores accurately reflect the knowledge and skills students must demonstrate to be classified into specific performance levels. In grade-specific groups, discussions begin with the proficient region, where each panel examines the cut placements from the Proficient, Advanced, and Nearing Proficiency regions.

Following the conclusion of the Round 2 judgment, panelists are instructed to complete the final workshop survey. This survey aims to verify that panelists grasp the entirety of the process and that their judgments are made independently. In the final workshop evaluation, panelists expressed generally positive support

for the workshop overall, workshop facilitation, training, practice, and the workshop process. More detailed results will be presented in the Standard Validation Technical Report.

Standard Validation Results

Tables 2-5 contain the standard validation panelist-recommended cut scores and associated content-based rationales across grades 5, 8, and 11 for BIE Science Assessment. The results include the item-PLD alignment for items most closely aligned with the cut scores, RP50 values of the items, and detailed rationales for the cut placements for all three cuts across three grades.

Table 2: BIE Grade 5 Round 2 Cut Placement Results

Asset Id	RP50	Rationale	Cut Placement
626478	-0.63678	The items below did not require science knowledge to get the answers correct. You can use logic instead of science. In the question above, a student needs to know science concepts to answer the questions. Students needed to at least identify or describe to answer the questions.	Nearing Proficiency Cut
697027	0.5428	Students would have to know how to use a graph and apply it to the information that is being asked. Applying is a proficient skill. The information is given to the students in the questions below and they have to use data/information instead of explaining or interpreting. The items above the cut have more information for students to read through and it would be more difficult for a nearing proficient student. They must compare more information and decide what is relevant which is language that is used in the proficient or advanced level.	Proficient Cut
706847	1.71525	This item requires students to synthesize information and look at multiple solutions. They must understand multiple pieces of data. The items below have more real-life experiences with the context. The items above are more abstract and they will not have exposure to those concepts and ideas.	Advanced Cut

Table 3: BIE Grade 8 Round 2 Cut Placement Results

Asset Id	RP50	Rationale	Cut Placement
637562	-0.91106	The item near the proposed Nearing Proficiency cut aligns closely with the expectations of the Nearing Proficiency PLD. It requires students to utilize a model to recognize the formation of molecules, indicating a partial understanding of all three dimensions, which is characteristic of the Nearing Proficiency level. Conversely, items below this cut tend to align more with the Novice level, lacking the partial understanding expected at the Nearing Proficiency level. Conversely, items above this cut generally align with the Nearing Proficiency PLD, as they demand a partial understanding of all three dimensions not typically met at the Novice level.	Nearing Proficiency Cut
641845	0.54417	The item near the proposed Proficient cut closely aligns with the Proficient PLD as it requires students to demonstrate understanding through connections and explanations, which are characteristics of the Proficient level. Items above this cut generally meet Proficient or Advanced PLD expectations, indicating a thorough understanding. Conversely, items below the proposed cut tend to align more with the Nearing Proficiency PLD, requiring only partial understanding for successful responses.	Proficient Cut
663576	2.7498	The item near the proposed Advanced cut aligns closely with the Advanced level, as it requires students to develop models, a characteristic of the Advanced PLD. Items below this cut tend to align more with the Proficient PLD, requiring a satisfactory understanding for successful responses. Conversely, items above this cut generally meet the Advanced PLD expectations, requiring a thorough understanding for successful responses.	Advanced Cut

Table 4: BIE Grade 11 Round 2 Cut Placement Results

Asset Id	RP50	Rationale	Cut Placement
666236	-0.73215	The item for the proposed Nearing Proficiency cut just barely matches the Nearing Proficiency borderline PLD because the item requires students to use evidence or mathematical representations to describe factors affecting biodiversity or populations in ecosystems. Students must calculate the average population of mummichogs to support claims, and this mathematical representation is described in the Nearing Proficiency PLD would not describe students in the Novice category. The items above this proposed cut generally meet the expectations of the Nearing Proficiency PLD because the items require students to show a partial understanding of all three dimensions to successfully respond to the items. The items below this proposed cut generally meet the expectations of the Novice PLD because items at this level do not require students to show a partial understanding of all three dimensions to successfully respond to the items.	Nearing Proficiency Cut
637610	0.09313	The item for the proposed Proficient cut barely matches the Proficient borderline PLD because the item requires students to use evidence to explain a barely satisfactory understanding of how DNA sequences for proteins. How proteins carry out the functions of life through specialized cells is described in the Proficient PLD but NOT in the Nearing Proficiency PLD. The items above this proposed cut generally meet the expectations of the Proficient PLD because the items require students to show a satisfactory understanding of all three dimensions to successfully respond to the items. The items below this proposed cut generally meet the expectations of the Nearing Proficiency PLD because the items require students to show a partial understanding of all three dimensions to successfully respond to the items.	Proficient Cut
710876	3.0119	The item for the proposed Advanced cut barely matches the Advanced borderline PLD because the item requires students to refine devices within a model that converts one form of energy into another. Students have to predict how to convert more electrical energy by changing various parts of the model (blade angles, height, blade length, materials, etc.) and how friction is involved. Students refining multiple devices within the model and demonstrating just barely thorough knowledge was described in the Advanced PLD but NOT in the Proficient PLD. The items above this proposed cut generally meet the expectations of the Advanced PLD because the items require students to show a thorough understanding of all three dimensions to successfully respond to the items. The items below this proposed cut generally meet the expectations of the Proficient PLD because the items require students to show a satisfactory understanding of all three dimensions to successfully respond to the items.	Advanced Cut

The panelist-recommended cut scores closely align with those set in the previous standards setting, validating the continued use of the provisional cuts adopted by BIE since 2022 as the official cut scores for future BIE Science assessments. These cut scores were initially established for the Cognia SSIB in 2022. The cut scores, both on the theta scale and the reporting scale, are provided in Table 5. These cut scores are also utilized for the Spring 2023 BIE Science Assessments.

Table 5. Spring 2023 Cutpoints on the Theta Metric and Reporting Scale by Grade

Theta			Scale Score				
Cut1	Cut2	Cut3	Min	Cut1	Cut2	Cut3	Max
-0.75048	0.51466	1.70117	500	544	560	574	590
-0.96101	0.48988	2.73095	800	845	860	882	890
-0.76114	0.03716	2.91134	1100	1154	1160	1181	1190

The empirical performance level distributions for the Spring 2023 administration of BIE Science Assessments are shown in Table 6.

Table 6. Performance Level Distribution as a Function of Grade*

Grade	Number of Students	Novice	Nearing Proficiency	Proficient	Advanced	% Novice	% Nearing Proficiency	% Proficient	% Advanced
5	1937	999	741	177	20	52%	38%	9%	1%
8	1662	479	928	254	1	29%	56%	15%	0%
11	870	497	267	105	1	57%	31%	12%	0%

**Calculations based on those students attempting 5 or more items.*

References

Cizek, G. J., & Bunch, M. B. (2007). Standard setting: Establishing and evaluating performance standards on tests. Thousand Oaks, CA: Sage Publications.

Cizek, G. J., Bunch, M. B., & Koons, H. (2004). An NCME Instructional Module on Setting Performance Standards: Contemporary Methods. *Educational Measurement: Issues and Practice, 23*(4), 31–50.

Ferrara, S., & Lewis, D. (2012). The Item-Descriptor (ID) Matching method. In G. J. Cizek (Ed.), *Setting performance standards: Foundations, methods, and innovations* (2nd ed., pp. 255-282). Routledge.