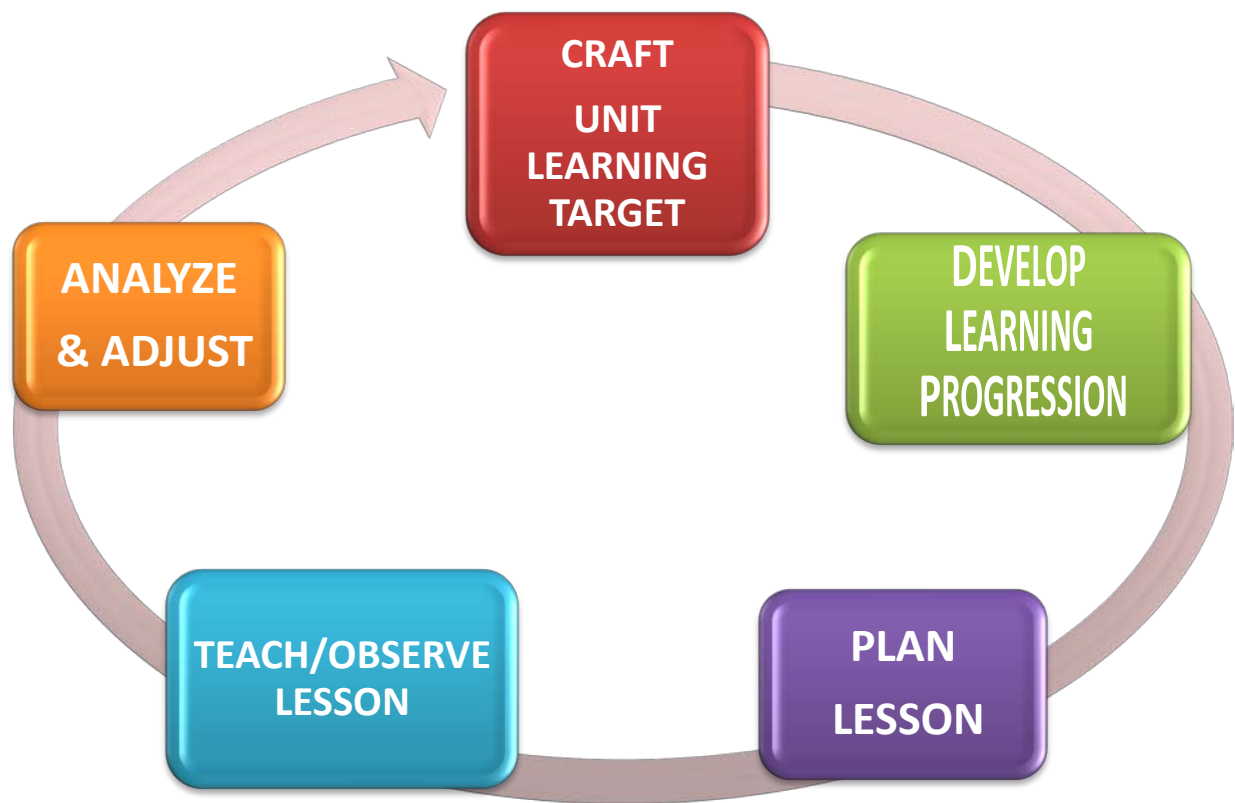


Math and Science Collaborative Inquiry Cycle



Math & Science Collaborative Inquiry Project

Step 1: Craft Unit Learning Target

- What do we want students to know and be able to do?
- What do our students already know?

Creating a lesson from unique community data inside a collaborative dialogue sets the stage for relevant, appropriate learning. What is relevant and appropriate becomes the most fundamental goal of all: student understanding. Lessons focus on what teachers want students to learn and know, rather than on what teachers plan to teach.

The team developing the lesson should begin by selecting a theme which captures school-wide goals as well as relevant academic content goals for students. If teachers in the group are from a single grade level, they will choose a subject area in which to focus their work. That work may be chosen by weak performances from standardized data and/or a district sequence appropriate for the collaborative time available. Whatever the chosen focus is, it will come through the filter of: *What do we want students to know, understand, and be able to do when the lesson is done?* Part of the answer to that question emerges as the team considers how this lesson links to other lessons and how it links to other grades.

If a vision describes the desired future and data analysis describes the current reality, goals are the benchmarks or milestones to assess progress toward the vision. "Vision may inspire, but goals foster immediate accountability," says Richard Dufour and Robert Eaker (1998) who liken goals to the "ports of call on the journey toward improvement" (p.203). On the other hand, according to Michael Schmoker, the absence of explicit learning goals is "the most striking, self-defeating, contradictory characteristic of schools and our efforts to improve them" (p.23).

According to Schmoker (2002), learning goals should target the lowest-scoring (standards) where achievement is low. Setting goals for students involves analyzing student's needs and confronting disparities in achievement between different populations of students. It is essential that goals for student learning specifically address closing achievement gaps where applicable and expanding learning opportunities to all students.

Adapted from *Designing Professional Development for Teachers of Science and Mathematics* (2010) by Susan Loucks-Horsley, et al.

Dufour, R., & Eaker, R. (1998). *Professional learning communities at work*. Bloomington, IN: National Educational Services.

Schmoker, M. (2002). Up and away. The formula is well known, now we need to follow it. *Journal of Staff Development*. 23 (2), 10-13.

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ESTABLISH THE UNIT LEARNING TARGET

1. TARGET:

- Your target is to select a Performance Expectation (or part of a PE) as a Unit Learning Target; and
- Build language that makes a SMART goal for students' academic performances.
- Use the lenses that follow to influence decisions.

2. DATA:

- Look at driving data for your school (MSP or any other standardized tool) and interpret your grade level.
- Local data can bring another look at strengths and weakness. If you happen to use MAP regularly, a placement test from a publisher, or any other mechanism, you certainly should use this as a tool for analysis of your population's academic identity.

3. ANECDOTAL OBSERVATIONS:

- Anecdotal observations (which may be introspective about your personal needs or the systemic work environment in which you work) need to be recorded. That can include perceived voids from a given text series, your personal educational background, strands that time never allows for adequate coverage, required lesson adherence, etc. Also,
- Describe where you may need support in background knowledge to feel more confident in presenting learning opportunities for students.

4. DEMOGRAPHICS:

- Characterize your community's makeup:
 - SES;
 - Free-and-reduced percent;
 - Ethnic minorities;
 - ELL; and any other important considerations.

5. ENVIRONMENT:

- Last, frame students with their environment for opportunities for learning.
- Is there a district or school goal that needs to be incorporated?

6. BUILD A CONSENSUS OF YOUR SELECTED UNIT LEARNING TARGET.

MATERIALS (SUGGESTED):

- Washington State Mathematics Standards
- MAP scores
- Any local data
- Demographic profile through the OSPI website or your own district site.
- District or text scope and sequencing guide

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Step 2: Develop Learning Progression

- What are necessary building blocks for success with this Learning Target?
- Upon which building block will we focus our lesson?

A “learning progression” is a sequenced set of building blocks (that is, subskills or bodies of enabling knowledge) that students must learn to master a larger Unit Learning Target. Because the instructional pursuit of almost any high level cognitive outcome will involve students mastering certain along-the-way building blocks, such as a key body of enabling knowledge or a significant cognitive subskill, the most pedagogically astute way to structure the evidence gathering is to find out whether students have successfully mastered the building blocks in a learning progression. A well-crafted learning progression – one that is not too complicated--constitutes the foundation of effective formative assessment. Formative assessment without a learning progression is akin to a human body without bones. Neither of them can stand up well.

The heart of formative assessment is its constant reliance of the use of assessment-elicited evidence to make adjustment decisions. In classrooms where formative assessment is working properly, there is continuing attention to the measured effect of whatever teaching and learning procedures are being used.

Two Key Preliminary Considerations:

The number of building blocks. To keep a learning progression sufficiently lean so that it is likely to be used, the only building blocks to include are those for which you plan to collect assessment evidence.

The “grain size” of the building blocks. The second issue to face before setting out to create a learning progression: the grain-size of a building block reflects the nature of the content it comprises. Is it small, specific, or simple, or is it large, ambiguous, or complex? A building block of enabling knowledge might range from a “small” amount of knowledge to mastery of quite a large collection of content. Similarly, a subskill building block might be a simple, fairly low-level cognitive skill or something far more demanding. One useful way to think about the grain size of a building block is to focus on the amount of instructional time it will take to get students to master them. Large building blocks are those requiring substantial amounts of instructional time; small building blocks are those requiring far less instructional time.

Popham, W.J., (2008) *Transformative assessment*. Alexandria, VA: ASCD.

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DEVELOP A LEARNING PROGRESSION

1. Identify all of the sub- skills and knowledge needed to reach your learning target. The collaborative inquiry team will physically work through the math or science expected of students. Team members will examine this work/process through the lenses of both teachers and students. This is the best way to identify the necessary Building Blocks of the math and identify possible misconceptions.
2. Place the Building Blocks in the best instructional sequence needed to bring understanding to the learning target. Working with the Learning Progression Template or materials from their own district, team members will use their expertise and experience in determining the best order in which to master the Building Blocks, or subskills. To keep the Learning Progression concise, it is recommended to only include those Building Blocks that you intend to assess. Note: It is possible, or even likely, that the students will already have some of the identified skills or knowledge.
3. Select just one of these Building Blocks to be the focus of the lesson in steps three, four, and five of the Collaborative Inquiry Cycle.
4. Write at least one formative assessment for this Building Block that is:
 - Diagnostic of student understanding
 - Quick
 - Informative for the next step.
5. Use your Building Block target and formative assessment to inform your lesson planning.

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Step 3: Plan Lesson

- What do you want the students to be able to do?
- What criteria will indicate evidence of student success?

In the third step of a Collaborative Inquiry Cycle, the team designs a lesson focused on student understanding of the lesson learning target. If the members of the team have time, study of existing quality lessons will benefit their planning.¹ The lesson they develop may be built on one of these quality lessons, or it may be built on the lesson provided in the present unit of study. If the lesson learning target addresses a state standard that is not included in the District's curricula, finding a related, existing, quality lesson to build on may be the most efficient way to plan and move students forward.

In order to better understand the learning target and the skills required, each member of the group first engages in thoughtful examination of strategies needed to solve the task, and notation is made of the strategies and skills the task requires. Those strategies and skills that represent or connect to prior knowledge are identified. The group also notes all the ways the problem may be solved. Drawing on this personal experience with the task and their knowledge of the classroom culture, the team begins drafting their lesson plan.

The lesson plan is more than a list of time, materials, and activities. Planning a lesson for collaborative study involves anticipating problems that may occur during the lesson and anticipating how these problems will be handled. In addition, the completed lesson framework includes plans for drawing out student preconceptions and developing procedures to help students make sense of new learning. Criteria and methods are identified for checking student understanding throughout the lesson, and the lesson flow ends with a formative assessment task designed to determine if there are any remaining misconceptions.

¹ Resources for quality existing lessons are listed in Appendix 7 of *Lesson Study: A Handbook*, by Catherine Lewis

Adapted from *Lesson Study: A Handbook of Teacher-Led Instructional Change* by Catherine C. Lewis

* Stigler, J.W. & Hiebert, J. (1999). *The Teaching Gap*. New York: Free Press.

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STEP 3: PLAN

GATHER PLANNING RESOURCES:

- Completed Unit Learning Progression
- Lesson Plan Guide
- Lesson Plan Template
- Teacher's Manual for unit of study
- Existing excellent lesson plans
- Other reference materials as needed

Record the Lesson Learning Target (selected from the completed Unit Learning Progression).

DO THE MATH/SCIENCE TO DETERMINE REQUISITE CONCEPTS AND SKILLS:

- Use the lenses of both learner and teacher. Examine your thinking.
- Record all concepts and skills you use to solve the task.
- Identify those concepts and skills that represent or connect to prior knowledge.
- Note all strategies and skills the task requires students to use.
- Record all known ways the task can be solved.

DETERMINE EVIDENCE OF STUDENT SUCCESS:

- Establish methods to check student skill development as the lesson progresses.
- Establish success criteria to determine evidence of student ability to meet the Lesson Learning Target.

ANTICIPATE:

- List the known ways to solve the task.
- Establish methods and language for responding to misconceptions.
- Establish feedback you will use to move students forward.
- Establish questions you will ask to help students clarify their thinking.
- Decide what you will be doing during student activity/group work.

DRAFT THE LESSON FLOW:

- Consider your personal experience with the task as you draft each step of the lesson.
- Allow sufficient time for the entire lesson to be taught in one session.
- Plan lesson steps with procedures designed to help students make sense of the task.
- List materials needed for each step of the lesson.
- Establish activity/ies to draw out each student's preconceptions and prerequisite skills.
- Establish activities that make students confront their misconceptions.
- Establish methods to motivate the students.
- Decide how to clarify learning intentions for each step of the lesson.
- Establish questions to ask that will move the lesson along.
- Decide what discussions, tasks, and activities you will use to elicit evidence of learning.
- Establish time to give students opportunity for reflection and sense-making.



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REMEMBER:

- Post the target visually
- Note any teaching practice you specifically want to apply during the lesson.
- Note any specific things you want to remember *not* to do.

CHECK FOR UNDERSTANDING:

- Decide what the students need to be able to do after each step of the lesson.
- Refer back to “Determine Evidence of Student Success;” in the lesson plan, note the methods and criteria you established.
- Allow time to administer the formative assessment you developed for this Lesson Learning Target (Refer to your Unit Learning Progression).
- Determine if there are any remaining misconceptions.

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Step 4: Teach/Observe the Lesson

- What evidence of learning are you searching for?
- What expected outcomes were not achieved?

Observing the collaboratively planned lesson allows the team to become the researchers and gather their own authentic data. This allows the team to see their lesson through the eyes of the students. What is the students' understanding of the subject matter? Are they authentically engaged, excited by the sense of discovery or are they ritually engaged, going through the motions only because this is what is expected? How are they handling the input of their peers? Teaching and observing the lesson carries it from theory to something tangible and utilitarian. It is important to remember that popular vehicles such as constructivism, technology, cooperative groups and others are only strategies; they are not learning goals in and of themselves. James Stigler and James Hiebert write:

*Reform documents that focus teachers' attention on features of "good teaching" in the absence of supporting contexts might actually divert attention away from the more important goals of student learning. They may inadvertently cause teachers to substitute the means for the ends – to define success in terms of specific features or activities instead of long-term improvements in learning.**

Theory and research about education are excellent starting points for reform and instructional improvement. However, every classroom or school is different, and each teacher will need to make a personal evaluation of the effectiveness of any technique they implement in the classroom. Lesson Observation enables teachers to develop the ability to gather evidence and see their instruction from the students' point of view.

Adapted from Lesson Study: A Handbook of Teacher-Led Instructional Change by Catherine C. Lewis

* Stigler, J.W. & Hiebert, J. (1999). *The teaching gap*. New York: Free Press.

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OBSERVING THE LESSON

BEFORE THE LESSON

- 1) Invite outside Observers:
 - Invite other teachers, administrators, and if possible at least one knowledgeable person from outside the school setting. The numbers of observers will depend on the comfort level of the participants and the space available at the site of the lesson.
- 2) Arrange classroom to allow space for the observers:
 - The lesson site should be arranged to allow the observers to circulate through the students' desks.
 - Consider adding chairs for the observers.
 - If possible the classroom should be arranged a week or so before the lesson, so that students can become used to the new layout.
- 3) Assign specific tasks to team members
 - Assign a recorder for whole task discussion sessions.
 - Assign members to observe and record specific student responses during the lesson.
 - Assign members to watch for the evidence of learning specified during the lesson planning session.
- 4) Arrange to meet with the team and observers for 30 minutes prior to the lesson.
 - Introduce observers if everyone has not already met.
 - Hand out required materials to all observers.
 - Go over points of evaluation with observers.
 - Go over lesson plan together.
 - Review observation protocols with team and observers.
- 5) Schedule a break of at least 10 minutes after the lesson before beginning the lesson analysis.

MATERIALS

- Observers' Guideline handouts
- Observation Recording Sheet
- Copies of the lesson plan
- Copies of the points of evaluation
- Copies of the seating chart with student first names (and last initial if necessary)
- Copies of any materials given to the students during the lesson.

DURING THE OBSERVATION

During the observation participants will focus on student activity and discourse. The teacher's activity has already been largely dictated by the collaboratively planned lesson. What is being studied is how students react positively and negatively to the activities and question put before them. Are the students able to do the math or science? Can they explain or communicate (to each other and to the teacher) about their math or science work?

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Step 5: Analyze & Adjust

- Have students met the expectations outlined in the standards?
- What skills or knowledge need strengthening in the future?

In the Analyze and Adjust Step of a Collaborative Inquiry Cycle, the team, and possibly outside observers, will have a chance to interpret the data gathered during the previous cycle. This can be a sensitive topic as it requires a de-privatizing of instruction. The use of clear and communicated protocols for discussing the lesson are crucial to keeping the conversation productive and extracting the most useful information from the data. It is important that the lesson be seen as belonging to the whole team and not just the presenting instructor. The discussion should be structured to promote this idea and free discussion time should be limited (but may continue informally for weeks).

Teachers will reacquaint themselves with the relevant standards and then analyze their observation notes and collected student work to identify evidence of understanding. They will discuss whether the students have met the expectations of the standards and make inferences about the strengths, weaknesses, and implications of instruction. What are the implications of the student work? Are there alternative instructional strategies or modifications that could improve the lesson in the future?

Finally, the team can reflect on the external benefits of the Collaborative Inquiry Cycle. What is useful or valuable about our collaborative work? Are we thinking about our everyday practice in new ways? Are we developing our knowledge of subject matter and student learning and development? Do all members feel included and valued?

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ANALYZING THE LESSON

BEFORE THE DEBRIEFING SESSION

- 1) Be sure to take a 10 minute or longer break after the lesson period to allow all those involved to recharge and reflect.
- 2) If at all possible, have the debriefing session in the same location as the lesson. This means that all the data on the whiteboards will be easily accessible and available to facilitate discussion about the lesson and the students. If it isn't possible to use the same location, be sure to pack up all evidence of student learning. This could be in the form of student notes, worksheet, scratch paper, transcripts of the whiteboard, or PDF's from the Smartboard. Bring all possible material to the debriefing site for analysis and reference.
- 3) Prepare the debriefing location. Seat the instructor and team members in the front as a panel. If you are using the lesson space, you will have to accomplish this during the break between sessions.
- 4) Arrange for the team to meet briefly following the session for reflection and a discussion of next steps.

MATERIALS

- Copies of the Protocol for Analysis and Adjustment
- Evidence of student learning from lesson site

DURING THE DEBRIEFING SESSION

- 1) Begin by assigning a record keeper to log the session. As facilitator you are not an official part of the discussion and might keep notes for the group on a whiteboard or presentation chart. The record keeper may transcribe these after the session has ended.
- 2) Review the protocol
 - Remind the participants of the session's purpose:
 - to analyze the data generated from the lesson
 - to determine the data's implications
 - Remind the participants to remain objective.
 - What did they see, not what do they think?
 - We are focusing on the lesson and students, not the instructor's strengths and weaknesses.
- 3) Begin the Protocol of Analysis and Adjustment

CONSIDER SHARING YOUR WORK

- Are there **specific protocols/procedures for guests** to take part in the Lesson Study at the chosen school? (**Parking, release forms, passes**, etc).
- Can this lesson be video-taped? Are there **permission forms** for students to be videotaped?
- May others participate?
- Will you write a final report to share with colleagues?