SERA
SPECIAL EDUCATION RESEARCH ACCELERATOR

CROWDSOURCE: SCIENCE

OBSERVATION MANUAL

Science Education for Elementary Students with Learning Disabilities

Fall 2023

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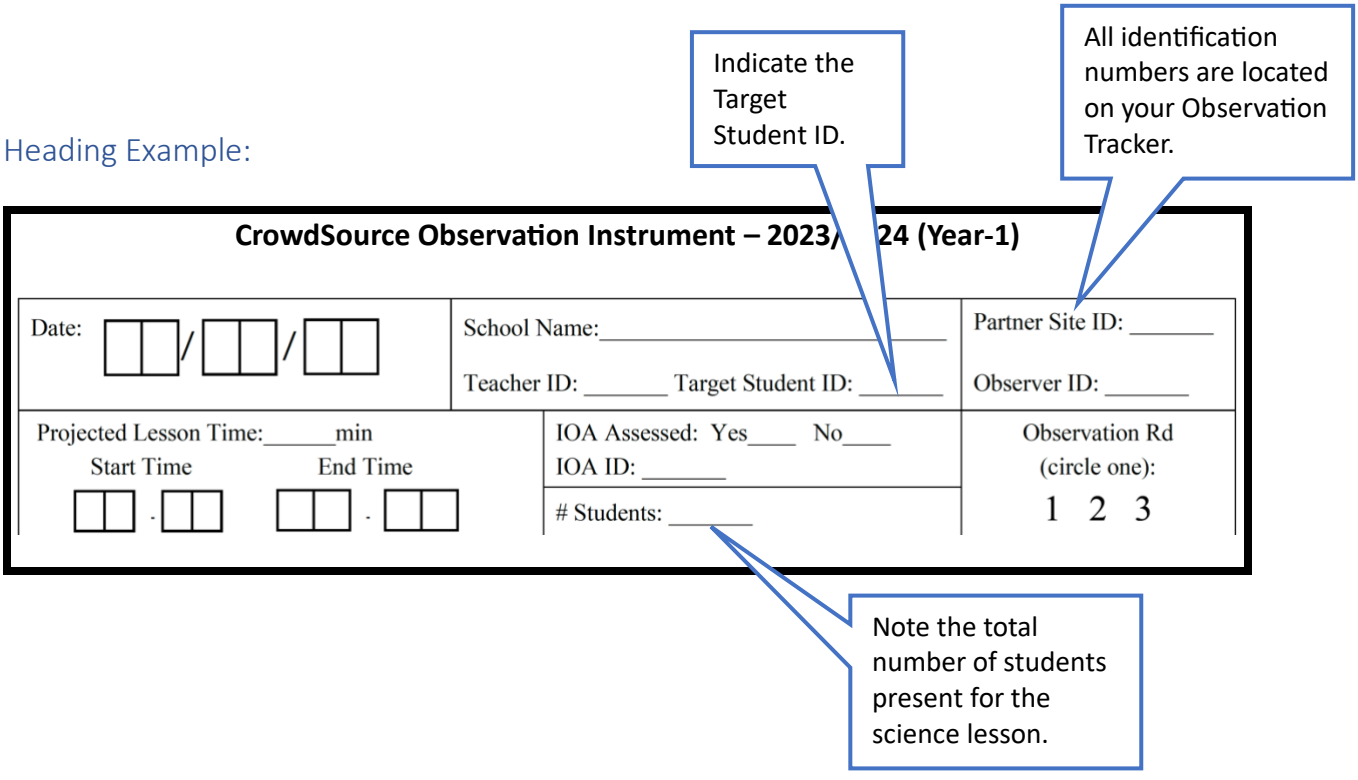
Overview

The CrowdSource: Science observation tool systematically measures the number of opportunities to respond (OTRs) that are received by a Target Student with a learning disability in comparison to other students in the classroom during fourth and fifth grade science instruction. The CrowdSource: Science tool includes two sections. The first section collects contextual information on the content and instruction of the observed science lesson, including (a) the science program/curriculum used; (b) the theme of the lesson; (c) support personnel present; (d) instructional formats; and (e) instructional types included. The second section collects the number of OTRs received by a Target Student and the number of OTRs received by other non-target students in the classroom. Additional information specific to the Target Student is collected, including (a) the amount of targeted academic feedback provided to the Target Student by the teacher and (b) any amount of time in which the Target Student was not receiving science instruction.

The following pages include operational definitions and procedures for conducting classroom observations using CrowdSource: Science.

CrowdSource: Science Observation Tool

Heading Example:



Science Content & Instruction Example:

Provide contextual information about the observed science lesson and instruction (pp. 9-10).

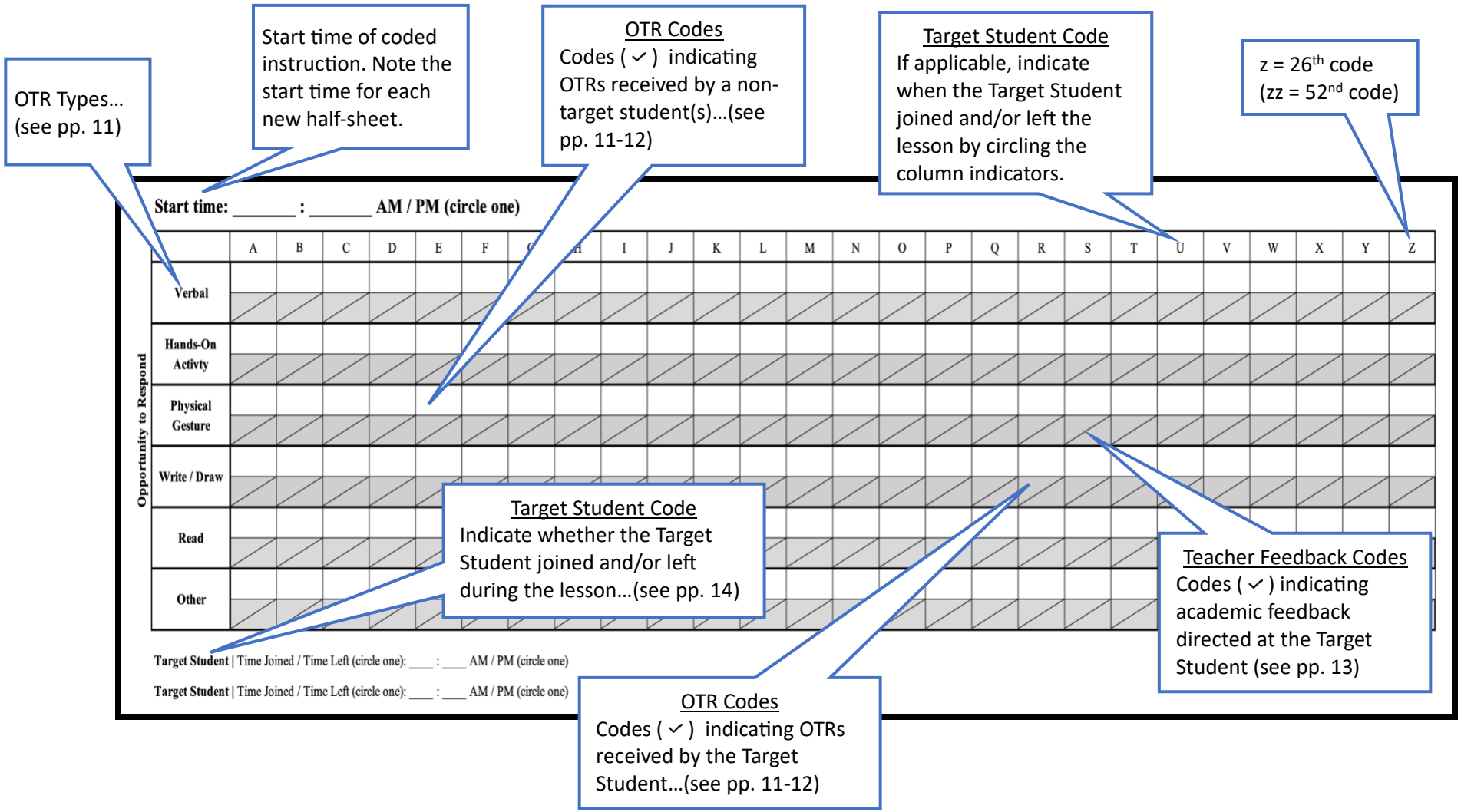
SCIENCE CONTENT & INSTRUCTION

1. Name of the ***science program/curriculum*** used during instruction? _____ Unrecognizable_____
   - The materials used during instruction appeared teacher developed? circle: Yes_____ No_____ Blend_____
2. What was the ***theme*** of the lesson? _____
3. Was there additional ***instructional support personnel*** present? Yes____ No____
   - If yes, check all present: 1. Co-teacher ___ 2. Paraprofessional ___ 3. Special Education Teacher ___ 4. Other ___
4. ***Instructional format*** in which science instruction occurred: (check all that apply)
   - Whole-group____ Small-group____ Partners ____ Independent ____
   - Primary format used_____
5. What ***instructional types*** were included in the lesson? (check all that apply)
   - Teacher-led discussion ____ Experiment ____ Written exercise ____ Vocabulary ____ Reading exercise ____ Mathematics exercise ____ Technology ____ Other (please specify) _____
6. Was the instruction structured around a ***phenomenon*** (i.e., observable event)? Yes____ No____
   - If yes, identify the phenomenon? _____ (e.g., habitats, pollination, erosion, H_2O on Earth)
7. Was a ***crosscutting concept(s)*** explicitly addressed? Yes____ No____
   - If yes, check all that were addressed: 1. Patterns ___ 2. Cause & effect ___ 3. Scale, proportion, & quantity ___ 4. Systems & system models ___ 5. Energy & matter ___ 6. Structure & function ___ 7. Stability & change ___
8. The lesson's primary science-based activity was: New Activity____ Review or Continuation ____ Unknown ____
   - Did the lesson include or focus on a testable question? Yes____ (investigation) No____
     - Describe the question? _____
     - Did students have an opportunity to pose and/or practice ***asking the question***? Yes____ No____
   - Did students ***carry out*** a hands-on experiment by ***developing*** or ***using scientific models***? Yes____ No____
   - Did students have any part in ***planning*** the activity? Yes____ Tchr/St____ Teacher-led only ____ No____
   - Did students have opportunities to ***explain*** or ***discuss findings*** from the activity? Yes____ No____
     - If students constructed explanations, did they ***engage in data-driven scientific argumentation***? Yes____ No____

   *Tchr/St = blend of teacher & student
9. Briefly describe the lesson: _____

Provide a brief description of the lesson, including any implications that are specific to the Target Student and their engagement in the lesson (e.g., if the Target Student received separate science instruction).

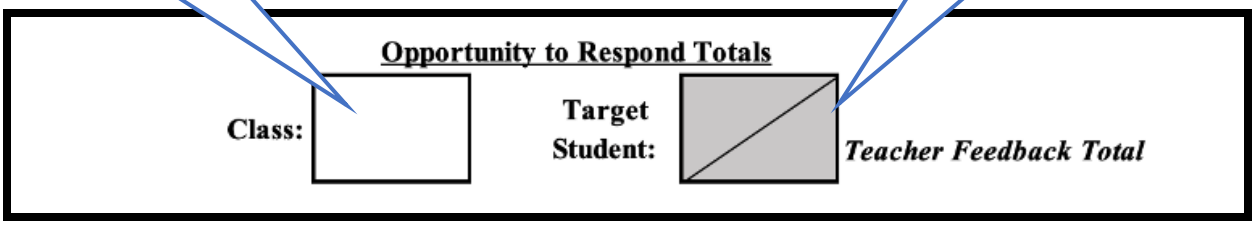
Opportunity to Respond (OTR) Example:



Opportunity to Respond (OTR) Totals Example:

Indicate the total OTRs coded on the page, which were received by non-target students.

Indicate the total OTRs ***and*** Teacher Feedback coded on the page, which were received by the Target Student.



Overall Quality of Science Instruction Example:

Quality Codes
Codes indicating the overall quality of the lesson as a whole…(see pp. 18-20)

OVERALL QUALITY OF SCIENCE INSTRUCTION	*Low*		*Medium*		*High*
10. **Overall student interest in the science lesson** (lesson appeared interesting to students)	1	2	3	4	5
11. ***Target Student* interest in the science lesson** (lesson appeared interesting to the Target Student)	1	2	3	4	5
12. **Overall discourse opportunities** (discussion was rich and involved majority of class)	1	2	3	4	5
13. **Overall teaching for scientific understanding**	1	2	3	4	5

Procedures for Conducting Classroom Observations

The following procedures should be used to conduct a classroom observation using this tool:

PREPARING FOR OBSERVATION

1. Check and confirm observation date and time with the teacher.
2. Make note of the Target Student (indicated on your Observation Tracker with an asterisk).
3. Bring a pencil to complete observation form and to correct any mistakes.

BEFORE OBSERVATION

1. Greet the teacher.
    a. Ask the teacher to identify the Target Student.
    b. Note the projected amount of time intended for the lesson (in heading).
    c. Identify the science program/curriculum being used during the lesson (Q1).
    d. Indicate the theme of the lesson (Q2).
    e. Remind the teacher to audio record and introduce the lesson:
        i. Teacher ID
        ii. Date of lesson
        iii. Theme of lesson
        iv. Practice question (directed at the Target Student): "What is today's date?"
2. Establish an unobtrusive place to observe instruction – and the Target Student.
3. Count the number of students in the classroom (enter total # in heading).
4. Indicate the start time of the science lesson (in heading).

DURING OBSERVATION

Record…
1. The start time of the instruction being coded.
2. Opportunity to Respond (OTR) Codes
    a. Each OTR received by any non-target student.
    b. Each OTR received by the Target Student.
3. Teacher Feedback Codes
    a. If the teacher provides (targeted academic) feedback to the Target Student.
4. Target Student Codes
    a. If the Target Student joins or leaves during the lesson.

***Note.* If a coding error occurs during the observation, simply erase the error or place a temporary X over the incorrect code. Correct all coding errors at the end of the observation. If the lesson lasts over 26 codes, begin coding using the next half-sheet to document.**

DURING OBSERVATION (continued)

5. Document *science content and instruction* of the lesson*:
    a. Indicate any instructional support personnel present during instruction (Q3).
    b. Indicate instructional formats during the lesson (Q4).
    c. Indicate instructional types included in the lesson (Q5).
    d. If instruction was structured around a phenomenon (Q6).
    e. If a crosscutting concept was explicitly addressed (Q7).
    f. Whether the primary science-based activity was new or a review/continuation (Q8).

***Note.* These items can be completed during or after the observation depending on the cadence of the observed lesson.**

AFTER OBSERVATION

1. Document additional *science content and instruction* details of the lesson.
2. Provide a brief description of the lesson (Q10).
3. Overall Quality of Science Instruction Ratings
    a. Overall student interest in the science lesson
    b. Target Student interest in the science lesson
    c. Overall discourse opportunities
    d. Overall teaching for scientific understanding

Science Content & Instruction

Science program/curriculum: The science program or curriculum provides the teacher with a structure of what is intended to be taught or learned during the science lesson. Oftentimes, teachers will use a blend of resources that include a program or curriculum supplemented with materials provided by the district.

Examples of common science program/curriculum:

- Amplify Science
- The Classical Science Series
- The Sassafras Science Series
- FOSS Next Generation

Theme: The theme identifies the primary subject of the science lesson, which is situated in one of the three sciences (i.e., Life Science, Physical Science, Earth Science):

Examples of common themes:

- Ecosystems (Life Science)
- Plant structures (Life Science)
- Energy (Physical Science)
- Matter (Physical Science)
- Erosion (Earth Science)
- Biosphere (Earth Science)

Instructional support personnel: Instructional support personnel can be identified as anyone working with students to support the learning of the science lesson taught by the lead teacher.

Examples of instructional support personnel:

- Co-teachers
- Paraprofessionals
- Special Education teachers

Instructional format: The instructional format can vary throughout the science lesson and indicates the configurations of students in instructional groups.

Types of instructional formats:

- **Whole-group:** Students working collectively as a class
- **Small-group:** Groups of three to five students working together
- **Partners:** Pairs of two (or sometimes three) students working together
- **Independent:** Students working by themselves

Instructional types: The instructional type indicates the methods used during instruction to teach and support the learning of science.

Types of instruction:

- Teacher-led discussion
- Experiment
- Written exercise
- Vocabulary
- Reading exercise
- Mathematics exercise
- Technology

Phenomenon: A scientific phenomenon is an event that occurs in the universe and can be observed either directly or by using a scientific tool (e.g., microscope, telescope).

Examples of phenomenon:

- Energy
- Earthquakes
- Volcanic eruptions
- Gravity
- Electricity

Crosscutting concept: Crosscutting concepts connect core ideas taught throughout science. **Crosscutting concepts must be made explicit by the teacher during the science lesson.**

Crosscutting concepts:

- Patterns
- Cause & effect
- Scale, proportion, & quantity
- Systems & system models
- Energy & matter
- Structure & function
- Stability & change

Primary science-based activity: The primary science-based activity is closely related to the theme of the lesson and supports student engagement with the content, focusing on the science and engineering practices on the Next Generation Science Standards (NGSS).

Opportunity to Respond Codes

An opportunity to respond is an instructional strategy initiated by the teacher to provide students with opportunities to engage with instruction. The teacher will present an instructional question, statement, or gesture to elicit student response. **The instruction will be academic in nature and will always be paired with an overt student response; a teacher prompt without student response does not qualify as an opportunity to respond.**

Examples of an opportunity to respond:

- The teacher says, "Can anyone give me an example of erosion you've seen or heard of before?" A student responds, "I saw erosion at the beach when the waves washed away the sand."
- The teacher says, "Can someone please volunteer to read the paragraph on photosynthesis aloud?" A student responds and begins reading the paragraph aloud.

Non-example of an opportunity to respond:

- The teacher says, "Please take out your science notebooks, pencils, and the handout I gave you yesterday." Students promptly reach into their backpacks, take out their supplies, and open their notebooks.
- The teacher says, "Let's watch this video clip to learn more about each layer of the Earth." Students watch the video clip.

Opportunity to Respond (OTR) Coding Procedures

Each opportunity to respond that occurs during the lesson should be documented and classified by type and recipient(s).

Type: The types of opportunities to respond can vary throughout the lesson and depend on the teacher prompt and student response. Each opportunity to respond should be indexed into the appropriate category.

Types of opportunities to respond:

- Verbal
- Hands-on activity
- Physical Gesture
- Write/Draw
- Read
- Other (e.g., technology)

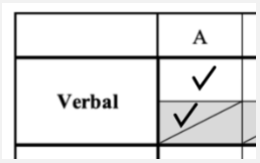
Recipient(s): The opportunity to respond should be documented by noting a checkmark (✓) in the non-target student(s) and/or the Target Student box, as exampled below.

Opportunity to Respond (OTR) Coding Examples

Example of an OTR received by all students (including Target Student):

Teacher:	"What is the process by which plants make their own food using sunlight?"
All Students: (including Target Student)	"Photosynthesis!"
Teacher:	"Great job, everyone! You got it right!"

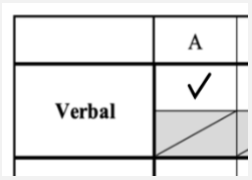
Coded Example:



Example of an OTR received by all students not including the Target Student:

Teacher:	"What is the process by which plants make their own food using sunlight?"
All Students (except Target Student)	"Photosynthesis!"
Teacher:	"Great job, everyone!

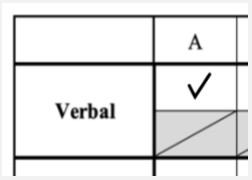
Coded Example:



Example of an OTR received by non-target student only:

Teacher:	"What is the main gas that plants take in from the air?"
Non-target student:	"Oxygen?"
Teacher:	"Good try, but it is actually carbon dioxide. Keep up the good work!"

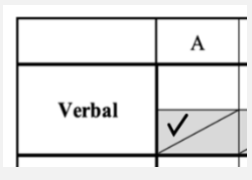
Coded Example:



Example of an OTR received by Target Student only:

Teacher:	"What is the main gas that plants take in from the air?"
Target Student:	"Carbon dioxide!"
Teacher:	"That's right. Good job, Timmy (Target Student)!"

Coded Example:



Teacher Feedback Codes

Teacher feedback can be a verbal reply, physical demonstration, or written response that is academic in nature and provides the Target Student with specific information that goes beyond correctness. Teacher feedback is not contingent on an OTR and can occur after a Target Student prompt (e.g., the Target Student asks a question). **Note that teacher feedback must be directed to the Target Student; teacher feedback provided to the whole class and/or to other students in the class should <u>not</u> be documented.**

Examples of teacher feedback:

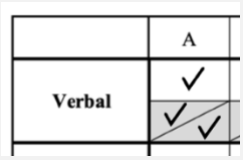
- The teacher is speaking directly to the Target Student and says, "Great job! That's correct, the answer is erosion."
- The teacher is speaking directly to the Target Student and says, "No, remember what we discussed about evaporation…"

Non-examples of teacher feedback:

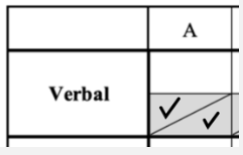
- The teacher says, "Great job! You got it right, Jimmy (Target Student)."
- The teacher head nods at the Target Student's response.
- The teacher asks the Target Student to sit down and pay attention.

Teacher Feedback (& OTR) Coding Example

Example of teacher feedback paired with an OTR received by <u>all</u> students:

		Coded Example:
Teacher:	"What is the process by which plants make their own food using sunlight?"	
All Students: (including Target Student)	"Photosynthesis!"	
Teacher:	"Great job, everyone! Timmy (Target Student), great job identifying photosynthesis as the process which plants make their own food."	

Example of teacher feedback paired with an OTR received by Target Student only:

		Coded Example:
Teacher:	"What is the main gas that plants take in from the air?"	
Target Student:	"Carbon dioxide!"	
Teacher:	"That's right, Timmy! Plants take in carbon dioxide and release oxygen as a byproduct."	

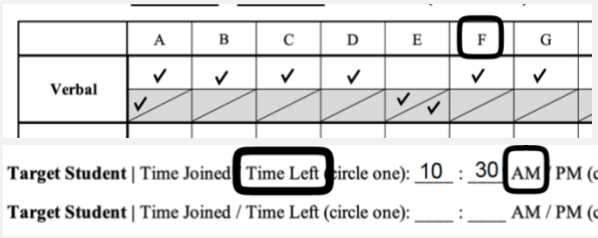
Target Student Codes

If the Target Student joins or leaves the classroom during the lesson, this should be indicated underneath the corresponding half-sheet by (a) indicating whether the Target Student joined or left the classroom and note the time and (b) circling the column letter to indicate the point at which the Target Student joined or left the classroom.

Example of Target Student leaving during lesson:

Scenario: Timmy (Target Student) is pulled out during the science lesson at 10:30AM to receive individual reading instruction. Before leaving the classroom, the teacher asks, "Timmy, what is the main gas that plants take in from the air?" Timmy responds, "Carbon dioxide!" to which the teacher responds, ""That's right, Timmy! Plants take in carbon dioxide and release oxygen as a byproduct. " After Timmy leaves, the teacher asks non-target students to name the gas released by plants back into the air.

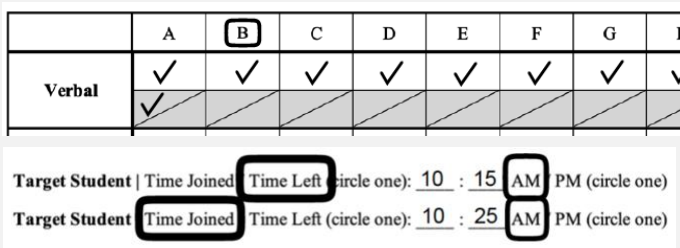
Coded Example:



Example of Target Student leaving and rejoining the lesson:

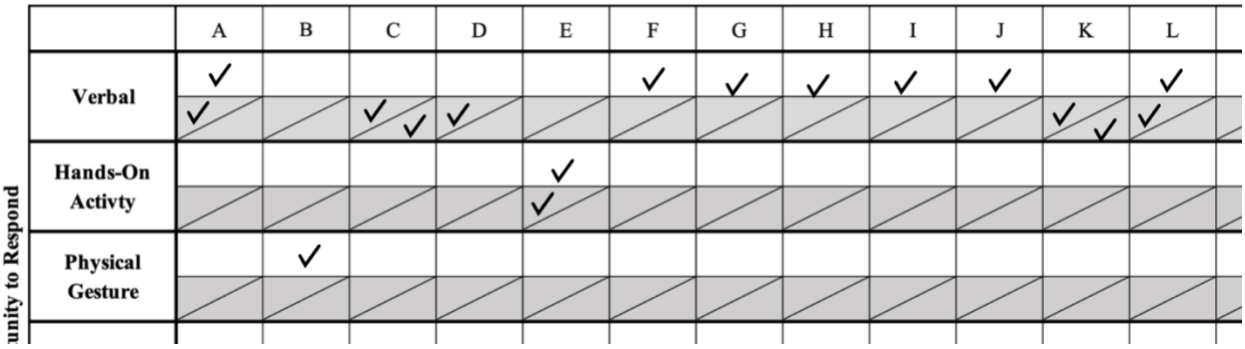
Scenario: The teacher asks, "Class, what is the main gas that plants take in from the air?" All the students (including Timmy) answer "Carbon dioxide!" Afterwards, Timmy asks to go to the bathroom (at 10:15AM). While Timmy is in the bathroom, the teacher reads a paragraph on the oxygen cycle and asks seven non-target students questions about the text. Once Timmy returns (at 10:25AM), the teacher asks one more non-target student a question before asking Timmy to name the gas released by plants back into the air. Timmy responds, "oxygen." The teacher responds, "Yes! So, oxygen is a byproduct of photosynthesis."

Coded Example:



Coding Sequence Example

Lesson Transcript Example A:

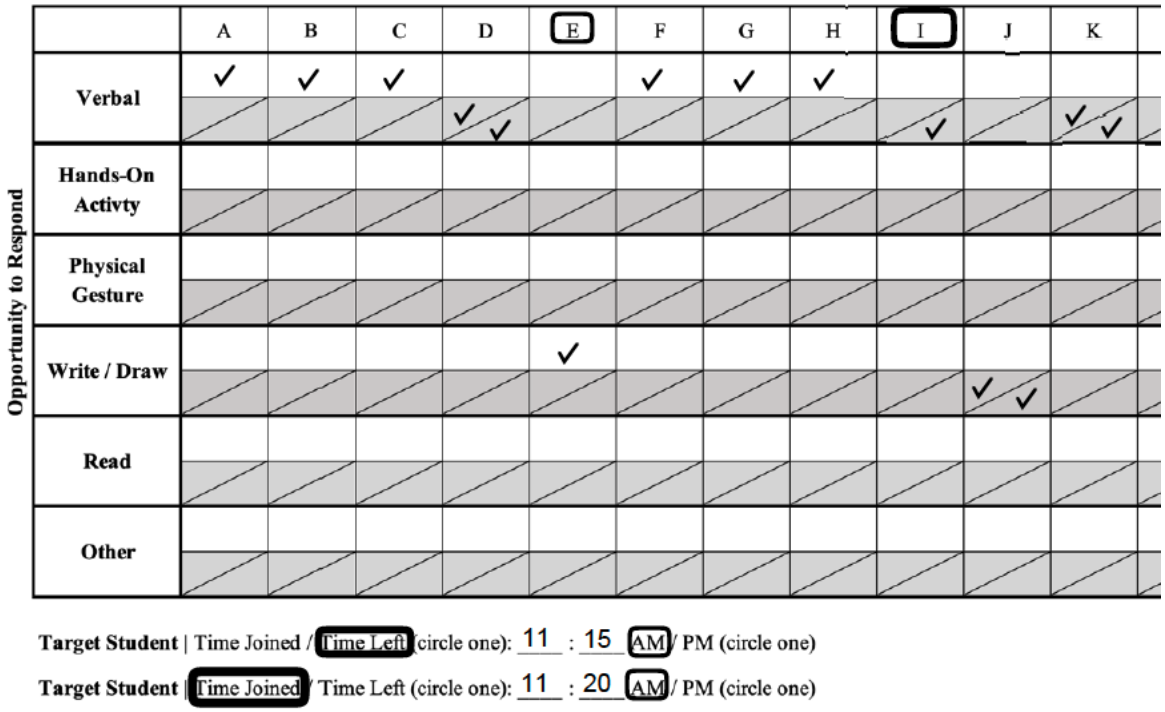


Teacher: "Good morning, class! Please take out your materials."
[Students take out their materials.]
Teacher: "Let's review what we learned last time. First question for everyone, what's the Earth's primary source of energy?"
All Students (including Target Student): "The Sun!" **(Verbal: All students, including Target Student)**
Teacher: "Great! Now, thumbs up if you agree: Does the Earth orbit around the Sun?"
[Students, except Timmy (Target Student), raise their thumbs.] **(Physical Gesture: Non-target student)**
Teacher: "Good. Timmy, what's the process of water changing from a liquid to a gas?"
Timmy: "Evaporation?" **(Verbal: Target Student)**
Teacher: "Not quite, Timmy. It's called condensation. But don't worry, you'll get it. Here's another one for you, what's the process when water changes from a gas back into a liquid?" **(Teacher feedback)**
Timmy: "That's condensation!" **(Verbal: Target Student)**
Teacher: Excellent, Timmy! You got it! Keep it up.
[The class breaks into groups for an experiment and all including Timmy engage in an experiment.]
(Hands-On Activity: All students, including Target Student)
[After some time, the teacher asks two non-target students questions about the experiment.] **(Verbal: Non-target student X 2)**
Teacher: "Timmy, let's join your group now and work together."
[Timmy joins his group, and they continue the experiment.]
[After the experiment...]

(Continued on pp. 15…)

Teacher: "Alright, class, let's come back to our seats. What did we learn about how temperature affects the rate of a chemical reaction?"
[Teacher calls on three non-target students and each respond.] **(Verbal: Non-target student X 3)**
Teacher: "Excellent! Now, Timmy, what's the name of the process when a solid turns into a liquid?"
Timmy: "Melting!" **(Verbal: Target Student)**
Teacher: "Great job, Timmy! Melting is when a solid turns into a liquid. And, class, what's the name of the process when a gas turns into a liquid?" **(Teacher feedback)**
[All students respond in unison including Timmy.] **(Verbal: All students, including Target Student)**

Lesson Transcript Example B:



Teacher: "Good morning, class! Today, we're going to learn about the water cycle by reading this book together."
[The teacher starts reading the book, pausing to ask questions.]
Teacher: "Okay, class, what's the first step in the water cycle?"
Non-target student: "Evaporation!" **(Verbal: Non-target student)**
Teacher: "That's right, Sarah! Now, who can tell me what happens next in the water cycle?"
[Two non-target students respond with the wrong answers.] **(Verbal: Non-target student X 2)**

(Continued on pp. 16…)

Teacher: "Great effort, but let's think about it a bit more."
Timmy (Target Student): "Um... condensation?" **(Verbal: Target student)**
Teacher: "Almost there, Timmy. Condensation comes later. Let's keep listening." **(Teacher feedback)**
[Continues reading, and Timmy asks to go to the bathroom.]
Teacher: "Timmy, alright, but be quick."
[Timmy leaves, and the teacher continues reading.] **[Note time and circle column]**
Teacher: "Now, let's transition to writing in our notebooks about what we've learned from the book."
[Students start writing as the teacher asks questions.] **(Write / Draw: Non-target student)**
Teacher: What is one stage of the water cycle you are writing about?
[Three non-target students respond, each with a different stage of the water cycle.] **(Verbal: Non-target student X 3)**
Teacher: "Timmy, welcome back! Please grab your notebook and write about the water cycle."
Timmy: "Okay, what do I write?"
Teacher: "Good question, Timmy. Start by writing about evaporation when water turns into vapor due to heat." **(Teacher feedback)**
[Timmy starts writing with the teacher's guidance.] **(Write / Draw: Target Student)**
Teacher: Nice job with your drawing of the water cycle, Timmy. **(Teacher feedback)**
Teacher to class: "Now, let's watch a science video on YouTube about the water cycle.
[After the video...]
Teacher: "Alright, class, what did we learn about the water cycle from the video?"
Timmy: "I learned that the water cycle is like a big circle, where water goes up into the sky, comes down as rain, and then goes up again." **(Verbal: Target student)**
Teacher: "Excellent, Timmy! You're absolutely right. The water cycle is indeed a continuous process. Great job, everyone!" **(Teacher feedback)**

Overall Quality of Science Instruction

The goal of this section is to grasp the *essence* of the lesson observed. It is not a count of specific behaviors, but rather an overall grasp of the quality of the lesson as a whole. Thus, it may be helpful to code these items at the very end of the observation. With rating scales such as these, it can be easy to overthink, we encourage you to go with your initial gut response on each component. To aid in your assessment of these items, consider the following descriptions of high-quality instruction for each item:

Overarching Question(s)	Description of High-Quality Instruction
Q10. Overall student interest in the science lesson	
Were *most* students engaged for *most* of the lesson?	Observed student behaviors: • Responded to OTRs from teacher as available • Eye contact on the teacher/phenomena being discussed • Minimal classroom disruptions • On-topic conversations among students as appropriate • Remained on task for almost all/all of the lesson

1	2	3	4	5
Almost never / rarely	**About 25% of the time / occasionally**	**About half the time / sometimes**	**About 75% of the time / often**	**Almost all the time / frequently**

Overarching Question(s)	Description of High-Quality Instruction
Q11. Target student interest in the science lesson	
Was the target student engaged for most of the lesson? Was there a discrepancy between the target student and the majority of the class? Did the target student seem more/less engaged than the rest of the class?	Observed **target** student behaviors: • Responded to OTRs from teacher as available • Eye contact on the teacher/phenomena being discussed • Minimal disruptions • On-topic conversations as appropriate • Remained on task for most/all of the lesson

1	2	3	4	5
Almost never / rarely	**About 25% of the time / occasionally**	**About half the time / sometimes**	**About 75% of the time / often**	**Almost all the time / frequently**

<table>
<tr><th colspan="2">Overarching Question(s)</th><th colspan="3">Description of High-Quality Instruction</th></tr>
<tr><td colspan="5">Q12. Overall discourse opportunities</td></tr>
<tr><td colspan="2">Discourse opportunities may include:

• Sharing background knowledge
• Reviewing prior content
• Sharing observations
• Interpreting data
• Building explanations
• Designing investigations
• Comparing/evaluating claims</td><td colspan="3">Discourse opportunities may occur in:

• Whole class discussions
• Small groups
• Pairs
• Individual responses</td></tr>
<tr><td colspan="2">Were students engaged in scientific discussions with each other and with the teacher?

Did the teacher provide opportunities for students to engage in scientific discourse?</td><td colspan="3">Observed teacher behaviors:

• Asking questions and providing opportunities to answer
• Pressing for further/deeper explanations
• Linking responses from one student to another
• Providing feedback based on student responses
• Engaging many different students to participate in discourse opportunities

Observed student behaviors:

• Providing explanations or claims based on evidence/experience
• Co-constructing ideas where a student builds off another students' response
• Critiquing responses and offering counter perspectives to teacher or student responses
• Many different students participating</td></tr>
<tr><td>1
Never / Very infrequently</td><td>2
Only one time during the lesson / few times with few opportunities</td><td>3
Occasionally throughout the lesson</td><td>4
A few times throughout the lesson / occasionally but with many opportunities</td><td>5
Consistently throughout the lesson</td></tr>
</table>

<table>
<tr><th colspan="2">Overarching Question(s)</th><th colspan="3">Description of High-Quality Instruction</th></tr>
<tr><td colspan="5">Q13. Overall teaching for scientific understanding</td></tr>
<tr><td colspan="2">Is the teacher promoting student understanding of scientific concepts and crosscutting practices?</td><td colspan="3">Observed teacher behaviors:
• Providing discourse opportunities
• Connecting content across concepts (e.g., cause and effect)
• Giving students opportunities to ask and answer questions
• Modeling scientific processes
• Providing practice opportunities
• Giving specific feedback</td></tr>
<tr><td>1
Almost never / rarely</td><td>2
About 25% of the time / occasionally</td><td>3
About half the time / sometimes</td><td>4
About 75% of the time / often</td><td>5
Almost all the time / frequently</td></tr>
</table>