Understanding Science Project

Classroom Observation Protocol

Force and Motion 2007-08

Date: _____ Observer: _____

Teacher: _____ School: _____

Grade level: _____ Curriculum: _____

IMPORTANT:

In order to keep teacher's data confidential, this cover sheet with the teacher's name will be removed upon receipt by the research staff, leaving only their ID number on the next page of the protocol. This cover sheet will be stored in a locked cabinet, separate from the completed classroom observation protocol.

Enter Site Number and Teacher ID Number here *and on the next page*.

Site Number: □

Teacher ID Number: T□□□

Site Number: ☐ **Teacher ID Number:** T☐☐☐

BEFORE LESSON BEGINS (via email communication with teacher)

Audio Recording? ❑ no ❑ teacher only ❑ teacher and classroom
❑ digital ❑ cassette

Video? ❑ yes ❑ no

1. Class period and/or time of class:
2. Topic or topics to be covered:
3. Placement of class within the force and motion sequence:
4. Description of the classroom and seating arrangement [draw/describe/take pictures if possible], posters, centers, charts, vocabulary posted, student projects displayed?

5. Approximate numbers of boys and girls; ethnic diversity of students

DURING OBSERVATION

Introduction to the Lesson
Student grouping: _____ Start time: _____

6. How does teacher begin or introduce the lesson?

7. What are the students doing?

8. Does teacher state the purpose of the lesson? ❑ yes ❑ no
   Stated purpose:

9. Does teacher provide an overview of the lesson? ❑ yes ❑ no

10. Does teacher explain how lesson relates to previous lessons? ❑ yes ❑ no

11. How does teacher elicit or assess *prior knowledge*, and how do students share what they know?

Activity/Task Number [take as many activity sheets as needed] _____
Student grouping: _____ Start time: _____

12. Describe science content, nature of activity, artifacts, what students are doing, what teacher is doing, how the lesson is being structured, accommodations of ELs, and examples of interactions if possible.

Materials used

13. List/describe materials here

Conclusion of Lesson

Student grouping: _____ Start time: _____
End time: _____

14. How does teacher conclude the lesson?

15. Do teachers or students summarize or synthesize observations or topics covered in activities?
    ❑ yes ❑ no

16. How does teacher frame the lesson, or relate it to scientific principles?

Post-observation questions for the teacher (if not in person, then via email)

17. What were your objectives for today's lesson?

18. How did the lesson go? [What went well? What were you less happy with? What do you look for to see if a lesson is working?]

19. How well do the students seem to understand the force and motion materials and today's lesson generally?

20. What do you think the students had difficulty with? What do you think they'll still have questions about?

21. Did you adapt the lesson for the ELs in your class in any way?

Check type of curriculum materials and identified ELs if necessary

AFTER OBSERVATION

22. Overall, what were the strengths of the lesson?

23. Overall, what were the weaknesses of the lesson?

24. Important things observed not covered in protocol

25. Exemplars, overall comments on observed

    a. Explicit eliciting of student understanding or prior knowledge:

    b. Structured opportunities for talk:

    c. Collaborative sense-making discussions, students building on each other's ideas:

    d. Analyzing or interpreting evidence; basing scientific claims on evidence:

    e. Teacher and student statements or questions in response to student errors and questions: [Evaluation, correction, probe, elicit other ideas?]

    f. Modification of activity in response to student difficulties or ideas:

    g. Activities focused on the academic language of science:

h. Support for the diversity of student language abilities and contributions:

CURRICULUM: COHERENT SCOPE AND SEQUENCING

26. Organization of lesson around a coherent set of related science concepts

❑ No opportunity to observe	❑ No links to larger or more general science concepts	❑ Vague references to one or two science concepts	❑ Science concepts explained and related to activity but little attempt to make conceptual connections	❑ Explicit, frequent links to fundamental science concepts; new concepts are linked to previously introduced

Evidence of accomplishment:
Teacher:
- Introduces activities and lessons in terms of fundamental concepts.
- Demonstrates how student observations and thinking relates to larger patterns.
- Explores the relationships between concepts.
- Discusses further applications and implications with students.
- Concludes lessons or activities with references to more general concepts.

Students:
- Understand the scientific purpose of activities.
- Mention or discuss fundamental concepts.
- Talk about science while doing.

Comments:

27. Opportunities to collect evidence and make sense of patterns

❑ No opportunity to observe	❑ Students do not work with evidence, observations, or given results.	❑ Activities involve hands-on exploration, but student experience is not related to teacher explanations or class discussions.	❑ Students observe, experiment, or make sense of provided data, but interpretations and models are provided. "Good" observations are cited when explaining model or scientific principle.	❑ Students regularly interpret evidence and work with models. All student observations are considered data, evaluated as such, used to construct or test models.

Evidence of accomplishment:
Teacher:
- Designs activities that are exploratory, open-ended, investigations.
- Gives students opportunities to summarize, compare, and theorize.
- Asks students to take a position on different explanations being discussed.
- Solicits or identifies questions that need to be answered to resolve contradictions or disagreements.

Students:
- Collect and report their observations or findings.
- Are given opportunities to try variations on the same principle and compare.
- Are asked to hypothesize about their findings, make guesses about scientific principles.
- Actively work with models and representations, e.g. enacting, building, illustrating.

Comments:

28. Instruction designed to reach explicit, grade-appropriate learning goals

❑ No opportunity to observe	❑ Goals obscure or inappropriate for this grade	❑ Grade-appropriate goals are stated, but the relationship between activities and goals is haphazard or unclear.	❑ A basic relationship between activities and grade-appropriate goals is established.	❑ Activities are designed to meet explicit and specific, grade-appropriate goals in a sequenced, comprehensive way.

Evidence of accomplishment:
Teacher:
- Implements instructional activities to pursue explicitly-stated, grade-appropriate learning goals.
- Relationship of activities to learning goals is clear and explicit.
- Assesses student understanding, checking if students are achieving learning goals and ready for new materials or activities.
- Activities within a lesson explore different aspects of the topic and/or build in complexity in order to reach learning goals.

Students:
- Carry out instructions and start activities with minimal delay.
- Use and refer to concepts and ideas from previous activities and lessons in solving new problems.

Comments (too challenging? not challenging enough?):

29. Classroom activities, assignments, and interactions incorporate accurate and precise science content

❑ No opportunity to observe	❑ Very inaccurate, unclear, or vague	❑ Somewhat inaccurate, unclear, or vague	❑ Mostly accurate and clear, somewhat precise	❑ Accurate, clear, and precise

Evidence of accomplishment:
Teacher:
- Explains science accurately.
- Explains and uses concepts with precision.
- Maintains clear distinctions between different concepts and processes.
- Wall postings and written materials are clear and accurate.
- Activities and assignments are clear and scientific ideas represented are accurate.

Comments:

30. Support for student learning of academic science talk

❑ No opportunity to observe	❑ No attempt to introduce new science words or to practice or discuss science discourse forms	❑ A few new vocabulary words are formally introduced but not used in context.	❑ Science vocabulary is introduced and teacher supports use in context, but there is no discussion of science discourse forms.	❑ Teacher introduces and expects use of science words in context; students discuss and practice science discourse forms.

Evidence of accomplishment:
Teacher:
- Uses language that is appropriate for elementary students.
- Announces clearly defined language objectives, e.g. new science words.
- Highlights, discusses and reinforces new and familiar science words.
- Makes regular use of scientific terms in appropriate contexts.
- Introduces and practice science-specific discourse forms and structures.
- Discusses and practices a variety of academic literacy skills (analyzing, comparing, summarizing).
- Cites evidence to support claims, modeling evidence-based reasoning.
- Coordinates activities that create meaning with activities to practice language (reading, writing, listening, and/or speaking).

Students:
- Use appropriate and precise science vocabulary.
- Practice and apply science discourse forms.
- Use discourse forms and vocabulary with increasing precision.

Comments:

31. Instruction anticipates and addresses difficulties students at that grade level often encounter

❑ No opportunity to observe	❑ No expressed awareness or anticipation of student difficulties	❑ A few difficulties are anticipated, but these tend to be practical rather then conceptual (e.g. how to use the bulb holders).	❑ Some conceptual misunderstandings are anticipated during instruction but not discussed. Teacher tells them 'the way it is' without exploring student understanding.	❑ Teacher explicitly anticipates and addresses a range of common difficulties and discusses 'tricky aspects' with students.

Evidence of accomplishment:
Teacher:
- Poses questions or assigns tasks that target common misconceptions.
- Poses questions or assigns tasks that create cognitive conflict with misconceptions.
- Lesson content addresses common misconceptions identified in PD or literature.

Students:
- Have opportunities to discuss misconceptions and reasoning behind errors.

Common difficulties:

32. Uses a variety of models, metaphors, and representations to support students' conceptual understanding

❑ No opportunity to observe	❑ Teacher does not use models, metaphors, or representations during lesson. Lesson focuses on manipulatives OR computations.	❑ Teacher refers to representations or drawings in curriculum materials when explaining concepts. These are not discussed or tested.	❑ Teacher introduces one or two models or representations that are not in the materials and discusses them with class.	❑ Teacher and students use or create a range of models, metaphors, and representations to map conceptual understanding and illustrate observations.

Evidence of accomplishment:
Teacher:
- Employs a range of models or metaphors to explain different aspects of the same concept.
- Encourages students to create representations that demonstrate their understanding.
- Discusses the strengths and limitations of particular models or metaphors.
- Encourages students to create and test models with real data.

Students:
- Use metaphors in their own explanations.
- Test and create representations and models.
- Ask questions about models and representations and their limitations.

Comments:

ASSESSMENT: MONITOR AND DIAGNOSE STUDENT UNDERSTANDING

33. Eliciting and paying close attention to details of student reasoning and understanding during lesson

❑ No opportunity to observe	❑ Teacher does not attempt to elicit or understand student reasoning during lesson.	❑ Teacher occasionally asks students to explain answers when they are incorrect.	❑ Teacher elicits students' thinking and reasoning for both correct and incorrect answers, but does not ask further questions or discuss differences.	❑ Teacher frequently elicits student understanding, illuminating similarities and differences in student reasoning.

Evidence of accomplishment:
Teacher:
- Elicits, probes, and assesses student reasoning.
- Cites student reasoning, recognizing alternative approaches without immediately evaluating.
- Recognizes the logic of students' science ideas even when they contain errors.
- Compares different student approaches and reasoning, highlighting different aspects of the problem and different student insights.
- Takes opportunities to observe students and pose probing questions during small group or individual time.

Students:
- Explain their thinking to teacher and to each other.
- Ask each other about reasoning in group activities.

Comments:

34. Activities and questions reveal students' understanding in depth and detail

❑ No opportunity to observe	❑ Activities do not require students to explain their answers or make their reasoning explicit.	❑ Activities occasionally include tasks that allow aspects of student thinking to be inferred.	❑ Activities often ask students to explain conclusions or procedures, but student thinking is not revealed in much detail or depth.	❑ Activities and tasks are designed to help students make their reasoning and ideas explicit in depth and detail.

Evidence of accomplishment:
Teacher:
Require students to explain or demonstrate their reasoning during activities and discussions in order to assess their conceptual understanding.
Uses assessments as opportunities to explore the logic behind errors.
Designs activities to require students to make choices in their approach to problems and to make their choices and reasons explicit.
Students:
Approach assessments as challenging activities rather than as 'tests'.

Comments:

35. Multiple, varied opportunities to demonstrate understanding and explain thinking

❑ No opportunity to observe	❑ Limited opportunities of any kind for students to demonstrate understanding	❑ Students are sometimes expected to share their answers verbally when asked; students who cannot articulate well are disadvantaged.	❑ Some variety in the ways students can share answers to given questions; e.g., by constructing or drawing individually or as a group	❑ Multiple and varied opportunities for students to demonstrate understanding and science ideas; students with difficulties are accommodated and encouraged

Evidence of accomplishment:
Teacher:
Provides opportunities for students to demonstrate what they know in multiple ways and formats (showing, telling, drawing, building), including in L1.
Differences in styles and abilities are accommodated.
Students:
Have opportunities to take the role of self- or peer assessors, establishing or discussing criteria, evaluating work, and revising the product based on feedback.

Comments:

36. Focus is on reasoning underlying students' answers, rather than correctness

❑ No opportunity to observe	❑ Teacher focuses on correct answers and immediately evaluates student contributions.	❑ Teacher occasionally asks for reasoning behind incorrect answers, but only as part of negative evaluation.	❑ Teacher sometimes elicits student reasoning without immediately evaluating.	❑ Teacher elicits and cites student thinking, highlighting student logic as part of discussion and probing for details.

Evidence of accomplishment:
Teacher:
- Respects and accommodates the variety of correct and incorrect contributions that students make to sense making discussions.
- Doesn't immediately evaluate student responses as right or wrong but examines (or asks other students to examine) the means by which the student arrived at the answer.
- Recognizes the logic of students' science ideas even when they contain errors.
- Does not accept explanations with only cursory evidence or attestation, but explores alternative explanations and questions before making initial conclusions.

Students:
- Develop understanding in an ongoing process of understanding—not simply by responding with answers.
- Present multiple ideas and perspectives, without immediately evaluating each other.

Comments:

INSTRUCTION: ADAPT TEACHING TO SUPPORT STUDENT SCIENCE LEARNING

37. Instructional plans modified during instruction to adapt to emergent conditions

❑ No opportunity to observe	❑ No acknowledgement of emergent conditions, including obvious boredom or frustration: teacher directs all activities and/or holds to script	❑ Teacher responds to student difficulties or ideas by re-explaining or repeating previous instructions, but does not noticeably modify instruction or activities.	❑ Teacher takes time to address student difficulties and need for greater challenges, primarily individually or on the side.	❑ Teacher adapts and modifies activities and instruction in response to student ideas and difficulties, improvising and adapting activities as needed.

Evidence of accomplishment:
Teacher:
- Modifies instructional plans as needed to address factors that emerge in the course of teaching.
- Will ‘deviate from the script’ based on what arises, using alternate examples, taking up student ideas and exploring misconceptions.
- Uses alternate activities to address specific misconceptions as they arise.
- Bases instructional decisions on several considerations including learning goals, students’ prior and current knowledge and difficulties, available classroom resources, as well as strengths and limitations of instructional activities, models, metaphors, and representations.

Students:
- Suggest activities to teacher.
- Ask complex (how or why) questions of teacher and each other.
    - Express confusion as a conversational opener rather than as an embarrassment, complaint, or problem.

Comments:

38. Opportunities for sense-making discussion and reasoning in depth

❑ No opportunity to observe	❑ Teacher provides no opportunities for extended discussion; students do not collect evidence or record observations as data.	❑ Teacher provides very limited opportunities for discussion; students investigate and observe but do not discuss in groups or with class.	❑ Teacher encourages discussion in groups. In whole class discussions, conversational exchanges are short and teacher-directed.	❑ Teacher encourages extended exchanging of ideas, acting as facilitator.

Evidence of accomplishment:
Teacher:
- Encourages students to work out patterns from the evidence and discuss and compare findings.
- Provides guidelines and guidance for interaction in inquiry groups, e.g. roles, scaffolding, informal check-ins.
- Grants intellectual authority to the reasoning process, rather than own status as teacher or that of written materials.
- Allows questions to develop and solutions to unfold.

Students:
- Take advantage of a variety of opportunities to talk about the science (pairs, groups, whole class).
- Discuss ideas without expecting or waiting for teacher evaluation after each contribution.
- Collaborate to work out problems, difficulties, and confusion.
- Discussion leads to a more general understanding of how and why.
- Explore real world applications and implications of classroom science.

Comments:

39. Adaptation of instruction based on students' prior and current knowledge and reasoning

❑ No opportunity to observe	❑ Teacher does not adapt instruction, in spite of inappropriateness	❑ Teacher offers some options or help for students who missed or did not understand previous lessons, or who are having serious difficulties.	❑ Teacher reviews previous learning and ensures that all students know enough to participate, but some students are under-challenged.	❑ Teacher reviews previous lessons and frequently checks for understanding, adapting activities as necessary for different levels of knowledge and engagement.

Evidence of accomplishment:
Teacher:
- Elicits and assesses student understanding and prior knowledge.
- Frequently checks for understanding and adapts activities as necessary.
- Tailors instruction and provides alternatives for different student interests.

Students:
- Make few requests for clarification.
- Are comfortable sharing what they understand and explaining what is difficult or unclear.
- Seem to understand what they are supposed to do.
- Carry out instructions and start activities with minimal delay.

Comments:

40. Close attention to student difficulties

❑ No opportunity to observe	❑ No apparent awareness or acknowledgement of student difficulties	❑ Teacher occasionally asks if students understand, expecting primarily yes/no answers, and responds to student difficulties or ideas by repeating explanations.	❑ Teacher regularly checks to see if students comprehend instructions and materials but does not probe for deeper conceptual understanding.	❑ Teacher takes an interest in student difficulties as challenging aspects of the science; seeks conceptual source; uses difficulties as a resource.

Evidence of accomplishment:
Teacher:
- Uses misconceptions as a way to talk about tricky aspects of the science.
- Encourages students to think about misconceptions and talk about confusing aspects as part of the discussion.
- Asks probing questions to help make conceptual misconceptions explicit.

Students:
- Confidently ask questions when they are confused, raising difficulties as conversational openers.

Comments:

41. Support for student interpretation of evidence, hypothesizing and predicting

❑ No opportunity to observe	❑ Students work with manipulatives (balls, slides, time/distance graphs), but are not given the opportunity to make predictions or interpret evidence.	❑ Students are occasionally encouraged to guess or predict, but these are usually simplistic yes/no predictions.	❑ Students are regularly asked to make more complex hypotheses. They record observations and are familiar with the steps of the scientific method.	❑ Students hypothesize and make complex predictions based on previous work. Hypotheses are tested with student data.

Evidence of accomplishment:
Teacher:
- Introduces and discusses investigative questions with students or works with students to generate investigative questions.
- Solicits predictions and explanations for observed results.
- Asks students to take a position on different explanations being discussed.
- Clarifies student positions, assumptions, and beliefs about science.
- Encourages students to use the language and discourse of the scientific method.

Students:
- Report their observations or findings.
- Hypothesize about their findings, make guesses about scientific principles.
- Compare and evaluate models and representations, based on own observations and experiences.
- Actively work with models and representations, e.g. enacting, building, illustrating.

Comments:

42. Accessibility of instruction and support for the variety of learners

❑ No opportunity to observe	❑ No recognition or accommodation of different abilities, linguistic, cultural differences; non-mainstream students' participation limited	❑ Recognition of linguistic, individual, or learning differences, but no support or accommodation from teacher	❑ Teacher verbally encourages all students to participate and helps ELs and weaker students on the side.	❑ Teacher and classroom culture are supportive of a variety of abilities and differences, using diversity as a resource and valuing and accommodating different types of participation.

Evidence of accomplishment:
Teacher:
- Uses diversity as a resource, incorporating language and culture in activities, active accommodation.
- Links concepts to students' linguistic and cultural backgrounds.
- Uses a variety of techniques to reach all kinds of learners (modeling, visual, hands on activities, demonstrations.
- Conducts checks for understanding in real time.
- Consistently provides sufficient wait time for student responses.

Students:
- Active participation by speakers of other languages, equitable participation by all ethnic groups.
- Respect and attend to each other's reasoning.
- Help each other reason and articulate, voluntarily and when directed.

Comments: