Washington State LASER Leadership and Assistance for Science Education Reform

Science Classroom Observation Protocol

Washington State's Vision of Effective Science Learning Experiences for Students

Developed by RMC Research Corporation in collaboration with the LASER leadership, Regional Alliance directors and staff, and the Washington State Science Coordinators

August 2010

This document contains science classes observation protocol that align with the vision of effective science instruction encouraged by Washington State LASER through the network of Regional Alliances and the network science coordinators.

Science Classroom Observation Protocol Overview

Informed by cognitive research about how students learn science, the science leadership in Washington State has developed a shared vision and a science theory of action of effective science learning experiences for students (Banilower, 2009; Donovan, 2005; Michaels, 2008; NRC, 2008). That is:

Student science achievement and student interest in science subjects and careers will improve if teachers consistently use research-based instructional practices, materials, and assessments so that each student:

- *Reveals preconceptions, initial reasoning, and beliefs;*
- *Is intellectually engaged;*
- *Uses evidence to generate explanations;*
- *Communicates and critiques their scientific ideas and the ideas of others;*
- *Makes sense of the learning experience and draws appropriate understandings;*
- *Makes connections between new and existing scientific concepts by understanding and organizing facts and information in new ways; and*
- *Reflects on how personal understanding has changed over time and recognizes cognitive processes that lead to changes*

The development of the science theory of action was driven by the need to provide greater clarity about current research in science education to guide the development of future science professional development. This effort directly addresses a major barrier to improving student achievement. According to City, "In most instances, principals, lead teachers, and system-level administrators are trying to improve the performance of their schools without knowing what the actual practice would have to look like to get the results they want at the classroom level." There is often a "lack of an agreed-upon definition of what high-quality instruction looks like." (City, 2009). The Science theory of action directly addresses this concern. The Science Classroom Observation Protocol is a tool designed to help science educators and researchers understand what the effective science learning experiences would look like among students and to gather data to determine the degree to which students are engaged in these experiences as a result of the science instructional practices within a school.

The protocol contains the following instruments:

Science Classroom Observation Rubric—The first column of this rubric contains a series of traits that are indicators of various aspects of effective learning experiences for students. For each trait the body of the rubric provides a description of the trait in practice on a scale that ranges from ***not observed*** (0) to ***very evident*** (6) during the observation. Another use of this rubric is to illuminate growth along a professional development path toward more effective implementation of the science theory of action.

Science Classroom Observation Worksheet—This worksheet is designed for use ***by researchers*** who would like to collect quantitative data about science instructional practice relating to the science theory of action for research or evaluation purposes. It is not recommended that this worksheet be used by teachers to rate classroom practice of their peers or for use by administrators to evaluate teacher performance. The worksheet is intended to be used in conjunction with the rubric and it provides a tool for the observer to rate and summarize what they observed.

Science Classroom Visitation Trait Reference Sheet—This 1-page reference sheet is a very abbreviated version of the rubric describing only the ideal (score of 6) as a quick reference.

Science Classroom Visitation Worksheet—This worksheet is designed for use by science teachers who are observing science classrooms as part of a professional development experience. It corresponds to the rubric but does not provide a means of rating what is observed. Instead, this document enables the teacher to organize the objective evidence they collect during the observations according to trait.

Possible Uses

The table below describes several possible uses for this tool and identifies which forms are most appropriate for each use.

Possible Use	Observation Rubric	Observation Worksheet	Reference Sheet	Visitation Worksheet
Inservice Professional Development: In this case the tools are used by teachers or administrators to collect evidence of student learning by observing classes or watching videos as part of a professional development experience. This work may focus on specific traits found in the tool that the teachers identify as an area where they would like to improve their professional practice. For example, teachers may identify that they would like to practice ways to engage students in metacognition as part of the lesson closure. In this case, teachers may collaborate on refining strategies for a specific lesson. The other teachers would then observe a volunteer teacher implementing the strategy during a class or on a video to see how students react to the strategy and whether the strategy has the desired effect. Teachers would use the tool to organize and record their evidence in preparation of a debriefing among the observers. The debriefing would focus on collaboratively examining the evidence and identifying ways to make instructional practice more effective at engaging students in productive learning experiences.			✓	✓
Preservice Professional Development: Teacher preparation programs would find the tool useful to help preservice teachers understand how high quality instructional practice engage students cognitively. This could be accomplished by using the instrument to record observations by watching videos or by observing classrooms directly.	✓			✓
Leadership Walk-Throughs (Instructional Rounds)**:** In this scenario, teams of science instructional leaders and administrators use the tool during and after walk-throughs of many science classes in a school in order to get a general sense of the kind of science learning experiences students are being offered. The information collected would inform planning of professional development or other science improvement efforts. This strategy involves collecting brief snapshots of students participating in science across a wide range of science classes. Observers would be in a science class for a short period of time (15 minutes) to collect evidence of students' experiences that relate to the traits on the instrument. These snapshots would be collected from all teachers of science in the school across all grade levels and times of the day. Each team member would individually use the tool to organize the evidence collected during the walk-throughs in preparation for a debriefing. During the debriefing team members would share their findings and develop a broad picture of the kind of science experiences available to students in their school. The debriefing would be followed by planning to address the results of the walk-throughs.			✓	✓
Data Collection for Research of Evaluation: Researchers or evaluators would use the tool to formally collect data. In this case the tool would need to be used under more rigorous standards by observers who have been trained on the use of the tool and who have a deep understanding of science instructional practice. See the section titled Using the Science Classroom Observation Worksheet	✓	✓		

Other Uses: There are many other uses for this tool that would be appropriate; however, the tool is ***not intended for individual science teacher evaluation***.

Using the Science Classroom Observation Worksheet

The observation worksheet is designed for use ***by researchers or evaluators*** to collect quantitative data from classroom observations. In this case, the observer would use the observation worksheet to record their judgment about which cell on the observation rubric best describes what they observed in the classroom. During the visit, observers are encouraged to record their observations on a regular tablet and then use this observation worksheet to organize those observations by trait and to provide a rationale for their rating. The observation worksheet also contains interview questions that the observer may use before and after the observation in order to collect information about the context of the session observed.

The observation worksheet does not contain a N/A (not applicable) box or rating. For research and evaluation purposes, it is important to collect data for all traits because the evaluation is concerned which traits are evident across multiple observations. Therefore, if a trait is not evident during a particular observation, but you feel the teacher will address the trait in some future lesson, the trait should still be scored zero (0). You should not rate a trait higher than 0 if you did not observe it during your observation period. Since it is not likely that all traits will be addressed during a single lesson, some researchers have elected to define an observation to consist of multiple lessons that develop a single topic or concept. In this case a single observation may involve observing many lessons. In the research or evaluation design, it is important to define which approach you wish to use, 1) observation of single lessons across many teachers, or 2) observation of all lesson that address a single topic or concept across fewer teachers.

Below are several tips to take into consideration when collecting classroom observation data.

- Adhere to all normal protocol when observing classes that relate to your role. This may include obtaining permission from the administrator and teacher or signing in when you visit the school.
- Meet briefly with the teacher of the class you plan to observe prior to observation and ask the pre-observation questions provided on the worksheet in order to gather information about the lesson and the classroom context.
- It is important that the lesson observed be a typical lesson. Therefore, do not indicate to the teacher what it is that you are looking for because then the teacher will feel obligated to show you that and will adjust their lesson accordingly. Do not share the observation rubric or worksheet with the teacher because they will try to address all of the traits for you which is nearly impossible to do in a single lesson.
- During each observation take notes on separate paper. Avoid interactions with students and do not become a teaching assistant by helping students with the activity. It may be necessary to quietly ask a few students a question or two to check their understanding. Focus your observation on what the students are doing and saying looking for evidence that they are learning the desired content. Do not focus your observation on the teacher.
- If possible, after the lesson is finished, ask the teacher the post-observations questions on the worksheet to get a better understanding of the lesson from the teacher's perspective.
- After the observation, refer to the rubric and your notes to complete the observation worksheet. Rate the lesson you observed according to each trait on the rubric by finding the cell that best describes what you saw among students during the observation. Provide a brief non-judgmental description of the evidence you observed. If a trait was not observed during the observation, it should be given a 0 rating.

Using the Science Classroom Visitation Worksheet

The visitation worksheet is intended for use in conjunction with professional development and contains a section for each trait on the observation rubric. It is important to note that it is <u>very unlikely that an observer will find evidence of all of the traits during any single classroom visit</u>. The traits provide a way of organizing what is observed in a manner that facilitates interpretation. If it is clear that a trait was not addressed during the session observed, the N/A box would be checked. The tool also contains a definition of the trait and provides a space to describe the evidence observation. During the visit, observers are encouraged to record their observations on a regular tablet and then use this visitation worksheet to organize those observations by trait and to objectively describe the evidence observed individually before reconvening for a debriefing of the evidence observed. The visitation worksheet also contains interview questions that the observer may use before and after the observation in order to collect information about the context of the session observed.

The visitation worksheet intentionally does not contain a rating scale or any means of encouraging the observer to make judgments about what they observe. Therefore, in the descriptive statement that the observer records, it is extremely important to describe what is observed, NOT the opinion of the observer regarding its quality (City, 2009). **Do not** use judgmental words or phrases when recording evidence. For example statements such as, "The teacher did a good job encouraging students to interpret data" is a statement that captures the opinion of the observer but is not at all helpful during a debriefing to understand what students are experiencing. Statements such as, "I observed two students discussing an anomaly in the data they collected during the experiment. The students could not agree on a possible explanation. The teacher, having overheard the discussion asked, the students, 'How could you find out which one of you has the most likely explanation for the anomaly?'" is an example of a description of the discussion which is much more useful to help understand what students are experiencing as a result of their science instruction.

References

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Michaels, S., Shouse, A., & Schweingruber, H. (2008). *Ready, set, science: Putting research to work in K-8 science classrooms*. Washington D.C: National Academies Press.

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Credits

To develop the Science Classroom Observation Protocol for Washington State LASER, RMC Research built upon the work of several other organizations and projects.

- RMC Research Science Classroom Observation Rubric, RMC Research Corporation for Washington State LASER Sentinel Site Visitation Study, Supported by the Washington State Legislature.
- Research on the Effectiveness of the Observing for Evidence of Learning Professional Development Model for Improving Grades 6-8 Science Instruction, Institute for Systems Biology, Supported by the National Science Foundation under Grant No.DRL 0455735.
- North Cascades and Olympic Science Partnership (NCOSP), Western Washington University, Supported by the National Science Foundation under Grant No. EHR-0315060.
- Local Systemic Change through Teacher Enhancement Classroom Observation Protocol, Horizon Research Inc., Supported by the National Science Foundation under Grant No. DRL-9912485.

Science Classroom Observation Rubric

No.	Trait	0	2	4	6
Learning Objectives—The teacher stated learning objectives were clear, aligned with lesson activities, and communicated to students.					
1	**Stated Objectives**	The teacher stated learning objectives described what students were going to do rather what they were going to learn.	The teacher stated learning objectives were limited to science skills and facts with little attention to any related science concepts.	The teacher stated learning objectives focused on the content but did not clearly convey the important and enduring science concepts (big ideas).	The teacher stated learning objectives focused on the content and very clearly conveyed the important and enduring science concepts (big ideas) in student friendly language.
2	**Alignment of Lesson Activities**	Lesson activities did not address the stated learning objectives. There was a clear mismatch between the stated learning objectives and the lesson activities.	Lesson activities addressed the stated learning objectives to some extent or poorly. It was difficult to understand how the lesson activities would lead to deeper student understanding of the learning objectives.	Lesson activities addressed the stated learning objectives but there was some question about how the lesson activities would lead to a deeper student understanding of the learning objectives.	Lesson activities directly addressed the stated learning objectives. It was very clear how the lesson activities would lead to a deeper student understanding of the learning objectives.
3	**Understanding of Purpose**	Throughout the lesson, students did not understand why they were doing each activity and, instead, most students were mechanically following a prescribed sequence of instructions.	Throughout the lesson, some students understood why they were doing each activity but the purpose of activities was not sufficiently clear.	Throughout the lesson, many students understood why they were doing each activity but the purpose of activities could have been more explicit.	Throughout the lesson, most of the students clearly understood why they were doing each activity.
Developing Understanding—Students constructed their own understanding based concrete experiences and evidence.					
4	**Elicitation of Prior Understanding**	Students did not have the opportunity to articulate their current understanding of the science content. The class as a whole did not recognize the range of preexisting ideas held among their peers.	A few students had the opportunity to articulate their current understanding of the science content but the class as a whole did not sufficiently recognize the range of preexisting ideas held among their peers.	Some students had the opportunity to articulate their current understanding of the science content but the class as a whole only vaguely recognize the range of preexisting ideas held among their peers.	Most students had the opportunity to articulate their current understanding of the science content and students recognize the range of preexisting ideas held among their peers.
5	**Intellectual Engagement**	Students were generally intellectually unengaged with the science content related to the lesson activities.	A few of the students were intellectually engaged with the science content related to the lesson activities. The lesson challenged a few students to think at high cognitive levels.	Some of the students were intellectually engaged with the science content related to the lesson activities. The lesson challenged some students to think at high cognitive levels.	Most of the students were intellectually engaged with the science content related to the lesson activities. The learning tasks challenged most students to think at high cognitive levels.
6	**Use of Evidence**	Students did not have any opportunities to use evidence to explain their reasoning, back up their claims, or critique claims made by others.	A few students used evidence to explain their reasoning, back up their claims, or critique claims made by others.	Some students used evidence to explain their reasoning, back up their claims, or critique claims made by others.	Most students used evidence to explain their reasoning, back up their claims, or critique claims made by others.
7	**Application of Science**	There was no opportunity for students to apply something they learned in the lesson to a new context.	A few students applied something they learned in the lesson to a new context.	Some students applied something they learned in the lesson to a new context.	Most of the students applied what they learned in the lesson to a new context.

No.	Trait	0	2	4	6
8	**Formative Assessment**	There was little or no evidence that the teacher assessed the depth of student understanding of the learning objectives.	The teacher rarely assessed the depth of student understanding of the learning objectives, and when appropriate, adjusted instruction accordingly.	The teacher occasionally assessed the depth of student understanding of the learning objectives, and when appropriate, adjusted instruction accordingly.	The teacher continually assessed the depth of student understanding of the learning objectives, and when appropriate, adjusted instruction accordingly.
Sense-Making—Students make sense of the intended science concepts.					
9	**Making Connections**	Students had no opportunity to make connections between new and preexisting scientific concepts.	Few students made connections between new and preexisting scientific concepts.	Some students made connections between new and preexisting scientific concepts by organizing facts and information in new ways.	Most students made connections between new and preexisting scientific concepts by organizing facts and information in new ways.
10	**Construction of Understanding**	Students did not have any opportunity to make sense out of how the lesson related to science concepts.	The teacher provided a brief review, but students did not have an opportunity to fully make sense out of how the lesson related to science concepts.	Students had some opportunity to make sense of the science concepts addressed but it was unclear whether most students drew conclusions that agree with current scientific knowledge.	Students had ample opportunity to make sense of the science concepts addressed and the conclusions reached by most students agree with current scientific knowledge.
11	**Reflection and Meta-cognition**	Students did not have an opportunity to reflect on their thinking at all.	Students had some opportunity to reflect on their thinking but students did not identify ways in which their thinking was reinforced or changed.	Students had an opportunity to reflect on their thinking and some could identify ways in which their thinking about the science concepts was reinforced or changed.	Students had ample opportunity to reflect on their thinking and most could identify what in their thinking about the science concepts was reinforced or changed and which learning experiences led to the changes.
Classroom Culture—Classroom was a positive, motivating, safe, and challenging learning environment.					
12	**Classroom Discourse**	Classroom culture did not support and encourage student discourse.	Generally students and teachers support and encourage respectful and constructive discourse but some students exhibit a disregard for the ideas of others.	For the most part, students and teachers support and encourage respectful and constructive discourse, however only some students seem comfortable asking questions, making claims, backing up their own claims, or critiquing claims made by others.	Students and teachers support and encourage respectful and constructive discourse. The classroom culture is one within which most students ask questions, make claims, back up their own claims, or critique claims made by others.
13	**Motivation**	The lesson did little or nothing to motivate students to learn the related content.	Students were extrinsically motivated to learn the related content by a desire to do well on a test, get an acceptable grade, meet a deadline, win a competition, etc. The lesson failed to stimulate intrinsic motivation.	The lesson provided mostly extrinsic and some intrinsic motivation. The intrinsic motivation was truncated by the lesson structure and was relatively short lived.	The lesson provided an appropriate balance of extrinsic (i.e., due dates, requirements, preparing for assessments) and intrinsic (I.e., appealing to students' interest, addressing a relevant topic, creating a desire to resolve a discrepancy, or creating cognitive dissonance) motivation.

Science Classroom Observation Worksheet

School & District: ____ **Date**: ____________________________

Teacher: ____ **Grade/Subject**: ____________________________

Observer: ____

Learning Objectives

Rationale for Rating	Rating
1. Stated Objectives	
	0 1 2 3 4 5 6
2. Alignment of Lesson Activities	
	0 1 2 3 4 5 6
3. Understanding of Purpose	
	0 1 2 3 4 5 6

Developing Understanding

Rationale for Rating	Rating
4. Elicitation of Prior Understanding	
	0 1 2 3 4 5 6

5. Intellectual Engagement

0 1 2 3 4 5 6

6. Use of Evidence

0 1 2 3 4 5 6

7. Application of Science

0 1 2 3 4 5 6

8. Formative Assessment

0 1 2 3 4 5 6

Sense-Making

Rationale for Rating **Rating**

9. Making Connections

0 1 2 3 4 5 6

10. Constructing Understanding

0 1 2 3 4 5 6

11. Reflection and Meta-cognition

0 1 2 3 4 5 6

Classroom Culture

<u>**Rationale for Rating**</u> <u>**Rating**</u>

12. Classroom Discourse

0 1 2 3 4 5 6

13. Motivation

0 1 2 3 4 5 6

Teacher Interview Questions

Pre-Observation Questions

- What is the name of the instructional module in use?
- What topics has this class covered recently?
- What do you anticipate doing with the class today?
- **What do you expect students to learn during this lesson?**
- What, if anything, should I know about the students in this class?

Notes:

Post-Observation Questions

- How did this lesson turn out compared to what you planned? What, if any, differences occurred?
- How typical was this lesson for your students?
- What do you think the students learned from this lesson, and what do they still need to learn? What causes you to say that?
- What follow-up experiences will students receive and what are the important science concepts the students will learn?

Notes:

Science Classroom Visitation Trait Reference Sheet

Learning Objectives

1. **Stated Objectives**—The teacher stated learning objectives focused on the content and conveyed the important and enduring science concepts (big ideas) in student friendly language.
2. **Alignment of Lesson Activities—**Lesson activities directly addressed the stated learning objectives and how the activities would lead to a deeper student understanding of the learning objectives.
3. **Understanding of Purpose—**Throughout the lesson, students understood why they were doing each activity.

Developing Understanding

4. **Elicitation of Prior Understanding—**Students had the opportunity to articulate their current understanding of the science content and students recognize the range of preexisting ideas held among their peers.
5. **Intellectual Engagement**—Students were intellectually engaged with the science content related to the lesson activities. The learning tasks challenged students to think at high cognitive levels.
6. **Use of Evidence**—Students used evidence to explain their reasoning, back up their claims, or critique claims made by others.
7. **Application of Science—**Students applied what they learned in the lesson to a new context.
8. **Formative Assessment**—The teacher continually assessed the depth of student understanding of the learning objectives, and when appropriate, adjusted instruction accordingly.

Sense-Making

9. **Making Connections—**Students made connections between new and preexisting scientific concepts by organizing facts and information in new ways.
10. **Construction of Understanding—**Students had an opportunity to make sense of the science concepts addressed and the conclusions reached by students agree with current scientific knowledge.
11. **Reflection and Meta-cognition**—Students had an opportunity to reflect on their thinking and they could identify what in their thinking about the science concepts was reinforced or changed and which learning experiences led to the changes.

Classroom Culture

12. **Classroom Discourse**—Students and teachers support and encourage respectful and constructive discourse. The classroom culture is one within which students ask questions, make claims, back up their own claims, or critique claims made by others.
13. **Motivation—**The lesson provided an appropriate balance of extrinsic (i.e., due dates, requirements, preparing for assessments) and intrinsic (i.e., appealing to students' interest, addressing a relevant topic, creating a desire to resolve a discrepancy, or creating cognitive dissonance) motivation.

Science Classroom Visitation Worksheet

School & District: ____

Teacher No: ______ **Grade/Subject**: ___________________________ **Date**: _________________________

Observer: ____

Definition	**Evidence**
1. Learning Objectives—Stated Objectives.	❑ N/A
The teacher stated learning objectives focused on the content and conveyed the important and enduring science concepts (big ideas) in student friendly language.	
2. Learning Objectives—Alignment of Lesson Activities	❑ N/A
Lesson activities directly addressed the stated learning objectives and how the activities would lead to a deeper student understanding of the learning objectives.	
3. Learning Objectives—Understanding of Purpose	❑ N/A
Throughout the lesson, students understood why they were doing each activity.	

Definition	Evidence

4. Developing Understanding—Elicitation of Prior Understanding ❑ N/A

Students had the opportunity to articulate their current understanding of the science content and students recognize the range of preexisting ideas held among their peers.

5. Developing Understanding—Intellectual Engagement ❑ N/A

Students were intellectually engaged with the science content related to the lesson activities. The learning tasks challenged students to think at high cognitive levels.

6. Developing Understanding—Use of Evidence ❑ N/A

Students used evidence to explain their reasoning, back up their claims, or critique claims made by others.

7. Developing Understanding—Application of Science ❑ N/A

Students applied what they learned in the lesson to a new context.

Definition	Evidence
8. Developing Understanding—Formative Assessment ❑ N/A	
The teacher continually assessed the depth of student understanding of the learning objectives, and when appropriate, adjusted instruction accordingly.	
9. Sense-Making—Making Connections ❑ N/A	
Students made connections between new and preexisting scientific concepts by organizing facts and information in new ways.	
10. Sense-Making—Construction of Understanding ❑ N/A	
Students had an opportunity to make sense of the science concepts addressed and the conclusions reached by students agree with current scientific knowledge.	
11. Sense-Making—Reflection and Meta-cognition ❑ N/A	
Students had an opportunity to reflect on their thinking and they could identify what in their thinking about the science concepts was reinforced or changed and which learning experiences led to the changes.	

Definition	Evidence
12. Classroom Culture—Classroom Discourse	❑ N/A
Students and teachers support and encourage respectful and constructive discourse. The classroom culture is one within which most students ask questions, make claims, back up their own claims, or critique claims made by others.	
13. Classroom Culture—Motivation	❑ N/A
The lesson provided an appropriate balance of extrinsic (i.e., due dates, requirements, preparing for assessments) and intrinsic (I.e., appealing to students' interest, addressing a relevant topic, creating a desire to resolve a discrepancy, or creating cognitive dissonance) motivation.	

Other Comments:

Teacher Interview Questions

Planning Conversation Questions

- What is the name of the instructional module in use?
- What topics has this class covered recently?
- What do you anticipate doing with the class today?
- **What do you expect students to learn during this lesson?**
- What, if anything, should I know about the students in this class?

Notes:

Reflective Conversation Questions

- How did this lesson turn out compared to what you planned? What, if any, differences occured?
- How typical was this lesson for your students?
- What do you think the students learned from this lesson, and what do they still need to learn? What causes you to say that?
- What follow-up experiences will students receive and what are the important science concepts the students will learn?

Notes: