Transforming STEM Learning
and
Evaluation of the North Carolina Race to the Top STEM Initiative

Classroom Observation Protocol

Training Manual

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Classroom Observation Protocol
TRAINING GUIDE

Researchers of curriculum and instruction distinguish between “intended curriculum” and “implemented curriculum.” Intended curriculum includes curriculum materials such as textbook, handouts, lesson plan, and goals and activities that the teacher specified and planned for her lesson. Implemented curriculum is what actually happens in the classroom and how students experience it. **The goal of the independent observations** is to describe implemented curriculum as close as possible to the way students experience it. Often these observations are supplemented with pre- and post-interviews with the teacher to determine how well the implemented curriculum is aligned with the curriculum intended by the teacher (teacher-stated goals).

This guide is intended to provide an overview of the six introduction questions related to the overall nature of the lesson and to explain each of the eight observation dimensions and the associated elements of each dimension.

General Lesson Information

The following items are included in each observation to capture the overall nature of the lesson.

1. **Please give a brief description of the class observed, including:**
   - *the classroom setting in which the lesson took place (space, seating arrangements, environment and personalization, etc.),*
   - *when in the overall lesson sequence this class takes place (toward the beginning of a unit, in the middle of a unit, toward the end)*
   - *any unusual context of the lesson (interruptions, etc.)*

   Use diagrams if they seem appropriate.

   The examples of unusual circumstances include: some students coming in late/leaving early due to conflicting activities; shortened lesson time (describe causes); faulty technology. It would be useful to also include here context such as sitting arrangement (students sitting in rows vs. in groups of 2/3/4, or in a circle, or working individually on computers).

2. **Lesson Topic/Goals:**

   Describe the topic and goals of the lesson as interpreted by the observer.

3. **Lesson Goals as presented *by the teacher to the students*:**

   Describe how the goals of the lesson were presented to students. The literature on formative assessment places a high importance on informing students about the goals of the lesson so they are involved in monitoring and regulation of their own learning. According to the formative assessment literature, clearly communicating learning goals for students helps them understand where they are going in their learning and how far are they from their destination, and thus motivate them to get there. Indicate whether the goals were written on the board/overhead, and, if so, copy them verbatim. Indicate whether the goals were also discussed and how. In analyses of the ways goals were presented to students from another study, the goals of the lesson, as presented by the teacher, were classified as (1) goals; (2) topic; (3) agenda. The goals (or learning outcomes) were the statements or questions that specified what students were expected to learn during the lesson. The agendas were statements about what students will do, without specifying the learning outcomes; and the topic simply specified the general or specific topic of the lesson without specifying what student will do or their learning outcomes. The goals were also classified into conceptual and procedural goals.

Here are a few examples that illustrate this classification:

1. Conceptual goal: “what is/defines a function in tables, graphs, symbols, and words”
2. Procedural goal in the form of a question: “How do you solve inequalities algebraically?”
3. Agenda: Solve problems involving exponential growth & decay; solve problems using the Pythagorean Theorem
4. Topic: Logarithmic Equations & Properties of Logs

When recording spoken goals, try to classify them by one of the four categories above.

4. **Curriculum Materials Used:** *(include any textbook, lab materials, or resources used)*

Provide the name of the textbook if one is used as different textbooks have different philosophies and types of assignments. If handouts are used, obtain and submit copies. These handouts will help in analyzing the cognitive demand, rigor, and types of assignments. If assignments are presented in other ways, please provide as detailed description as possible either here or in the sections on math/science content.

5. **Lesson Structure:** Briefly describe the structure of the lesson (e.g. 5 min quiz, followed by 25 min of homework review, followed by 10 min of whole class discussion, followed by 15 min individual work on worksheets; note whether there was a conceptual summary at the end of the lesson; if summative assessment is present, please describe).

Describe the overall structure of the lesson and how the time is spent. Note if most time was spent on mathematics/science or if time was wasted on issues unrelated to mathematics/science.

Examples of time spent on mathematics/science:

- Teacher reviews content from a prior lesson
- Teacher introduces content
- Students practice content
- Students work on a warm-up problem while teacher takes attendance

Examples of time spent on other things:

- Gathering or distributing materials
- Attending to other administrative issues
- Disciplinary issues that severely impinge upon instructional time
- Students doing an activity (cutting, pasting, coloring) that is not clearly connected to mathematics or science

6. **As implemented, what did the lesson mostly focused on?**

- Most time spent on practicing algorithms/basic skills and procedures/vocabulary
- About equal time spent on practicing algorithms/basic skills and procedures/vocabulary and on concept development and meaningful learning
- Most time spent on inquiry/meaningful learning and genuine problem solving

This question provides a holistic impression about whether the main focus was on procedures or conceptual development, or both.

Ratings of Dimensions

As you are observing the classroom, you will look for evidence in the areas below. You will code the observation on the following dimensions:

1. Mathematics and Science Content
2. Student Cognitive Engagement in Meaningful Instruction
3. Student Activities: Inquiry learning; Project-based learning; and Problem-based instruction
4. Teacher Instruction/Formative Assessment
5. Common Instructional Framework
6. Student Engagement
7. Use of Technology
8. Classroom Culture

Notes about the rating scale:

- A rating of ‘0’ is not considered a bad or negative rating; it just means that the element was ‘not observed.’ However, the absence (a zero rating) of a desired element can influence the summary rating.
- A rating of 3 or 4 is considered a ‘high’ rating and is referenced throughout the observation guide and instrument.
- You will provide a summary rating that ***is not*** an average of individual elements. Some elements are more important than others, and a high rating in specified elements (even with low ratings in others) should still warrant a high summary rating. The following sections of this guide will provide details for each dimension on the important elements for you to consider when determining the summary rating.

1. Mathematics and Science Content

Select one from scale: 0 = not observed, 1 – minimal, 2 – to some extent; 3=very descriptive of the observation.

1a. Math and science content information was accurate.
- Provide your best judgment on content correctness.
- Note overall teacher comfort with and knowledge of mathematics/science content of the lesson.
- Note any mistakes by the teacher, incorrect use of notation, or use of imprecise language.
- Note if the teacher noticed her own mistakes or slips of tongue or writing, and whether she used them as learning opportunities.
- Did students notice teacher's mistakes and could they freely talk about them?
- Were all inaccuracies clarified in the end?
- Note if you were not confident in your judgment of content accuracy.

1b. Teacher's presentation or clarification of mathematics or science content knowledge was clear.
- Teacher provided explicit clear explanations and modeling of approaches to solving the problem or answering the question.
- Teacher's explanations of core content are clear and easy to follow.
- Teacher explicitly discussed features of a problem that pointed to a selection of a certain procedure
- Teacher explicitly compared multiple methods for solving a problem for efficiency, appropriateness, and other advantages and disadvantages
- The explanations included multiple representations and modes (visual, symbolic, audio, hands-on, etc.).
- The explanations explained: (1) why a procedure works; (2) why a problem solution makes sense; (3) why an answer is true.
- When teacher answered student questions, it was evident that it clarified students' confusion
- Teacher noticed students' ideas in questions or comments and built her/his explanations on those ideas
- Note few, incorrect or incomplete explanations for lowering the score.

1c. Teacher used accurate and appropriate mathematics or science vocabulary.
- The teacher used subject-specific vocabulary appropriate for the level of students
- The teacher used subject-specific language fluently and with high density
- If informal vocabulary was used, it was not in place of, but in support of learning of concepts and of formal vocabulary.
- Subject-specific terminology was clearly explained to students, emphasizing its meaning
- Students are encouraged and pushed to use accurate subject-specific vocabulary
- Abstraction and symbolic representations were used appropriately

1d. Teacher/students emphasized meaningful relationships among different facts, skills, and concepts.
Examples of connections within topics include:
- Among different representations of ideas or procedures (e.g., a linear
- graph and a table both capturing a linear relationship; diagrams of atoms and atomic notation)
- Analyzing different representations of a concept and how these representations emphasize different properties of the concept (Different forms of a quadratic function formula could make more explicit the zeros or coordinates of the vertex)
- Among different mathematical and scientific ideas (e.g., proportionality and linearity; fractions, ratios, and decimals; plant and human respiration; etc)
- Between a procedure and underlying ideas, determining mathematical/scientific meaning of procedures or methods (for example, multiplying two binomials represented with an area model; controlling a variable in experiments).
- Comparing and contrasting different concepts, problems, and procedures
- Having students use different procedures to double-check the accuracy of their work (Detecting possible errors by using estimation, checking the correspondence of the measurement units, and other mathematical and scientific knowledge)
- Teacher explanations went beyond just describing procedural steps and generalized across problems or in some other ways.

1e. Student mistakes or misconceptions were clearly addressed (emphasis on correct content here).
- The teacher did (or did not) notice students' mistakes and/or misconceptions
- Teacher identified the sources of students' mistakes and/or misconceptions
- She/he addressed them in such a way that made misconceptions explicit, addressed and clarified them.
- Were mistakes used as learning opportunity or were students embarrassed by their mistakes?
- Teacher anticipated common student errors or misconceptions and provided instruction to address them
- Teacher responses to students distinguished between students' correct and incorrect thinking
- Did students have a chance to check their own answers using a different method or by looking at whether it made sense?

1f. Teacher and students discussed key mathematical or science ideas and concepts in depth.
- Some significant mathematical or scientific ideas were at the heart of the lesson
- Sufficient time was spent on discussion of important concepts using multiple instructional strategies to allow students to develop understanding of these concepts
- These discussions could occur in small groups or as a whole class
- Note if all students were actively engaged in such discussions
- Teacher links students' contributions to each other
- Teacher notices students' ideas, comments on them, emphasizes the important points, and weaves them into the development of lesson concepts

1g. Teacher connected information to previous knowledge.
- Teacher actively solicited students' understanding of knowledge that is pre-requisite for a current lesson and on ideas related to topics to be taught
- Teacher explicitly connected the currently taught concepts, procedures, and facts with concepts and facts that students already know (either from school or from everyday experience)
- Previous assumptions were reexamined in light of new knowledge
- In solving problems, doing experiments, and other procedures, teacher and students explicitly considered and compared analogous problems or procedures; tried special or simpler cases

1h. Appropriate connections were made to other areas of mathematics/science or to other disciplines.
Examples of connections include:
- Connection with a math or science topic studied last month/year
- Connecting current algebra content (concepts/skills) with geometry or statistics concepts; connecting current chemistry content to content learned in biology
- Applying mathematics to physics, biology, chemistry, or engineering problems (solving chemical equations, modeling bacterial growth)

1i. Appropriate connections were made to real-world contexts.
- The teacher provided examples of real-world applications of the content or procedures
- When word or contextual problems were used, connections between the situation and its mathematical or science model were made explicit
- There was a sufficient number of examples of real world or contextual applications of concepts and skills
- Students had a chance to reflect on whether the results make sense in the context and possibility to improve their mathematical or scientific model if it had not served its purpose
- Students were able to identify important quantities in a practical situation
- Students were able to decontextualize the situation (represent it symbolically and in an abstract way, manipulate the symbols without referring back to the situation)
- Students were encouraged or able to contextualize the situation (interpret mathematical or scientific results in the context of a situation they represent)

Summary: Elements 1a-1d, must be rated high (3 or 4) for an overall high rating. Elements 1e-1i contribute to overall rating, but don't need to be high.

Record specific examples below.

It is important to provide as detailed examples as possible to justify all ratings. These specific examples will provide a picture of what these ratings mean and which features make this classroom strong or weak on particular dimensions. Examples that justify both high and low ratings should be provided.

2. Student Cognitive Engagement in Meaningful Instruction

The emphasis in this dimension is on students. The review of research in math education shows that two dimensions are very important in advancing students' learning of mathematics: (1) the focus in the classroom on conceptual development (could be mainly teacher-driven); and (2) the students actively doing mathematics/science or "wrestling" with mathematical/scientific ideas, meaning that they are cognitively involved in genuine problem solving and constructing their own conceptual understanding. This second aspect is the main emphasis of this dimension. The student cognitive processes listed below could be encouraged and/or facilitated by the teacher, but there has to be significant emphasis on the student's own cognitive involvement. Students' arguments or activities have to be present, but don't have to be complete or correct.

Select one from scale: 0 = not observed, 1 – minimal, 2 – to some extent; 3=very descriptive of the observation.

2a. Students experienced high cognitive demand of activities because teacher did not reduce cognitive demand of activities by providing directive hints, explaining strategies or providing solutions to problems before students have a chance to explore them, etc. - The activities were of high cognitive demand in the first place, and - Teacher **did not reduced** a cognitive demand of a problem or task by doing most of the cognitive work herself and feeding it to students
2b. Students were asked to explain or justify their thinking. - Students made sense of quantities and their relationships in problem situations - Students explained solutions to problems not only by merely listing solution steps, but also by attending to meaning of those steps and explaining **why** the whole solution works - Students explained **why** a procedure works (not **how**!) - Students understood and used stated assumptions, definitions, and previously established results in constructing their arguments - Students made conjectures and built a logical progression of statements to explore the truth of their conjectures - Students justified their conclusions either in discussion or in writing, communicated them to others, and responded to the arguments of others
2c. Students were given opportunities to summarize, synthesize, and generalize. - Students looked for patterns or structure in various representations of phenomena (visual, symbolic, numeric, etc.) - Students looked for general methods and for shortcuts in procedures - Students had a chance to appropriately generalize from two or more problems, from two or more results of an experiment/exploration to a general relation, and were able to explain why such generalizations were valid - Students had an opportunity to synthesize knowledge from different sources - At the end of the lesson or a small unit, students were given a chance to summarize their learning, to highlight major ideas or procedures learned
2d. Students used a variety of means (models, drawings, graphs, concrete materials, manipulatives, etc.) to represent phenomena. - Students used various representations or tools to represent mathematical or scientific relationships - Students used various representations or tools to model real life or word problem situations

2e. Students were asked to apply knowledge to a novel situation. - Students were asked to use their previous knowledge to solve a novel problem or to do a novel exploration - Students were involved in carefully orchestrated practice activities with feedback - Students were trying to make sense of a confusing issue or trying to resolve a problematic situation in mathematics/science - Students were involved in solving cognitively demanding tasks that require some degree of cognitive effort - Students were thinking on their own
2f. Students were asked to compare/contrast different answers, different solutions, or different explanations/interpretations to a problem or phenomena. - Students had a chance to analyze situations by breaking them into cases - Students recognized and used counterexamples - Students explained and compared the effectiveness of solution methods - Students compared the effectiveness of different plausible arguments, explanations, or interpretations - Students distinguished correct logic or reasoning from that which is flawed - Students were asked to evaluate the arguments of others
Summary: For this dimension to be rated high, Elements 2a-2c should have a high rating (3 or 4). Elements 2d-2f don't have to be all high, but they contribute to an overall rating.

Record specific examples below.

3. Inquiry learning; Project-based learning; and Problem-based instruction

This dimension assesses the quality of inquiry, project-based, and/or problem-based learning. Recent research on inquiry teaching (Furtak, Seidel, Iverson, & Briggs, 2012) describes two attributes of inquiry-based science teaching: (1) student participation in a set of scientific practices, what scientists do (ask scientifically oriented questions, generate hypotheses, design/conduct experiments, record/analyze data, draw conclusions based on or interpreting data, generate/revise theories, present the results of experiments/research); and (2) the extent to which these activities are guided by the teacher or by students.

In the rating scale for this dimension, elements 3b/3d evaluate the first attribute, and elements 3c and 3d the second attribute. Elements 3a/3e evaluate the extent of problem-based learning, and 3b and 3g evaluate the extent of project-based learning. 3f relates to all of them.

Select one from scale: 0 = not observed, 1 – minimal, 2 – to some extent; 3=very descriptive of the observation. NA = not applicable to activity being observed (since projects may not occur in every lesson)

3a. Students were engaged in open-ended tasks or questions. - The problems or tasks that students worked on had either more than one possible answer or more than one solution path - Students had to understand the approaches of others to solving complex problems or tasks - Students considered available tools when solving an open-ended problem or task - Students were trying to make sense of a confusing issue or trying to resolve a problematic situation in mathematics/science - Students were trying to formulate a definition for a concept or a relationship that they found - Teacher provided plenty of wait/processing time

3b. Students engaged in hands-on or real-life problem solving activities or a lab experiment.

- Students solved authentic problems that were related to everyday life, society or workplace
- Students performed hands-on activities that ***helped them better understand mathematical/science relationships or concepts*** (if hands-on activities were not connected with mathematical/science relationships or concepts, this should be noted and the score should be lowered)
- Students conducted a scientific experiment that ***helped them better understand scientific relationships or concepts*** (if experiment was not connected with scientific relationships or concepts, this should be noted and the score should be lowered)
- Students used physical models to assist with analyses or interpretation of data

3c. Students developed their own questions and/or hypotheses to explore or test.

- Students had a chance to develop (or contribute to development) or select their own questions for exploration
- Students were encouraged to develop their own hypotheses or make predictions to test
- Students researched what is already known about a topic or question to help them shape their own inquiry
- Prior to investigation, students discussed appropriate questions and possible hypotheses
- Students discussed and/or selected variables for exploration

3d. Students engaged in scientific inquiry process (tested hypotheses and made inferences).

- Students were engaged in literature or internet research on a topic
- Students had a chance to develop (or contribute to development) of methods of testing a hypothesis
- Prior to investigation, there was a discussion about appropriate methods to test a hypothesis
- Students discussed how to use control in their investigation
- Students made descriptive observations
- Students made accurate measurements using scientific tools and instruments
- Students accessed and recorded secondary data (from internet or other sources)
- Students were encouraged to interpret the results of their exploration (in math or science)
- After the investigation, there was a discussion about students' interpretation of the results
- Students had to check their answers to problems using a different method
- Students had to ask themselves, "does it make sense?" – about the problem answers or results of an experiment
- Students revised their hypotheses or theories based on the evidence from their experiment

3e. Students determined which problem-solving strategies to use to complete the task.

- The problems or tasks that students worked on were unfamiliar enough so that there was no immediately obvious solution path
- Student exploration preceded the formal presentation of content or problem solving strategy
- Students were not shown an example of a solution to a very similar problem before they solved problems or did an investigation on their own
- Students had to explain to themselves a meaning of a problem or task and to look for entry points to its solution
- Students had to analyze givens, constraints, relationships, and goals of the problem or task

3f. Students had to (or will have to) present or explain results of project.

- Students had (or will have) to present the project to a class or an outside group (We do not need to observe an actual presentation if there is indication that the presentation will happen)
- If the presentation does happen, the quality of the project or research should be judged based on it. Therefore, the quality of the project or research should drive the Summary rating, not only the quality of the presentation alone.

3g. Students worked on a project requiring creativity. - The project that students worked on required creation of an original product (it is not required to observe an actual final product to rate this highly) - Students' diverse ideas were solicited and encouraged - Teacher used brainstorming and other ways to encourage divergent thinking - For their product, students had a chance to use common things or ideas in uncommon ways - Students were encouraged to use creative solutions to problems/obstacles they encountered - Students had a chance to use their imagination/creative side while working on an assignment
3h. There was an explicit evidence of teacher modeling engineering (or reverse engineering) design process. - Teacher modeled how to define a problem - Teacher modeled how to brainstorm possible solutions to a problem - Teacher modeled how to research possible solutions to a problem - Teacher modeled how to choose the best ideas for the solution - Teacher modeled how to develop a model or prototype for the solution - Teacher modeled how to test or evaluate the solution to the problem - Teacher modeled how to improve design/revising solution based on the tests - Teacher modeled how to communicate results of the solution to the problem
3i. There was an explicit evidence of students using engineering (or reverse engineering) design process. - Students were engaged in defining a problem - Students were brainstorming possible solutions to a problem - Students were researching possible solutions to a problem - Students were choosing the best ideas for the solution - Students were developing a model or prototype for the solution - Students were testing or evaluating their solution to the problem - Students were improving design/revising solution based on the tests - Students were communicating results of their solution to the problem
Summary: High rating (3 or 4) on any one of the elements 3a-3e warrants a high summary rating. Elements 3f through 3i contribute to the summary rating, but alone cannot justify a high summary rating.

Record specific examples below.

4. Formative Assessment

Select one from scale: 0 = not observed, 1 – minimal, 2 – to some extent; 3=very descriptive of the observation.

4a. Teacher provided clear learning goals to students. - Teacher explicitly stated and discussed the learning goal(s) for a lesson or a bigger unit with students - It was evident that students understand their learning goals - If the agenda is written on the board and discussed, rate as 2 - If the learning goals or agenda are written on the board and not discussed, rate as 1
4b.Teacher provided clear criteria for success/examples of good work to students. - Teacher shared with students the examples of an "A" work and explicitly explained how the work will be graded - Students and teacher used clearly written rubrics to evaluate work - It was evident that students know what criteria was used to judge their work and receive a good grade - If the teachers solves problems for students as examples of work, rate as 2
4c. Teacher used a variety of strategies to monitor student learning and understanding throughout the lesson. - Teacher used questioning to elicit students' current/emerging thinking and understanding - Teacher observed peer interactions around the task

- Teacher used some quick written quizzes or question of the day to gather immediate results - Teacher used variety of means to gather each student's state of knowledge simultaneously (clickers, small white boards, index cards with answers, etc.)
4d. Teacher provided specific feedback to students. - Teacher provided descriptive feedback to students about areas of improvement and means of achieving improvement - Teacher engaged students in carefully orchestrated practice activities with feedback
4e. Students were engaged in self- and/or peer-assessment. - Students were asked to evaluate their own work against an exemplar product or a rubric. - Students worked in pairs or groups to assess each other's work.
4f. Teacher adjusted or differentiated instruction based on evidence of student learning. - There was evidence that the teacher adjusted her whole class or small group instruction based on the gathered evidence of student understanding - Teacher placed students in small groups based on skills or content they need to work on
4g. Students were given opportunities to reflect on their own learning. - Students were given exit slips or other ways to reflect on their learning during the lesson - Students wrote in journals about their learning - Students described what they learned about the lesson's goal - Students approach teacher about something they did not learn/understand - Teacher starts the class with students reflecting on what they learned yesterday
Summary: Elements 4a-4c must be rated high (3 or 4) for a high overall rating. Elements 4d-4f contribute to summary rating but don't have to be high.

Record specific examples below.

5. Common Instructional Framework

The goal of the Common Instructional Framework (CIF) is: ***Every student reads, writes, thinks and talks in every classroom every day.*** This dimension covers the general description of the CIF and specific descriptions for math and science classrooms created by the NCNS. The examples in these elements may overlap with examples on other dimensions. This dimension is included because it is the instructional framework used by NCNS coaches and professional development providers to guide teachers' instruction in NCNSP schools.

Select one from scale: 0 = not observed, 1 – minimal, 2 – to some extent; 3=very descriptive of the observation.

5a. Students worked collaboratively in teams or groups. - Students worked in pairs or groups of 3 or 4 - Groups were created purposefully to achieve relevant learning goals - Students had defined roles - Guidelines for collaborative group work were communicated to students - Activities incorporated individual and group accountability - Teacher circulated, using this time to assess students' understanding
5b. Students used writing to communicate what they had learned. - Daily low stakes writing used to develop students' ideas and critical thinking skills - Writing was used as a mechanism to enhance fluency of math or scientific terminology - Students wrote to explain math and science ideas or justify their thinking - Students reflected on their learning and made connections to the real world - Writing helped teacher see level of understanding or confusion

5c. Teachers asked open-ended questions that required higher level thinking.

Teachers' questions exhibited some of the following characteristics:

- Elicited student thinking, made student reasoning public
- Asked students to make conjectures
- Focused on process more than on answer
- Pressed students to explain and justify their responses
- Asked students to evaluate claims
- Probed for evidence of understanding
- Asked students to make connections to previous knowledge or experiences
- Encouraged student-to-student questions
- Provided plenty of wait/processing time

5d. Teachers provided assistance/scaffolding when students struggle.

- Students' prior knowledge was elicited and built upon
- Students participated in shared concrete experiences to gain prior knowledge through direct observations
- Student ideas were solicited for how to design investigations
- Teacher monitored student frustration and engagement levels and asked questions to help students get unstuck or refocused – starting with general, open questions and gradually simpler or more guiding questions until students are challenged to think at an appropriate level, without reducing task complexity
- Students were allowed adequate time to grapple with tasks before the most minimal effective assistance was offered
- Teacher plans included sub-questions for complex investigation tasks
- As multi-day lessons and daily investigations unfolded, activities progressed from more structure to less, moving from more frequent whole class discussion and shorter launch-explore-share & summarize cycles to more extended group work and longer launch-explore-share & summarize cycles

5e. Students engaged in discussion with each other.

- Discussions focused on building a shared understanding of mathematical and scientific ideas
- Students shared diverse strategies and ways of thinking; students made connections among diverse approaches
- Multiple representations of knowledge were valued
- Students listened to, questioned, and responded to one another
- Students articulated their thinking about math and science ideas
- Teacher listened and facilitated student-to-student discussion
- Students may have been in small groups or discussing as a whole class

5f. Students participated in guided reading discussions. (all students)

- Students read daily, to understand a variety of different types of text and to engage in high level discourse
- Students were reading sections of text, scientific journals, or other print and electronic resources about science or mathematics
- Students were assigned roles to facilitate interpretation, analysis, and discussion of readings

Summary: High rating (3 or 4) in two or more of elements 5a-5e warrants a high summary rating. Alternatively, if all five elements are present to some extent, a high summary rating is warranted. Absence of element 5f does not lower the summary rating.

Record specific examples below.

6. Student Engagement

Student engagement is one of the desired outcomes of NCNS instructional improvement efforts. Here are some excerpts from their vision document:

> "Throughout the school, teachers engage students in learning through active solving of real problems, bolstering student motivation and understanding."

> "In addition to standard measures of achievement, indicators of success include student excitement about coming to school, enthusiasm for learning and a passionate interest in the world. Students exhibit confidence and perseverance when faced with a challenge…"

Select one from scale: 0 = not observed, 1 – minimal, 2 – to some extent; 3=very descriptive of the observation.

6a. Students were behaviorally engaged. - Students followed directions, responded to teachers' questions - Students were actively engaged in the task - There was a lack of off-task behavior - Students volunteered to solve a problem or demonstrate an experiment in front of the class
6b. The time in class was spent productively on meaningful tasks. - The classroom appeared orderly and well managed, the teacher provided clear instructions on what to do - The time was mostly spent on tasks that advanced learning vs activities that contributed little to learning - The pace of the lesson was appropriate to accommodate most students - Students knew what to do both at the time of engagement in tasks and at transitions, there was little wandering around - There were minimal disruptions of time for learning - All tasks and materials were always ready and provided timely with minimum time spent in transitions - Time cues were provided to students - Students who finished their tasks early were provided with additional tasks promptly or knew what to do - The teacher was fully prepared for the lesson
6c. Teacher pursued the active engagement of <u>all</u> students. - The teacher noticed when some students were not engaged and actively re-engaged them with a task or discussion - The teacher pursued cognitive engagement of all students, giving them all opportunity to participate in problem solving, group work, and discussions
6d. Students appeared cognitively engaged. - Students actively listened to the teacher - Students asked questions of the teacher and each other related to the content and ideas being discussed - Students shared their ideas - Students followed up on each other's responses - There was a clear evidence of students working/thinking hard on a problem or activity
6e. Students showed perseverance when solving math/science problems. - There was evidence that students didn't give up a math or science problem/task when they encountered difficulties or obstacles - Students sought help from their peers before they asked for help from a teacher - Students tried different strategies and didn't just wait for a teacher to show them how to solve a problem - There was an evidence that students were confident that if they apply enough effort, they will be able to complete their assignment
Summary: Elements 6a-6d must be rated high (3 or 4) for a high summary rating. Element 6e is important but may be difficult to observe, so its absence should not decrease the summary rating.

Record specific examples below.

7. Use of Technology

NCNS promotes a "heavy and meaningful integration of technology" in the classroom.
Any electronic equipment would count as technology. Examples include computers, calculators, cell phones, smart boards and clickers, computer projectors with access to internet, video equipment, GPS, etc.

Select one from scale: 0 = not observed, 1 – minimal, 2 – to some extent; 3=very descriptive of the observation.

7a. **Technology was used to a high extent (as a proportion of time of the lesson and intensity of use)** - use a weight metaphor
7b. **Students used technology to explore or confirm relationships, ideas, hypotheses, or develop conceptual understanding.** - The use of technology helped students visualize a complex concept - Students used technology to explore underlying patterns
7c. **Students used technology to generate or manipulate one or more representations of a given concept or idea.** - Students use web applets to manipulate and view 3D geometric shapes
7d. **Students used technology as a tool to meet a discreet instructional outcome (like an assignment or specific objective).** - Using calculators to speed up calculations while working on a different instructional goal
7e. **Students used technology to practice skills or reinforce knowledge.** - Working on practice problems on a computer
7f. **Technology was used but did not appear to provide any added benefit.** - Students used a SMART board as a regular white board - Technology adds time to complete tasks (does not work well, there are glitches) with not much benefit
7g. *Teacher* used technology to achieve instructional goals. (Emphasis on the "teacher" here)
Summary: *Use of technology* The summary rating denotes the quality and appropriateness of technology use (elements 5b, 5c and 5f (reverse), but also considers the extent of use (element 5a). The following is the descriptions of the summary ratings. 0 = technology used minimally or not at all **1 = Replacement.** Technology used to replace and in no way change established instructional practices, student learning processes, or content goals. The technology serves merely as a different means to the same instructional end. Most of the learning activities might be done as well or better without technology. Examples: - Using an interactive whiteboard for the same purposes as a chalkboard - Using calculators for simple calculations **2 = Amplification.** Technology used to amplify current instructional practices, student learning, or content goals, oftentimes resulting in increased efficiency and productivity. The focus is effectiveness or streamlining, not fundamental change. Examples: - Using a word processor rather than written materials for instructional preparation) - Using clickers with multiple answer choices (A, B, C) instead of index cards with the same choices. In addition to seeing the answers from all students at once, the teacher can also get the summary statistics on the board (% of specific answers). - Using calculators for complex calculations - Using calculators to graph and analyze functions (added benefit: possibility of seeing all different ranges of the graph by changing the window, and have exact values in between point that are graphed by hand.) **3 = Transformation.** Technology used to transform the instructional method, the students' learning processes, and/or the actual subject matter. Technology is not merely a tool, but rather an instrument of mentality. The focus is fundamental change, redefining the possibilities of education. Most technology uses represent learning

activities that could not otherwise be easily done. Examples:
- Using StorySpace software to write hypertext narratives
- Using interactive applet for analyzing functions which connects the graph, and the coefficients of the function equation in such a way that when the coefficients are manipulated, the graph changes accordingly (and vice versa)
- Using simulation software to manipulate/study an ecological system.

Record specific examples below.

8. Classroom Culture

Select one from scale: 0 = not observed, 1 – minimal, 2 – to some extent; 3=very descriptive of the observation.

8a. Students exhibited positive classroom behavior.
- Students clearly knew the classroom rules and followed them
- Students talked when appropriate, asked appropriate questions

8b. The classroom exhibited a respectful environment.
- Students exhibited respect to the teacher and other students
- Teacher exhibited respect to students
- Students and teacher used respectful language and warm calm voice
- Students and teacher listened to each other, they called each other by name

8c. There was encouragement for students' ideas, questions, and contributions; mistakes are viewed as an opportunity to learn.
- Students' ideas and questions were welcomed and solicited by the teacher
- Students were comfortable asking questions and suggesting ideas
- Students questions were answered or discussed
- Students ideas were respected and discussed
- Students were comfortable if they made a mistake
- Students' mistakes were used as an opportunity to learn

8d. Students and teacher appear to have positive relationships and enjoy spending time with each other.
- Students and teacher showed enthusiasm for being together
- Students and teacher laughed and smiled together and shared a positive affect
- Students and teacher engaged in positive conversations, there was social peer interaction
- Evidence of students and teacher being comfortable with physical proximity to each other
- Evidence of warm relationships and an emotional connection between students and teacher

8e. Students actively sought and/or provided assistance or guidance.
- Students were easily and actively seeking help from their peers and from the teacher
- Students and teacher showed cooperation with each others' needs and requests
- Students and teacher showed concern and desire to help if one of their peers is upset, frustrated, or confused

8f. Teachers and students provided positive reinforcement and feedback to each other.
- Either students and/or teacher showed positive expectations of each other
- Either students and/or teacher made positive comments to each other
- Either students and/or teachers praised each other.

Summary: High rating (3 or 4) on three of the four elements 8a-8d warrants a high overall rating. Elements 8e/8f contribute to the overall rating, but absence of either would not be reason for a low score.

Record specific examples below.