Resubmit 6.4 Protecting Your Cell Phone (F4)
EQuIP Rubric for Science Evaluation

Developer/Curriculum: Michigan Science Teaching and Assessment Reform (Mi-STAR)
Unit Name: Protecting Your Cell Phone
Grade: Middle School (Grade 6)
Date of Review: February 2020
Overall Rating (N, R, E/I, E): E/I
Category I: NGSS 3D Design Score (0, 1, 2, 3): 2
Category II: NGSS Instructional Supports Score (0, 1, 2, 3): 2
Category III: Monitoring NGSS Student Progress Score (0, 1, 2, 3): 2
Total Score (0–9): 6
Click here to see scoring guidelines

This review was conducted by the Science Peer Review Panel using the EQuIP Rubric for Science.

Category I Criteria Ratings		Category II Criteria Ratings		Category III Criteria Ratings	
A. Explaining Phenomena/Designing Solutions	Adequate	**A. Relevance and Authenticity**	Adequate	**A. Monitoring 3D Student Performances**	Adequate
B. Three Dimensions	Adequate	**B. Student Ideas**	Adequate	**B. Formative**	Adequate
C. Integrating the Three Dimensions	Adequate	**C. Building Progressions**	Adequate	**C. Scoring Guidance**	Inadequate
D. Unit Coherence	Adequate	**D. Scientific Accuracy**	Adequate	**D. Unbiased Tasks/Items**	Adequate
E. Multiple Science Domains	Adequate	**E. Differentiated Instruction**	Inadequate	**E. Coherence Assessment System**	Adequate
F. Math and ELA	Inadequate	**F. Teacher Support for Unit Coherence**	Adequate	**F. Opportunity to Learn**	Adequate
		G. Scaffolded Differentiation Over Time	Adequate		

Summary Comments

Thank you for your commitment to students and their science education. Achieve is glad to partner with you in this continuous improvement process. It is obvious that this unit was thoughtfully crafted, and it has many strengths that may not be apparent from the ratings. The unit is strong in several areas, including a relevant driving unit challenge that each lesson connects back to using the summary table and that students can experience firsthand in the classroom, the use of lesson level phenomena, the embedded assessments, and the background information and exemplar answers to guiding questions provided for teachers. The reviewers also found the format and consistency of the lesson plans easy to follow.

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During revisions, the reviewers recommend paying close attention to the following areas:

- Some students may be sensitive to the use of car crashes as a phenomenon or way to make sense of forces.
- Consider using elements of SEPs, DCIs, and CCCs that are not associated with the Performance Expectations listed. For example, the reviewers found several opportunities for elements of the CCC of Cause and Effect to be developed and used throughout this unit.
- Ensure that the elements of the three dimensions claimed are fully addressed by students.
- Consider supporting students to use and build elements of the SEP **Asking Questions** and eliciting new student questions throughout the unit in order to improve the unit's coherence and connection to students' lives.

Note that in the feedback below, black text is used for either neutral comments or evidence the criterion was met and purple text is used as evidence that the criterion was not met.

Category I. NGSS 3D Design

Score: 2

3: *At least adequate evidence for all of the unit criteria in the category; extensive evidence for criteria A–C*
2: *At least some evidence for all unit criteria in Category I (A–F); adequate evidence for criteria A–C*
1: *Adequate evidence for some criteria in Category I, but inadequate/no evidence for at least one criterion A–C*
0: *Inadequate (or no) evidence to meet any criteria in Category I (A–F)*

I.A. Explaining Phenomena/Designing Solutions: Making sense of phenomena and/or designing solutions to a problem drive student learning.

Student questions and prior experiences related to the phenomenon or problem motivate sense-making and/or problem solving.

The focus of the lesson is to support students in making sense of phenomena and/or designing solutions to problems.

When engineering is a learning focus, it is integrated with developing disciplinary core ideas from physical, life, and/or earth and space sciences.

Rating for Criterion I.A Explaining Phenomena/Designing Solutions: Adequate
(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that learning is driven by students making sense of phenomena or designing solutions to a problem because the Unit Challenge Scenario drives the learning throughout the unit and each lesson has a lesson level phenomenon that drives the learning of the lesson.

Materials support students in designing the solution to keeping a cell phone from breaking. It is clear to the student how the learning they are doing will help them better design a solution to a problem. Lesson-level phenomena help students better understand protecting a cell phone and iterate on the design solutions based on learning.

- Students design "a case from their repurposed materials that will protect 'paper people' from being crushed under a heavy weight" (Lesson 1, page 6).
- Students are introduced to a challenge scenario "Marcus broke his cell phone! … "Marcus needs you to make him a new cell phone case" (Unit Challenge Scenario, page 1)
- "Students reflect on what they need to know to address the Unit Challenge Question by completing a Unit Bubble Map activity that requires them to brainstorm smaller questions they must answer in order to address the Unit Challenge Question. The goal is to elicit at least three questions that can be mapped to the lesson questions from the unit" (Lesson 1, page 10). However, the bubble map only contains a list of "questions they believe will need to be answered in order to answer" the unit problem instead of student questions that are generated out of student curiosity.
- In a whole group "students craft a class-wide explanation to the phenomenon from the uncover phase: How can we model the forces present in the situation of a hand pushing on a wall?" (Lesson 2, page 10). The question above and the modeling of forces when pushing against a call is cannot be considered a phenomenon.
- The teacher reminds students of the Lesson Discovery Question they identified in Lesson 1 "Why do things get crushed?" and revisited the Unit Bubble Map to "let students see the connections between their questions and this Lesson Discovery Question" (Lesson 3, page 6).
- Students use the lesson level phenomenon of a penny launcher to "investigate how mass and force affect change in motion" (Lesson 4, page 13) and "craft a whole group explanation to the question, "What are the components of a fair investigation?" (Lesson 4, page 17).
- Students engage in the egg drop investigation and craft a class-wide explanation of the phenomenon from the Uncover phase: "What are the differences between the FORCES in the cushioned collision vs. a non-cushioned collision? How does cushioning help prevent the egg from breaking?" (Lesson 5, page 14). This question is not a phenomenon but a question that students are asked to answer through investigation.
- Students investigate a lesson level phenomenon using a pre-constructed "bottle accelerometer to study how constant motion differs from changes in motion (acceleration)" (Lesson 6, page 7). However, this was used more as a hook or engage strategy and the investigation did not drive the learning in this lesson. A second phenomenon was presented in the uncover your ideas phase when students watch a video of a "Crash Test" and are then required to model the forces present. The reviewers did not find that this lesson-level phenomenon drove the learning in the lesson.
- The DCI PS2.A Forces and Motion are developed throughout the lessons and applied to the engineering Unit Challenge Scenario.

Suggestions for Improvement

- Student questions and prior experiences could be leveraged more to motivate sense making and drive the unit challenge. Students could be supported to have a feeling of "need to engage" in the unit challenge if the teacher referenced their questions and elicited new questions instead of only

using the "Connecting Your ideas" to the unit challenge section of the Summary Table that the students complete at the end of each lesson.

- Rather than the lesson beginning with an object falling on the teachers' foot, he/she could show the class his/her broken cell phone. The class could then problem solve the need for a protective case. This could lead to the students generating the list of questions that need to be answered in a way that drives the learning.
- The bubble map activity (Lesson 1) has the potential of driving the learning if students would return to their questions, connect their new ideas to those questions, and modify or ask new questions based on new experiences.

I.B. Three Dimensions: Builds understanding of multiple grade-appropriate elements of the science and engineering practices (SEPs), disciplinary core ideas (DCIs), and crosscutting concepts (CCCs) that are deliberately selected to aid student sense-making of phenomena and/or designing of solutions.

Provides opportunities to *develop and use* specific elements of the SEP(s).
Provides opportunities to *develop and use* specific elements of the DCI(s).
Provides opportunities to *develop and use* specific elements of the CCC(s).

Rating for Criterion I.B. Three Dimensions: Adequate

(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that the materials give students opportunities to build understanding of grade-appropriate elements of the three dimensions because adequate student usage of each dimension was found and students also have opportunities to build toward DCI elements.

Science and Engineering Practices (SEPs): Adequate

The reviewers found adequate evidence that students have the opportunity to use SEPs in this unit because students are engaged for a sufficient amount of time for a sufficient number of SEPs for the length of the materials. There's a reasonable match between the SEPs that were claimed and the evidence of SEP use in the materials. However, the reviewers did not find evidence of SEP development in the materials.

Constructing Explanations and Designing Solutions

- Students apply the scientific idea of modeling forces (Lesson 2), how mass and force affect change in motion (Lesson 4), and net force (Lesson 6) to design a protective case for Marcus' cell phone. This provides evidence of student use of the 6–8 band element *Apply scientific ideas or principles to design an object, tool, process or system*.

Planning and Carrying Out Investigations

- "Students collaboratively plan an investigation to test different cushion materials." They record the independent and dependent variables and "how many times should we repeat the tests in the "Uncover Student EggDropGuide" (Lesson 5, page 8). This provides partial evidence of student of the 6–8 grade band element *Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.*
- Students plan and carry out the penny launcher investigation to "test both force and mass and their effect on change in motion". (Lesson 4, Page 14) "Students report their investigation findings on poster paper and make specific notes on why their investigation is fair and why the results can be trusted." They also create tables, graphs, and or models to make a claim. This is evidence of the 6-8 grade band element Conduct an investigation and/or evaluate and/or revise the experimental design to produce data to serve as the basis for evidence that meet the goals of the investigation. Note the change of SEP element than what is claimed by developers. This element was chosen since the investigation was mostly provided for students and the main goal was to determine a fair test and collect evidence on the relationships between force and mass and their effect on change in motion.

Developing and Using Models

- "Students work in small groups to create a Two Object Model of both cases (before and during crushing)" and "identify force pairs". (Lesson 3, Page 14). This is evidence of the 6-8 grade band element *Develop and/or revise a model to show the relationships among variables, including those that are not observable but predict observable phenomena.*
- Students work in small groups to create one object models of what happens in the "Crash Test" video with a role of explaining what happens to one component in the model including the car, car driver, van, van driver and sandbag. (Lesson 6, Pages 9-10) Students then put these models together to make a mural of models. This provides evidence of the 6-8 grade band element *Develop and/or use a model to predict and/or describe phenomena.*

Disciplinary Core Ideas (DCIs): Adequate

The reviewers found adequate evidence that students have the opportunity to use or develop the DCIs in this unit because there are sufficient DCI elements for the length of the materials and there is a reasonable match between the DCIs that are claimed and the DCI developed.

PS2.A Forces and Motion

- "Students pair up and push hand to hand or back to back to "feel" forces in pairs" (Lesson 2, page 7). Students receive a copy of Force Modeling Norms, "This guide covers all of the norms for the unit… specific items on the guide that students should notice are forces at contact points between

two objects come in pairs and are always equal in magnitude" (Lesson 2, page 10). This provides partial evidence that students are building toward the 6–8 grade band element *For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law) since the Force Modeling Norms give away part of the DCI rather than students developing their understanding as they develop their models.*

- Students "complete the Dog Sled One Object model by adding green vectors to the point in the center of the sled before the dogs begin to pull the sled when the break is still engaged. Students should consider the point of contact in the center of the sled as the object being acted upon with the dogs exerting a force in one direction and the sled brake exerting a force in the opposite direction. No change of motion is evidence of balanced forces" (Lesson 3, page 20). Students "write a brief prediction as to whether or not their case will pass the test based on the expected resulting change in motion or shape due to unbalanced forces" (Lesson 6, page 17). This provides evidence that students are building toward the 6–8 grade band element *The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, it's motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion.*
- Students draw a model to show the device they would build to stand upon to reach an item on the top shelf of a closet. They use their "knowledge of interacting forces to identify where there would be interacting forces between you and the object(s) that you would stand upon. Add red arrows to your model to show the magnitude and direction of the forces. Describe the forces that would interact between you and the device you designed" (Lesson 3, page 10). This provides evidence that students are building toward the 6–8 grade band element *All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared.*

Crosscutting Concepts (CCCs): Adequate

The reviewers found adequate evidence that students have the opportunity to use or develop the CCCs in this unit because over time, elements of the CCC of **Systems and System Models** were developed so that students eventually use them at grade level. However, the reviewers did find that the CCC elements claimed at the start of each lesson were not met at grade level in many of the lessons. Several of the CCC elements students engage in were below the 6–8 grade band level, while developing students' ability to use and apply elements of **System and System Models** at a middle school level happened more towards the later lessons. There are also more CCCs claimed by the developers in the unit than were found by the reviewers. For example, reviewers did not find evidence that the grade level CCC elements claimed at the start of Lesson 1 were used by students within the lesson.

System and System Models

- Teachers are prompted to ask guiding questions to formatively assess understanding of system and system models such as "How do the parts of the design work together as a system to protect the paper people? (What are the elements and how do they interact/work together?)" (Lesson 1, page 9). This is evidence of the K–2 grade band element *Systems in the natural and designed world have parts that work together*. A second guiding question is asked, "What can the parts of the system do together that the individual parts cannot do alone?" This question provides evidence of student use of the 3–5 grade band element *A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot*.
- Teachers are provided guiding questions to assess student understanding of how to represent forces in the student developed model of "forces when they pushed on the wall" (Lesson 2, page 11). This provides partial evidence of student use of the 3–5 grade band element *A system can be described of its components and its interactions.* However, it was unclear to reviewers if the students were simply following teacher directions or if they were developing a deeper understanding of system components and interactions.
- Students answer questions that pertain to System and System Models "How can we show balanced forces using a model? And "How can we show unbalanced forces using a model?" (Lesson 3, page 16) Their responses could provide evidence of the 6–8 grade band element *Models can be used to represent systems and their interactions-such as inputs, processes, and outputs-and energy, matter, and information flows within systems.* However, the reviewers did not find evidence that students would be cognizant of the connection between force and input or that this is a part of a larger system.
- Students create a model as shown in the "Connect Teacher Cell Phone Models" where they label the forces as vectors and explain whether the forces are unbalanced or stable (Lesson 3, page 17). This provides evidence of student use of the 6–8 grade band element *Models can be used to represent systems and their interactions-such as inputs, processes, and outputs-and energy, matter, and information flows within systems.*
- Students are provided a "Forces Modeling Norms" that shares requirements of how to show "System Boundaries" using dashed lines, "vectors" for forces, how to analyze "forces between TWO interacting forces" using a Two Object Model, and how to "analyze "balanced/unbalanced forces" using a one object model. The Force Modeling Norms are used to create the models of the "crash test between a car and a van" (Lesson 6, pages 7–9). This provides evidence of student use and building of the 6–8 grade band element *Models can be used to represent systems and their interactions—such as inputs, processes, and outputs—and energy, matter, and information flows within systems.*

Stability and Change

- The sixth guiding question on a formative assessment asks, "Is the system stable? How do you know? Give evidence" (Lesson 3, page 14). This is evidence of student use of the K–2 grade band element *Some things stay the same while other things change.*

- Students draw models to explain the relationship between the magnitude of a force and a cell phone's stability (Lesson 3, page 17). This provides evidence of the 6–8 grade band element *Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time ~~and processes at different scales, including the atomic scale.~~*
- The CCC of **Stability and Change** is claimed in the Lesson 4 assessment when students make predictions based on the data provided showing changes in distance using penny launchers. However, the reviewers found little evidence that students are aware of this CCC or that they are prompted to use the language of this CCC when answering Question 4 and 5 of this assessment (Lesson 4, pages 15–16).
- The CCC of **Stability and Change** is claimed in the Lesson 6 assessment when students apply learning about forces and the modeling of forces to "complete one object model to help describe how mass of a chocolate bunny affects the force of its collision from a fall to the ground" (Lesson 6, page 19). While the writers claimed this activity could be used to formatively assess student understanding of MS-PS2-2, which is connected to the CCC Stability and Change element Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales, the reviewers found it might be better connected to Cause and Effect (3-5) Cause and effect relationships are routinely identified, tested, and used to explain change.

Suggestions for Improvement

SEPs

- Consider claiming elements of the **Developing and Using Models** SEPs to be developed in this unit.
- Consider providing information regarding the development of SEPs throughout the unit. For example, students entering grade 6 are expected to already be able to *plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered* (a 3-5 grade band element). *Consider providing teacher guidance about how t*his unit might develop students' ability further in order to plan the investigation individually, identify independent and dependent variables, and determine the tools that are needed and how to record measurements.
- Since determining how to record measurements is part of the 6-8 grade band element for **Planning and Carrying Out Investigations**, consider having students determine the best way to record information for investigations rather than providing the tables to be completed. When students test their designed cell phone cases, the teacher might ask students to create a data table and include the table with their force analyses.

DCIs

- *In order to receive an extensive rating, c*onsider asking students to draw Force Models for something they experienced outside of the classroom or this unit with less scaffolding provided such as the Modeling norms.
- Consider including which ETS DCI elements students are building toward.

- Consider including the progression of understanding that students are expected to acquire during each activity. Each lesson in this unit should result in students gaining a deeper understanding of the DCIs that build upon one another. Consider providing teacher guidance on what portions of the DCI elements are being developed in each lesson.

CCCs

- Consider using the language from the 6–8 grade band elements (NGSS Appendix G) with students for **System and System Models** such as inputs, outputs, processes, interactions, components, and relationships and system boundaries in order to engage students more at the element level. Providing guidance for teachers and students on how they might use this language helps to prompt use of this CCC within the context of the learning.
- When evidence isn't clear for student use of claimed CCC elements, consider providing an explanation of why students are using the CCC at a lower grade band to either support or develop student's ability to use the CCC. Consider providing guidance on how students could be made aware of and intentionally using the CCC while engaging in the SEPS targeting the DCIs.
- Consider including the CCC **Cause and Effect** in this unit. The reviewers found multiple opportunities for students to use elements of the CCC Cause and Effect as a lens for students to organize their thinking. For example, the penny launcher and paper tower activities lend themselves to using elements of the CCC **Cause and Effect**.
- Consider providing teacher guidance about the progression of developing student ability to use the CCC at grade level in later lessons, while using lower grade band levels in earlier lessons.

I.C. Integrating the Three Dimensions: Student sense-making of phenomena and/or designing of solutions requires student performances that integrate elements of the SEPs, CCCs, and DCIs.

Rating for Criterion I.C. Integrating the Three Dimensions: Adequate

(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that student performances integrate elements of the three dimensions in service of figuring out phenomena or designing solutions to problems because there is a central event—the need to build a case for Marcus' cell phone—that required grade-appropriate elements of all three dimensions. The dimensions intentionally work together to help students design the cell phone case.

Evidence related to this criterion include:

- Students experience forces between pairs of interacting objects (Forces and Motion) to design models that will represent interactions between cell phone cases and the ground (System and System Models). They then use their models to design a cell phone case (Constructing Explanations and Designing Solutions)

- Students create a poster to share the problem they are trying to solve with the claim, evidence, and reasoning for the effectiveness of their phone case. They also create a model of the forces applied to the phone in the test and are prompted to "Define the system and the components of the system (boundaries, components, inputs/outputs, relationships)" in the Unit Challenge Students Checklist (Lesson 7, Page 6). This provides evidence of a three-dimensional task including PS2.A DCI, SEP Defining Problems, SEP Arguing with Evidence, SEP Modeling and CCC System and System Models.

Suggestions for Improvement

Consider using the CCC Cause and Effect as the lens students use to construct their explanations related to each investigation. There seems to be missed opportunities to use this CCC and it fits very well into each investigation. For example, the exemplar answer to question 9 on page 14 of Lesson 5 uses the wording of "lessens the affect of the forces". Please revise the use of the word "affect" in this lesson to "effect" and consider making the connection to the CCC Cause and Effect as a natural fit of CCC within these investigations. This might make for a much stronger three-dimensional learning experience. Also consider making students more aware of their use of the CCCs to help organize their thinking and their engagement in the three-dimensional learning process.

I.D. Unit Coherence: Lessons fit together to target a set of performance expectations.

Each lesson builds on prior lessons by addressing questions raised in those lessons, cultivating new questions that build on what students figured out, or cultivating new questions from related phenomena, problems, and prior student experiences.

The lessons help students develop toward proficiency in a targeted set of performance expectations.

Rating for Criterion I.D. Unit Coherence: Adequate

(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that lessons fit together coherently because students revisit the driving question / challenge question multiple times and connect new learning to the challenge question. However, there is a lack of evidence about the targeted set of performance expectations that students are developing towards proficiency.

Evidence related to this criterion includes:

- The Unit Summary Table student version requires students to share how they are connecting the ideas from Lessons 2, 3, 4, 5, and 6 to the challenge question. The Summary Table teacher version provides sample student responses.
- "Students reflect on what they need to know to address the Unit Challenge Question by completing a Unit Bubble Map activity that requires them to brainstorm smaller questions they

must answer in order to address the Unit Challenge Question. The goal is to elicit at least three questions that can be mapped to the lesson questions from the unit" (Lesson 1, page 10).

- Teacher Notes in subsequent lessons include reminders to revisit the Unit Bubble Map: "In the Check Your Progress phase of Lesson 1, you helped students group their questions from the Unit Bubble Map into a Lesson Discovery Question to drive this subsequent lesson. If you wish, you can show the Unit Bubble Map questions again here to let students see the connections between their questions and this Lesson Discovery Question" (Lesson 3, page 6, Lesson 4, page 7). However, no new student questions are cultivated.
- "Students individually revisit the Unit Bubble Map that they have been working on throughout the unit. Students review the supporting questions around the Unit Challenge Questions and write answers to any supporting questions. Students identify any questions that they have not yet answered." As a whole group, students review the latest version of the class Unit Bubble Map, and discuss and reflect on what they have learned and what they still need to figure out (Lesson 7, page 3). However, no new student questions are cultivated.

Suggestions for Improvement

- Consider providing opportunities at the end of each lesson to see which student questions were addressed and figured out and opportunities to cultivate new questions that may have arisen from the lesson, student experiences, or related phenomena.
- Consider making a connection to a targeted set of performance expectations such as MS-PS2-1 Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.

I.E. Multiple Science Domains: When appropriate, links are made across the science domains of life science, physical science and Earth and space science.

Disciplinary core ideas from different disciplines are used together to explain phenomena.

The usefulness of crosscutting concepts to make sense of phenomena or design solutions to problems across science domains is highlighted.

Rating for Criterion I.E. Multiple Science Domains: Adequate

(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that links are made across the science domains when appropriate because the unit focuses on the Physical Science domain of Forces and Interactions when students engage in solving an engineering design solution. The CCCs of **System and System Models** and **Structure and Function** are used throughout the unit but not necessarily in a way to help students organize their thinking to help them design a solution. It is unclear if students are simply following teacher directions or if they are using the CCCs as thinking tools to make connections between the domains.

Evidence related to this criterion includes:

- In Lesson 7, students design a cell phone case (Engineering Design) that can withstand forces (Forces and Interactions). They design and share the Structure and Function of cell phone designs using models (System and System Models) that include force diagrams (Forces and Interactions.)
- In Lesson 3, students build and test paper towers (Engineering Design) and test the ability of their towers (Structure and Function) to withstand the force exerted by a textbook (Force and Interactions).
- The PS2.A Forces and Motion DCI in the physical science domain is developed throughout each of the six lessons to be applied to the final design solution in Lesson seven.

Suggestions for Improvement

Consider supporting students to intentionally use crosscutting concepts to make connections between the science disciplines as a tool to organize their thinking to help them develop a solution to the engineering problem.

I.F. Math and ELA: Provides grade-appropriate connection(s) to the Common Core State Standards in Mathematics and/or English Language Arts & Literacy in History/Social Studies, Science and Technical Subjects.

Rating for Criterion I.F. Math and ELA: Inadequate

(None, Inadequate, Adequate, Extensive)

The reviewers found inadequate evidence that the materials provide grade-appropriate connections to mathematics, English language arts (ELA), history, social studies, or technical standards because there were few opportunities for students to engage inwriting and limited opportunities to apply mathematics concepts, reading, listening or speaking skills to aid in learning.

Evidence related to ELA-Literacy connections includes:

- Students write a “short four sentence poem in their notebooks about what happens when forces are applied to the objects. They should use the word ‘force’ or ‘forces’ (or similarly appropriate words) in the poem” (Lesson 3, page 6).
- Students answer Guiding Questions after sharing results of their egg drop tests (Lesson 5 page 13).
- “In their object teams, students write out the ‘motion story’ of their ONE object on their 11 x 17-inch paper, using words and a story stem starter; ‘I am the XXX (van, car, driver, sand bag). I was moving at a constant speed of 40 mph when, all of a sudden…’” (Lesson 6, page 8).

Evidence related to Mathematics connections includes:

- Lesson 3: “Students may compare longer or shorter vectors to determine unbalanced forces and result in a change in motion” (Lesson 3, page 4).

Suggestions for Improvement

- Consider providing a direct connection to specific ELA-Literacy and mathematics standards when they are used in the materials.
- Consider having students construct written explanations using new layers of understanding to explain a lesson level phenomenon or a model instead of being prompted in the form of question and answer.
- Consider including opportunities for students to read scenarios about forces and motion in place of or in addition to one or more or the scenarios provided.
- Consider using the metric system when measuring height and distance

Overall Category I Score (0, 1, 2, 3): 2

Unit Scoring Guide – Category I
Criteria A–F **3:** At least adequate evidence for all of the unit criteria in the category; extensive evidence for criteria A–C **2:** At least some evidence for all unit criteria in Category I (A–F); adequate evidence for criteria A–C **1:** Adequate evidence for some criteria in Category I, but inadequate/no evidence for at least one criterion A–C **0:** Inadequate (or no) evidence to meet any criteria in Category I (A–F)

6.4 Protecting Your Cell Phone
EQuIP Rubric for Science Evaluation

Category II. NGSS Instructional Supports

Score: 2

Criteria A-G:

3: *At least adequate evidence for all criteria in the category; extensive evidence for at least two criteria*

2: *Some evidence for all criteria in the category and adequate evidence for at least five criteria, including A*

1: *Adequate evidence for at least three criteria in the category*

0: *Adequate evidence for no more than two criteria in the category*

II.A. Relevance and Authenticity: Engages students in authentic and meaningful scenarios that reflect the practice of science and engineering as experienced in the real world.

Students experience phenomena or design problems as directly as possible (firsthand or through media representations).

Includes suggestions for how to connect instruction to the students' home, neighborhood, community and/or culture as appropriate.

Provides opportunities for students to connect their explanation of a phenomenon and/or their design solution to a problem to questions from their own experience.

Rating for Criterion II.A. Relevance and Authority: Adequate

(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that the materials engage students in authentic and meaningful scenarios that reflect the real world because the lessons focus on examples that most students in the class understand and there are some opportunities for students to experience some of the phenomena firsthand or through videos.

Evidence related to this criterion includes:

- In Lesson 1, students observe an object falling on and hurting the teacher's foot and observe the crushing of a paper person.
- In Lesson 2, students observe a video of a dog sled harness.
- In Lesson 3, students observe a video of items being crushed by a hydraulic press and design and observe what happens to paper towers built to support textbooks.
- In Lesson 5, students observe a video of gymnasts avoiding injury by landing on cushioned mats.
- In Lesson 6, students use a bottle accelerometer to better understand why some objects change motion and use a simulator to change variables and observe two cars colliding.
- The Teacher Note sections in the "Student Steps" include suggestions such as "If students are struggling to describe both a push and a pull, bring up different situations that the students can identify with. One such example students just engaged with—pushing on an object (wall). Another example is when students play tug of war or they pull on the leash of a stubborn dog." (Lesson 2, page 7). "It may help the students to provide them with a "Connect Question": How can we describe forces and force pairs acting on the cell phone to Marcus?" (Lesson 2, page 14).

Suggestions for Improvement

- In order to receive an extensive in this criterion, the unit would need to provide more support to teachers or students for connecting students' questions to the targeted learning throughout the learning, not just in the beginning. There would also need to be explicit opportunities for students to bring their own experiences into the classroom.
- Consider increasing opportunities for students to generate questions to drive their learning and having a role in the selection of lesson-level phenomena, as that would increase ownership and engagement.
- When students design a solution, explicitly build on the 3-5 element "plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests....". Since this is a 3-5 element, the 3 types of candy activity should not be used as an "anchoring experience" in middle school. (It could be included as an extension for students struggling with the concept of fair tests).

II.B. Student Ideas: Provides opportunities for students to express, clarify, justify, interpret, and represent their ideas and respond to peer and teacher feedback orally and/or in written form as appropriate.

Rating for Criterion II.B. Student Ideas: Adequate

The reviewers found adequate evidence that the materials provide students with opportunities to both share their ideas and thinking and respond to feedback on their ideas because student ideas drive some of the instruction.

Students are provided many opportunities for classroom discourse and support for teachers for eliciting student ideas. The Students' area also provided some opportunities to share ideas and feedback with each other directly. Evidence related to this criterion includes:

- A link is provided for the "Consensus Discussion" to a resource that provides many strategies that help uncover and represent student ideas called "A Catalog of Pedagogical Strategies & Instructional Tools" (Lesson 2, page 11).
- Students participate in a "Consensus Discussion" in order to "craft a class-wide explanation to the phenomenon from the Uncover phase" of a hand pushing on a wall (Lesson 2, page 11).
- Students work in small groups to discuss the tower testing, the forces present, and the guiding questions provided in Steps 3 and 4 of the Paper Tower Challenge. "Students may also record their thoughts from the discussion to prepare for the whole-class discussion" (Lesson 3, page 10).
- Students trade investigation posters with another group and provide feedback, which leads to a class discussion about the investigation process and explanations of the phenomena (Lesson 4, page 17). Strategies are provided for teachers to help with eliciting student ideas including the NEWS and consensus discussion strategies.

- Students provide feedback to one another using the "6.4 L05 Connect Student Evaluation tool" regarding their investigation plans and students then are provided time to make changes to their plans (Lesson 5, page 19).

Suggestions for Improvement

In order to receive an extensive rating, the students would need to be provided opportunities to use others' ideas that were shared in class to improve or change their own thinking and explain why they chose to incorporate those ideas. Evidence would also need to be found of students elaborating, reasoning and reflecting on their thinking based on both peer and teacher feedback.

II.C. Building Progressions: Identifies and builds on students' prior learning in all three dimensions, including providing the following support to teachers:
Explicitly identifying prior student learning expected for all three dimensions
Clearly explaining how the prior learning will be built upon.

Rating for Criterion II.C. Building Progressions: Adequate

(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that the materials identify and build on students' prior learning in all three dimensions because there is evidence of prior learning being identified in the "Lesson Introductions" and how this will be built upon within each lesson. However, there is minimal reference to prior learning and progression of each dimension, specifically the SEPs and CCCs.

Evidence related to this criterion is listed below:

- In Lesson 1 (page 7), teachers are prompted to "observe student groups and probe students to gage their prior understanding of criteria, constraints, and scientific knowledge, such as forces or system models, which they are using to define this problem and design a solution" (Lesson 1, page 7). However, the reviewers did not find evidence of an expected level of proficiency students should have with all three dimensions.
- The "Lesson Introduction" provides a summary of what was learned in the previous lesson. For example, "Students uncover an engineering approach to problem-solving: design solutions include a systematic method to identify criteria and constraints, and undergo repeatable and fair testing" (Lesson 2, page 3). Although this does relate to the ETS DCIs, it lacks mention of how the prior learning relates to the PS DCIs or CCCs of Systems and System Models.
- The Lesson 3 "Lesson Introduction" explains how "students draw on their experience from L1 and L2 as they design and build paper tower to support several textbooks" using One Object Models and diagramming balanced and unbalanced forces (Lesson 3, page 4). However, it does not mention of how prior learning directly relates to the three dimensions.

- The Lesson 5 “Lesson Introduction” explains how students have “extensively practiced modeling and have done several investigations on crushing” and that they will need to “explore dropping, which is the other test of the Unit Challenge.” (Lesson 5, page 5). However, it does not mention of how prior learning directly relates to the three dimensions.
- The "Unit 6.4: Prior and Future Knowledge" document is an outline of each dimension and the knowledge students should have prior to the unit, will be developing during the unit, and will be developing in later middle school units and during high school.

Suggestions for Improvement

- Consider identifying the learning targets for each dimension for each lesson.
- Consider detailing clear, expected progressions of each targeted element in all three dimensions. For example: In Lesson 2, students create models of force pairs that will be used when they model forces on a cell phone and "predict observable phenomena" of a cell phone cracking when a force is applied. (Developing and Using Models (6-8) Develop and/or revise a model to show the relationships among variables, including those that are not observable but predict observable phenomena.)
- If questions are to be used to assess targeted DCI, SEP, and CCC, consider specifying the element of each and proficiency expected in each dimension
- Consider providing guidance of how each dimension will be built upon from lesson to lesson.
- The Prior and Future Knowledge document outlines what students should know prior to this unit. Consider expanding this document to explicitly connect student progressions with unit activities

II.D. Scientific Accuracy: Uses scientifically accurate and grade-appropriate scientific information, phenomena, and representations to support students’ three-dimensional learning.

Rating for Criterion II.D. Scientific Accuracy: Adequate

(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that the materials use scientifically accurate and grade appropriate scientific information because all science ideas included in the materials are accurate and there is strong support for teachers.

Evidence related to this criterion includes:

- The teacher version of Unit Summary Tables includes sample student responses.
- Each lesson has a Lesson Introduction that includes what students learned in previous lessons.
- The unit includes a Teacher Background Content Resources document that is linked to Lessons Plans: “Additional Resources to Support Teacher Background Knowledge.” The document includes the following sections: “NGSS PE(s) or Subcomponent(s)” “Associate Lesson(s) or Unit Challenge” “Title of resource with link” and “Brief description of resource”

Suggestions for Improvement

- Consider providing support for teachers to clarify potential alternate conceptions that they or their students may have.
- On page 14 in Lesson 2, consider changing the wording of the question in the first bullet to "What force pairs are acting on the cell phone when an object is placed on it?" rather than the current "What force pairs are acting on the cell phone when it is being crushed?"
- Provide support to help teachers identify and clarify misconceptions.

II.E. Differentiated Instruction: Provides guidance for teachers to support differentiated instruction by including:

Appropriate reading, writing, listening, and/or speaking alternatives (e.g., translations, picture support, graphic organizers, etc.) for students who are English language learners, have special needs, or read well below the grade level.

Extra support (e.g., phenomena, representations, tasks) for students who are struggling to meet the targeted expectations.

Extensions for students with high interest or who have already met the performance expectations to develop deeper understanding of the practices, disciplinary core ideas, and crosscutting concepts.

Rating for Criterion II.E. Differentiated Instruction: Inadequate

(None, Inadequate, Adequate, Extensive)

The reviewers found inadequate evidence that the materials provide guidance for teachers to support differentiated instruction because unit materials provide some differentiation strategies with some examples and guidance for use that support struggling students. However, there is limited guidance for supporting reading, writing and speaking integral to sense making and for supporting students who have already met the performance expectations.

Evidence of supports provided for struggling students includes:

- The Teacher Note sections in the "Student Steps" include suggestions for struggling students, such as "If students are struggling to describe both a push and a pull, bring up different situations that the students can identify with. One such example students just engaged with—pushing on an object (wall). Another example is when students play tug of war or they pull on the leash of a stubborn dog." (Lesson 2, page 7). "It may help the students to provide them with a "Connect Question": How can we describe forces and force pairs acting on the cell phone to Marcus?" (Lesson 2, page 14).
- There are Reteaching Support sections, including information such as "If students are struggling with the analysis questions and concepts of investigation design, teachers could use the following slide set as an inspiration for further work with experiment design" "These slides specifically focus

on the difference between independent, dependent and control variables (Lesson 5, page 16). If students are struggling with the concepts of balanced and unbalanced forces or the way in which cushioning affects forces in collision, analysis of the following bubble soccer video clip could be used…" (Lesson Plan 5, page 16).

Suggestions for Improvement

Consider providing an activity for proficient students to do when students who are struggling are provided a reinforcement activity such a Phet simulation or any of the other re-teaching resources provided. Also, consider providing a variety of differentiation strategies with examples and guidance for use that support reading, writing, listening, and speaking that are integral to sense-making for all types of learners, including English language learners, learners with special needs, and students who have already met the performance expectations.

II.F. Teacher Support for Unit Coherence: Supports teachers in facilitating coherent student learning experiences over time by:

Providing strategies for linking student engagement across lessons (e.g. cultivating new student questions at the end of a lesson in a way that leads to future lessons, helping students connect related problems and phenomena across lessons, etc.).

Providing strategies for ensuring student sense-making and/or problem-solving is linked to learning in all three dimensions.

Rating for Criterion II.F. Teacher Support for Unit Coherence: Adequate

(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that the materials support teachers in facilitating coherent student learning experiences over time because students have some opportunities to reflect on their learning and generate more questions using the Unit Bubble Map. However, there was not clear instruction for teachers to utilize these questions to drive the learning.

Evidence of supporting teachings in facilitating coherent student learning experiences includes:

- After reading the Unit Challenge Scenario, students record thoughts on a Student Problem Statement handout (Lesson 1, page 9).
- "Students reflect on what they need to know to address the Unit Challenge Question by completing the Unit Bubble Map activity…" "The Unit Bubble Map will be used often throughout the unit to reflect on learning (which questions have been answered?), generate more questions, and generally allow students to drive the unit with their questions" (Lesson 1, page 10).
- Suggestions are made as a Teacher Note to revisit the Unit Bubble Map "If you wish, you can show the Unit Bubble Map questions again here to let students see the connections between their questions and the Lesson Discovery Question" (Lesson 1, page 6).

Suggestions for Improvement

- Consider increasing student ownership of the problem by having them generate the idea that a cell phone case is needed, and by having them generate the questions they have and the things they need to figure out in order to design the ideal cell phone case.
- Consider using the opportunities when students return to the Bubble Maps to prompt teachers to address which questions have been answered from the lessons already and to cultivate new student questions regarding the anchoring unit design challenge. Also consider the option of using the Driving Question Board Strategy instead of the Bubble Map to have student questions visible throughout the unit as a reminder that their questions are driving the learning.

II.G. Scaffolded differentiation over time: Provides supports to help students engage in the practices as needed and gradually adjusts supports over time so that students are increasingly responsible for making sense of phenomena and/or designing solutions to problems.

Rating for Criterion II.G. Scaffolded Differentiation Over Time: Adequate

(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that the materials support teachers in helping students engage in the practices and then gradually adjusts supports over time as students develop their abilities to engage in the practices at grade level. Some supports are provided including engaging students in lower grade band elements of the practices while developing their abilities to engage at grade level. However, this was not called out by the developers as a way to scaffold differentiation over time and few additional strategies were provided.

Evidence related to this criterion includes:

- Layers of understanding are applied to help all students "apply scientific ideas or principles to design, construct, and/or test a design of a cell phone case." Students are expected to demonstrate growth in Unit Summary Table and the revision of models. The reviewers question if this would truly indicate student learning or if the answers would be similar to taking notes. "These two rows can be partially or completely filled in by the teacher prior to teaching the unit (to save time), or can be filled in by the students."
- The use of arrows to represent balanced and unbalanced forces was reviewed in Lesson 2 and applied in Lesson 5 when students produced models of a force exerted by a book is not equal in strength to the force that the cell phone exerts on the book. Students draw initial models of the "pushes and pulls they can identify" in the "Uncover Student Wall Model" on page 8 of Lesson 2. They then make consensus models in groups of three or four and the teacher is prompted to "use guiding questions below to scaffold students in creating their consensus models" and help them think about how they will represent force direction, amount of force and location of force". Students then view group models and make observations about what the models "have in

common", "how the models are different" and "what symbols and labeling are used" in order to come to "consensus about how to communicate the idea of forces using common symbols and language" (Lesson 2, page 9). This provides evidence of scaffolding modeling.

- In Lesson 4," students consider what makes a 'fair test'... when planning and carrying out an investigation. By Lesson 5 students are expected to "identify and organize the components of a fair investigation" (Lesson 4, page 2). Although there is scaffolding provided here, this is an elementary-level expectation.
- In the Extension section of Lesson 4, students are expected to show growth from the whole class approach to small groups when stated, "Instead of planning as a whole-class, allow student groups to use the penny launch to plan and carry out their own investigation" (Lesson 4, page 13).

Suggestions for Improvement

- Consider explicitly stating how teacher scaffolding and support should decrease over time as student understanding and proficiency build and clearly describe when scaffolding differentiation over time is being used as an instructional strategy.
- Consider strategies that specifically target students who need support with SEP elements.
- Consider revising the directions for utilizing the Unit Summary Table as a way to assess student growth in understanding, rather than the teaching partially filling out the table for the students.
- Students make several models of systems throughout this unit. Therefore, expectations could be adjusted over time. For example, at the start of the unit students could be shown a variety of force diagrams and asked which ones tell a clearer story about what is happening, and then after viewing the slides that accompany Lesson 2, students could be asked what each is showing (vs. the teacher telling them as the notes on the slide suggest).

Overall Category II Score (0, 1, 2, 3): 2

Unit Scoring Guide – Category II
Criteria A-G: **3:** At least adequate evidence for all criteria in the category; extensive evidence for at least two criteria **2:** Some evidence for all criteria in the category and adequate evidence for at least five criteria, including A **1:** Adequate evidence for at least three criteria in the category **0:** Adequate evidence for no more than two criteria in the category

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Category III. Monitoring NGSS Student Progress

Score: **2**

Criteria A–F:

***3**: At least adequate evidence for all criteria in the category; extensive evidence for at least one criterion*

***2**: Some evidence for all criteria in the category and adequate evidence for at least five criteria, including A*

***1**: Adequate evidence for at least three criteria in the category*

***0**: Adequate evidence for no more than two criteria in the category*

III.A. Monitoring 3D student performances: Elicits direct, observable evidence of three-dimensional learning; students are using practices with core ideas and crosscutting concepts to make sense of phenomena and/or to design solutions.

Rating for Criterion III.A. Monitoring 3D Student Performances: Adequate

(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that the materials elicit direct, observable evidence of students using practices with core ideas and crosscutting concepts when developing a design solution for the culminating engineering performance task. Many of the assessments also require students to answer questions about a phenomenon. However, the developers claimed three-dimensionality for some assessments where the reviewers did not find evidence that supports the claim.

Evidence related to this criterion includes:

- On page 4 of Lesson 1, the materials claim that the "pre/post assessment includes a series of 3-dimensional performance-based tasks." However, the reviewers found little evidence of CCCs integrated into the assessments other than models being used. At no point is a student asked to use the lens of a crosscutting concept to help explain their understanding of scientific concepts.
- Students complete the "6.4 L02 Share Analysis" worksheet to demonstrate their understanding of elements of PS2.A **Forces and Motion** and CCC **System and System Models** by SEP **Developing a Model** to "show force pairs that occur when a bird perches on a branch." "Students use the model guidelines to complete the two-object model and answer questions to demonstrate their understanding of vectors and force magnitude. Although the permissions did not allow this assessment to be viewed by the reviewers, a three-dimensional assessment is described.
- Students Complete watch a video on Dog Sled Racing and then apply their knowledge of forces and modeling forces in the Dog Sled Guide Assessment at the end of Lesson 2 (page 16) that requires students "draw force pair vectors" within the system boundary identified. This provides evidence of elements of the DCI PS2.A, CCC **System and System Models**, and SEP **Developing and Using Models** within this three-dimensional assessment.
- On page 18 of Lesson 3, the materials claim all three dimensions are assessed in the assessment provided related to the hydraulic press. The permissions did not allow this assessment to be viewed by the reviewers, so it is not evident that the assessment is indeed three-dimensional.

Students might be using models and describing balanced and unbalanced forces without using the CCCs in their explanations.

- Students create models to "show that unbalanced forces cause enough of a change in shape for damage to occur to the phone" (Lesson 3, page 19). The slideshow containing the answers shows how the CCC **Stability and Change** should be included into the models as well as the DCI PS2.A to provide evidence of a three-dimensional assessment.
- The "Check Your Progress- Embedded Assessment" found on page 24 of Lesson 4 assesses student understanding of the DCI PS2.A through engaging in the SEP **Planning and Carrying Out Investigations** when students design a fair test using a scenario of SpongeBob playing tennis. Question 6 asks students to relate forces enacted on the ball to the CCC **Stability and Change** using the language of "stable" and "change of motion".
- Most scenarios driving the tasks include a phenomenon e.g. Lesson 1: object falling on teacher's foot, Lesson 2: video of dog sleds/snow hook used to hold the sled while dogs are being attached, Lesson 3: hydraulic press crushing various household items, Lesson 5: video of gymnasts avoiding injury by falling on cushioned mats, Lesson 6, functioning of bottle accelerometer

Suggestions for Improvement

- Consider having students construct explanations that require all dimensions to be used in order to demonstrate their understanding instead of asking guiding questions that target each dimension individually.
- Consider explicitly calling out the three dimensions separately and then together in the Unit Summary Table. This would help teachers and students better understand the elements of the three dimensions needed to make sense of the phenomena.
- On page 18 of Lesson 3, consider ensuring that students are using the lens of the CCCs in order to construct their explanations about forces. This use would be necessary in order for the assessment to be considered three-dimensional.

III.B. Formative: Embeds formative assessment processes throughout that evaluate student learning to inform instruction.

Rating for Criterion III.B. Formative: Adequate

(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that the materials embed formative assessment processes throughout that evaluate student learning and inform instruction because the materials include many regular opportunities for formative assessments clearly connected to important learning experiences.

Evidence related to this criterion includes:

- Unit 6.4 Lesson 04: Assessment of the Check Your Progress Activity includes assessment information for the teacher “The Check Your Progress phase in this lesson is one opportunity to gauge what your students know and can do in relation to the Key Concepts and Practices in this lesson and the targeted performance expectations for the unit.”
- The Unit 6.4 Select Assessment Tools includes a list of “additional assessment opportunities located within each lesson.”
- Check Your Progress sections provide exemplary student responses and include Reteaching Support which offers additional learning experiences for students. "If students are struggling with the Check Your Progress phase activities and concepts of vectors, magnitudes and force pairs, teachers could supplement instruction with the following activities and questions..." (Lesson 2, p. 16). "If students are struggling with the analysis questions and concepts of investigative design, teachers could use the following slide set as inspiration for further work with experimental design..." (Lesson 5, p. 16).

Suggestions for Improvement

- Consider clarifying and calling out the opportunities in the lesson plans when teachers can formatively assess students through engaging in the science and engineering practices instead of through the teacher asking guiding questions. For example, when assessing prior knowledge in the initial model created on page 6 of Lesson 1 (Student Step 1), this could be marked as a formative assessment opportunity. In order to make it more three dimensional, consider asking students to identify the components of the model system or cause and effect relationships that may be taking place.
- Consider ensuring that formative assessments attend to issues of student equity and access in some ways by including culturally- and linguistically-responsive strategies to help interpret and respond to student thinking toward learning targets. These might include providing multiple ways for students to demonstrate their thinking and some supports for interpreting student responses that attend to linguistic and cultural diversity.
- Consider providing teacher guidance of how formative data collected might be used to shift or modify instruction.

III.C. Scoring guidance: Includes aligned rubrics and scoring guidelines that provide guidance for interpreting student performance along the three dimensions to support teachers in (a) planning instruction and (b) providing ongoing feedback to students.

Rating for Criterion III.C. Scoring Guidance: Inadequate

(None, Inadequate, Adequate, Extensive)

The reviewers found inadequate evidence that the include aligned rubrics and scoring guidelines that help the teacher interpret student performance for all three dimensions because assessment targets for all dimensions are unclear. There is minimal guidance to help teachers and students interpret progress.

Student exemplars are provided but there is not a range of responses that would help interpret student progress.

Evidence related to this criterion includes:

- Exemplary answers are provided for questions students are to answer in the Unit Summary Table. On page 13 of Lesson 2, it is suggested that the "analysis questions may be used as an interim Check Your Progress." However, no scoring guidance is provided.
- Sample answers are provided for the questions students are to answer in the "Analysis Questions and Exemplary Answers" assessment box on page 11 of Lesson 3. However, no scoring guidance is provided.
- Scoring guidance is provided for the "Check Your Progress- Embedded Assessment" found on page 24 of Lesson 4 that assesses student understanding of the DCI PS2.A through engaging in the SEP **Planning and Carrying Out Investigations** when students design a fair test using a scenario of SpongeBob playing tennis. A four-point scale is used for scoring and the questions answered correctly are aligned to a rubric score.
- Scoring guidance is provided for the "Share Your Ideas" phase of Lesson 7 when students complete the "Assessment Peer Evaluation Rubric" (Lesson 7, page 7).

Suggestions for Improvement

Consider providing clear guidance to interpret student progress along all three dimensions being assessed and their use together. Also consider providing guidance for a range of responses and how to address gaps and misconceptions through future instructional experiences or other assessment opportunities.

III.D. Unbiased tasks/items: Assesses student proficiency using methods, vocabulary, representations, and examples that are accessible and unbiased for all students.

Rating for Criterion III.D. Unbiased Task/Items: Adequate

(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that the materials assess student proficiency using accessible and unbiased methods, vocabulary, representations, and examples because students are provided with scaffolds to make sure they have the background they need to be successful with the task. There is a limited number of pathways for students to make connections to their lives beyond the classroom. Task items provide a limited number of ways for students to convey answers.

Evidence related to this criterion includes:

- Videos, demonstrations, and simulations were used to provide students with the background they need to be successful with the task. For example:

- In Lesson 1, an object falls on the teacher's foot to demonstrate the force exerted when an object drops.
- In Lesson 2, students experience forces by pushing on a wall and on another student.
- In Lesson 3, students view a video of objects being crushed to visualize extreme pressure on an object.
- In Lesson 4, students view a video of a phone (with and without a case) falling; this provides an opportunity for students who have never experienced a cell phone falling to see what would happen.
- In Lesson 5 in a simulation of colliding cars, students are able to alter mass and speed of cars to visualize the change in impact and force on the cars.

- The lesson level phenomena and driving problem are relevant and often introduced with hands-on experiences to reach all students.
- The vocabulary is at grade-level and students are able to show their thinking both orally through questions and answers, in written form, and drawn through models.
- The final assessment task of students creating a poster on page 6 of Lesson 7 is an example of an unbiased task where students are able to use multiple modalities to demonstrate their understanding of the DCIs, SEPs, and CCCs in a context that they have had first-hand experience with. However, the reviewers did find biases in the pre/post assessment since the length of the test requires stamina for test taking, high levels of reading skill, and provides scenarios that students may or may not be familiar with.

Suggestions for Improvement

Consider providing more opportunities for students to bring in and connect to experiences beyond the classroom or providing alternate resources to help all students make sense of the phenomenon or scenario. For example:

- after initial introduction, students could be asked to share other times they have seen the effect of force on motion, speed, shape… The teacher could ask them to use arrows to represent the forces.
- Consider allowing students to provide a test case on an object of their own choosing (in place of the egg drop).
- Consider providing additional ways for students to convey their answers, e.g., video descriptions, photographs, and more complex answers.

III.E. Coherent Assessment system: Includes pre-, formative, summative, and self-assessment measures that assess three-dimensional learning.

Rating for Criterion III.E. Coherent Assessment System: Adequate

The reviewers found adequate evidence that the materials include pre-, formative, summative, and self-assessment measures that assess three-dimensional learning because materials include assessments designed to connect to learning goals and require students to apply appropriate elements of the three dimensions to solve the problem of protecting Marcus' cell phone. The unit contains pre- post and formative assessments with a significant three-dimensional task at the end of Lesson 7. Sample student answers and answer keys were provided however, there was little guidance for interpreting student responses and using responses to inform instruction. Guidance was limited to reteaching and reassessing.

Evidence related to this criterion includes:

- "Prior to beginning Lesson 1 of Unit 6.4, you may have students complete the Unit 6.4 pre/post assessment...which includes a series of 3-dimensional performance-based tasks. This will give you a baseline for assessing student knowledge, skills, and abilities in relation to primary DCI, SEP, and CCC Performance Expectations subcomponents covered in this unit. At the conclusion of the unit you may want to administer the assessment again and use the results to assess student growth over the unit" (Lesson 1, page 3).
- Unit 6.4 Select Assessment Tools "has links to selected assessments prepared for this unit along with instruction and notes about their use" (Lesson 1, page 3).
- Unit 6.4 Lesson 04: Assessment of the Check Your Progress Activity includes assessment information for the teacher "The Check Your Progress phase in this lesson is one opportunity to gauge what your students know and can do in relation to the Key Concepts and Practices in this lesson and the targeted performance expectations for the unit."
- The Unit 6.4 Select Assessment Tools includes a list of "additional assessment opportunities located within each lesson." The Check Your Progress section of the document includes hyperlinks to the student copy and teacher copy of each assessment. The teacher copies include sample student responses.

Suggestions for Improvement

- Consider using student products such as models as a formative assessment instead of the repetitive structured questions and answers.
- Consider explicitly identifying where each dimension is assessed and including methods for helping students use self-assessments as a way to measure growth in each dimension.

III.F. Opportunity to learn: Provides multiple opportunities for students to demonstrate performance of practices connected with their understanding of disciplinary core ideas and crosscutting concepts and receive feedback

Rating for Criterion III.F. Opportunity to learn: Adequate

The reviewers found adequate evidence that the materials provide multiple opportunities for students to demonstrate performance of practices connected with their understanding of core ideas and crosscutting

concepts because there are multiple, linked student performances that provide students with opportunities to demonstrate understanding. There are some feedback loops based on peer feedback and some opportunities to utilize feedback to construct new learning.

Evidence related to this criterion includes:

- "Students draw an initial model of what they think occurred with forces when they pushed on the wall… They use their models to create a group model. The purpose here is to continue to refine protocol for models and to establish common symbols to represent forces (with magnitude and direction)" (Lesson 1, page 6).
- "Students modify their scientific explanations to address the lesson question(s) in the context of the Unit Challenge, based on the 'Connecting Your Ideas Investigation' and using the lesson 'Gotta Have Checklist' and key concepts as reference" (Lesson 2, page 14).
- "Students work in their Unit Challenge Teams to revise their own posters based on feedback from others" (Lesson 7, page 8).

Suggestions for Improvement

Consider providing support on the type of feedback teachers should provide students, such as feedback on student responses on the Unit Summary Tables. Students could use this feedback to modify responses, models, and design.

Overall Category III Score (0, 1, 2, 3): 2

Unit Scoring Guide – Category III
Criteria A–F:
3: At least adequate evidence for all criteria in the category; extensive evidence for at least one criterion
2: Some evidence for all criteria in the category and adequate evidence for at least five criteria, including A
1: Adequate evidence for at least three criteria in the category
0: Adequate evidence for no more than two criteria in the category

Overall Score

Category I: NGSS 3D Design Score (0, 1, 2, 3): 2
Category II: NGSS Instructional Supports Score (0, 1, 2, 3): 2
Category III: Monitoring NGSS Student Progress Score (0, 1, 2, 3): 2
Total Score: 6
Overall Score (E, E/I, R, N): E/I

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EQuIP Rubric for Science Evaluation

Scoring Guides for Each Category
Unit Scoring Guide
Category I (Criteria A–F): **3:** At least adequate evidence for all of the unit criteria in the category; extensive evidence for criteria A–C **2:** At least some evidence for all unit criteria in Category I (A–F); adequate evidence for criteria A–C **1:** Adequate evidence for some criteria in Category I, but inadequate/no evidence for at least one criterion A–C **0:** Inadequate (or no) evidence to meet any criteria in Category I (A–F)
Category II (Criteria A-G): **3:** At least adequate evidence for all criteria in the category; extensive evidence for at least two criteria **2:** Some evidence for all criteria in the category and adequate evidence for at least five criteria, including A **1:** Adequate evidence for at least three criteria in the category **0:** Adequate evidence for no more than two criteria in the category
Category III (Criteria A–F): **3**: At least adequate evidence for all criteria in the category; extensive evidence for at least one criterion **2**: Some evidence for all criteria in the category and adequate evidence for at least five criteria, including A **1**: Adequate evidence for at least three criteria in the category **0**: Adequate evidence for no more than two criteria in the category

Overall Scoring Guide
E: Example of high quality NGSS design—*High quality design for the NGSS across all three categories of the rubric; a lesson or unit with this rating will still need adjustments for a specific classroom, but the support is there to make this possible; exemplifies most criteria across Categories I, II, & III of the rubric. (total score ~8–9)* ***E/I: Example of high quality NGSS design if Improved—****Adequate design for the NGSS, but would benefit from some improvement in one or more categories; most criteria have at least adequate evidence (total score ~6–7)* ***R: Revision needed—****Partially designed for the NGSS, but needs significant revision in one or more categories (total ~3–5)* ***N: Not ready to review****—Not designed for the NGSS; does not meet criteria (total 0–2)*