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Professional Development Planning Tool

Supporting and sustaining professional learning communities

NORTH CASCADES AND OLYMPIC Science Partnership

Rev. 8/07

Advancing science learning and teaching for all

Table of Contents

Introduction

For the last three years, NCOSP has focused on developing the knowledge and skills of Teacher Leaders in three key areas - instruction, collaboration, and more recently, assessment – all with the purpose of advancing student learning in science. Being an effective Teacher Leader means a commitment to effective teaching and learning based on research. The focus on content and pedagogy in NCOSP is grounded in research that indicates Teacher Leaders must be effective in the classroom and understand what makes them effective. Mounting evidence suggests that a culture of collaboration must be present if a school is to have all students learn. Moreover, that collaboration needs to be focused on issues related to instruction and student learning. The professional learning community model is one approach to build such a collaborative culture. Finally, using evidence to monitor student understanding and inform instruction is critical for student success. Effective teaching can only result if assessment practices that elicit student thinking, diagnose student understanding, and guide instructional decision-making become the norm.

Instruction, Professional Learning Community, and Assessment are inextricably linked. Assessment evidence is often the fodder for discussion of professional learning communities. Instruction is informed and guided by assessment results. Professional learning communities monitor and drive instructional change. All three are necessary; each requires focused study to result in improvements to school culture, classroom instruction, and student learning. This planning tool was created to assist Teacher Leaders and Administrators intent on such study to improve the educational experience of students.

What's in the Planning Tool

The planning tool is a collection of resources from NCOSP organized around the three themes of Instruction, Professional Learning Community, and Assessment. Most of the contents are taken from prior NCOSP programs, along with many of the source documents that informed these programs. Pages 4-6 provide an overview of the contents of the tool. Pages 6-7 offer suggestions for using the tool and monitoring the quality of the product created. Pages 9-50 organize and list the NCOSP resources in Instruction, Professional Learning Community, and Assessment. PowerPoints, handouts, and articles listed in the source column throughout the planning tool are provided in electronic form whenever possible. This synthesis of tools and resources will assist you in designing professional development experiences for your three-day summer workshop, and other events throughout the school year.

Instruction

Two critical elements of effective instruction are content and pedagogy. Effective teachers have a deep understanding of the content that they are teaching and they bring a variety of proven, research-based teaching techniques to their classroom. The content that teachers choose to teach should be relevant and grade level appropriate. The way in which the content is taught should allow students to construct a lasting and deep understanding.

In this section we collect the resources that can be used to ensure that teachers develop a deep content knowledge in subject areas they teach and will allow those teachers to incorporate a research-based approach to facilitate student learning of that content.

I Content for teachers and students	II Prior ideas/knowledge	III Constructing understanding	IV Metacognition
Effective teaching requires a deep understanding of the central facts, principles, ideas, and important generalizations organized within a common core of science content. An effective curriculum does not focus on facts but rather emphasizes conceptual understanding of the most important topics. Thus, teachers must be able to identify the "big ideas," central concepts and skills, and specific ideas associated with the content they teach. To do this, teachers must be familiar with state and national documents that guide content selection and know how to effectively incorporate these documents into their curriculum.	Students come into the classroom with a wide set of preconceptions about how the world works; some correct, some partially correct, some incorrect. If these ideas are not directly confronted, students may fail to incorporate new concepts into their understanding and revert to their previously-held incorrect ideas after instruction has ended. There is a fairly extensive literature on common misconceptions that children hold. These common ideas should be used to inform instruction and can be incorporated during the curriculum development process. There are also methods for eliciting preconceptions held by students in specific classrooms and these can be used to inform daily classroom practice.	In order to have lasting, deep understanding of a subject students must be provided with opportunities to construct their own understanding. This requires teachers to teach a subject with sufficient depth while providing a foundation of factual knowledge and opportunities for conceptual understanding. When relevant content is taught in the proper framework and at sufficient depth, students will then be able to apply what was learned in new situations and learn related information more rapidly.	Metacognition is the ability to monitor one's own understanding; evaluating when new information is consistent with current understanding and identifying when further information is needed to further learning. Although it often takes place as an internal dialogue, children can be taught metacognitive skills. As they become more adept at monitoring their own comprehension, they rely less on teacher support and become more independent learners.
❑ A. Deep content understanding for teachers ❑ B. Determining appropriate amount and level of content for students	❑ A. Student prior ideas ❑ B. Identifying common prior ideas ❑ C. Eliciting students' prior ideas	❑ A. High-quality instruction ❑ B. Questioning techniques	❑ A. Incorporating metacognition into teaching ❑ B. Facilitating metacognition in the classroom

Professional Learning Community (PLC)

Collaboration in peer groups can greatly enhance the effectiveness of instruction and the performance of students. High performing schools create a culture of collaboration by breaking down barriers that isolate teachers. Building such a culture does not happen by chance; it must be structured, taught, learned, and practiced. Developing collaborative cultures is the work of leaders who realize that even "superstar" teachers working in isolation cannot produce the same results as teachers who share and develop professional practices together.

The professional learning community (PLC) model is a research-based approach to education reform that enables schools to develop and sustain a collaborative culture. In a PLC group, members work interdependently to impact classroom practice in ways that lead to better results for students, teachers, and schools. PLCs enable educators to measure current student performance, set clear goals for improvement, work together to meet those goals, and then monitor teaching and learning to ensure continuous progress. The fundamental goal of a PLC is to ensure that all students are learning.

I	II	III
Structures to Support Effective PLCs	**Facilitating Effective PLCs**	**Characteristics of Effective PLCs**
Specific scaffolds, structures, and protocols enable PLC members to perform tasks that they may not yet be able to perform without support. They help enforce norms of collaboration before such norms become routine. The structures highlighted here ground the work of the PLC in standards, research, practice, and evidence.	The role of the facilitator is to ensure that the needs of the group are met so that the group's goals can be achieved. Groups address student learning through facilitated problem solving and planning. Facilitation provides the focus, direction, and organization necessary for a PLC to see positive results for students. Time spent planning and preparing facilitation strategies reaps enormous benefits by increasing the efficacy of the group.	A skilled facilitator is insufficient to generate an effective group. Group members must also embrace habits of mind and behaviors consistent with collaborative practices. While working to become an effective group it is important to explicitly identify the desired behaviors, practice applying them, and evaluate the extent to which they influence the group's work. When these behaviors become routine, the cohesion, energy, and commitment to shared work increase dramatically.
❑ A. Lesson Study ❑ B. Curriculum Topic Study ❑ C. Looking at Student Work Protocols ❑ D. NCOSP District Action Plans	❑ A. Four Hats of leadership ❑ B. Skills and settings that facilitate learning	❑ A. Elements of Professional Learning Community ❑ B. Behaviors of Effective PLC Members

Assessment

Assessment begins with the processes and products used to generate evidence of student thinking. These processes can be initiated by teachers or by students. Once gathered, this evidence must be interpreted and acted upon if learning gains are to be secured. Summative assessment measures the learning attained after instruction has been completed. Assessment becomes formative when it is used to adapt learning and teaching activities based on student needs. The fundamental goal of assessment is to measure student understanding so that instruction can target student needs.

I Gathering evidence of student thinking	II Making sense of the evidence	III Deciding how to respond
While written tests may be most familiar, information about student thinking can be gathered in many ways and at many stages of instruction. The integration of assessment throughout instruction allows teachers to track the development of student ideas over time. Some assessments generate written work that teachers can later review. Others involve observing student discussions and actions during class. The resources below provide a variety of strategies that can be used to elicit student thinking.	The data that are generated through assessment can be difficult to interpret. The resources described here provide guidance for making sense of student responses or other types of evidence of student thinking. In the day-to-day practice of classroom assessment, teachers may use these resources individually. However, discussion in collaborative groups can increase the depth to which student thinking can be understood. Some of the tools below are designed expressly for use in peer groups.	Once assessment data is collected and analyzed, the results can be used to guide the modification of instruction. If this step is absent, then gains in student learning are unlikely to result. A cycle of assessment, improvements to instruction, and further assessment can support a positive spiral of increasing student learning. Changes to instruction may take many forms, from providing additional time for students to assimilate and reflect on new ideas to redesigning an entire instructional sequence. Making decisions about instructional change can be challenging. This section of the tool helps make connections between assessment data and instructional decisions, linking back to the "Instruction" resources in Section I.
❑ A. Classroom probes ❑ B. Science notebooks ❑ C. Assessments drawn from existing curricula ❑ D. Assessment resources drawn from research literature ❑ E. WASL ❑ F. Classroom observation ❑ G. Questioning	❑ A. Interpreting written evidence ❑ B. Interpreting observational evidence	❑ A. Examining the efficacy of the assessment ❑ B. Instructional decision-making

How to use the Professional Development Planning Tool

The planning tool is filled with resources, tools, and strategies to use in professional development. It is tempting to just dive into the pages, pull out some activities, and be done. Unfortunately, effective planning isn't that simple.

Before you begin to select activities, you will need to return to the application you submitted for your school. This application identifies the people you will work with, the content area they will explore, and maybe even some strategies they will use. Given that knowledge, you now need to establish some clearly defined goals for your upcoming three-day professional development program. These goals should meet the needs of your specific audience given the chosen content and strategies. But, remember, your three day workshop is just a start. You'll be providing support for your colleagues throughout the year. So, you may find it helpful to consider potential goals for your ongoing work with your colleagues through the fall and on into winter and spring. Breaking your planning down into this way will help you select and focus on the appropriate resources in the planning tool.

The following prompts are intended to help you consider the context of your work, identify goals, and make informed and strategic use of the planning tool.

Planning with the End in Mind

Review the school-based application you submitted to NCOSP this spring. After completing your review, respond to the following questions.

What do you want teachers to learn or be able to do at the completion of the three-day workshop you will support this summer? Please be as specific as possible. Consider writing your responses in the form of "Teachers will understand…" or "Teachers will be able to….".

What do you want the teachers to learn or be able to do at the end of Fall?

What do you want the teachers to learn or be able to do at the end of Winter?

What do you want the teachers to learn or be able to do at the end of the school year?

Review each of the major sections of the planning tool - Instruction, Professional Learning Community, and Assessment – and begin to familiarize yourself with the resources and tools provided. Note that specific outcomes for groups of strategies and tools are described throughout the planning tool. Activities that list outcomes closely matched with the outcomes you listed above are likely to be most effective for your professional development plan.

What resources within each of those sections might help you achieve the outcomes you just described?

Having looked at the planning tool, you may have surfaced strategies and tools that you recognize as valuable and appropriate for your group, but were not described in the outcomes you listed above. Consider whether you need to modify your goals to reflect the inclusion of these additional strategies or whether these strategies are best saved for another time.

Putting the Planning Tool to Work

Now that you have established initial statements of what you would like to accomplish, it's time to design experiences that will help you succeed. The planning tool catalogues a wide array of tools and resources that you can use to support your professional development plan. The powerpoints, handouts, and articles used in many NCOSP programs have been collected here so that you can adapt and use them with your school-based team.

Included in your binder are two vignettes that describe hypothetical school-based teams and sample professional development program agendas to support those teams. In each case, the planning tools was used to create those agendas. These examples of professional development plans are meant to illustrate how working from the planning tool can help create an agenda. The actual agenda you will construct will be tailored to your own unique context.

Monitoring the Quality of Your Plan

As you work through the planning tool to develop your professional development plan, periodically use the following prompts to reflect on the quality of your plan. Consider using these prompts as something of a "daily debrief" so you can make continuous modifications based on your analysis.

- How well do your goals and emerging professional development plan address important ideas in Instruction, Professional Learning Community, and Assessment?
- How does your emerging professional development plan provide experiences appropriate for participants given their prior knowledge with the intended content or strategy?
- How does your emerging professional development plan reflect the recommendations in "How People Learn" by providing sufficient time for participants to surface their prior knowledge, develop new understandings, and reflect on their learning?
- How does your emerging professional development plan provide opportunities to monitor participant learning and assess whether the intended outcomes were achieved?

◗◗◗ Instruction

Two critical elements of effective instruction are content and pedagogy. Effective teachers have a deep understanding of the content that they are teaching and they bring a variety of proven, research-based teaching techniques to their classroom. The content that teachers choose to teach should be relevant and grade level appropriate. The way in which the content is taught should allow students to construct a lasting and deep understanding.

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Making the Case for a Research-based Approach to Instruction

In order for instructional change to occur there needs to be a reason to make a change. The most compelling reason is a demonstration that our students are not learning what we are teaching. Research on student learning as well as test scores provide compelling evidence that we need to make significant changes in our instructional practice to ensure that our students learn science.

◗◗◗ Outcomes

Teachers will understand the data that demonstrates common instructional practices are not facilitating student learning.

Strategy/Tool	Description	Source
Evidence of students' limited understanding of science	This collection of classroom video clips provide a rich resource that highlights the weaknesses of our current science teaching practice as well as a discussion of what needs to be done to improve.	• *A Private Universe/Minds of Our Own* Harvard-Smithsonian Center for Astrophysics (SA 2004) *Private Universe:* http://www.learner.org/resources/series28.html *Minds of Our Own*: http://www.learner.org/resources/series26.html • *Private Universe* Template descriptor matrix Note: The Descriptor Matrix provides annotations and descriptions of the videos. Use it to select appropriate clips for your work.
Data from state and national reports	PowerPoint presentations of student data for different grade levels. The Horizon PowerPoint is associated with the report in the row below.	• NCOSP States and National Data • *Looking Inside the Classroom: Results of a National Observation Study. Horizon Research Inc.*

Strategy/Tool	Description	Source
Readings from state and national reports	This report summarizes findings from observations of and interviews with science and mathematics teachers. Areas addressed include: how science and mathematics are portrayed, the intellectual engagement of students in lessons, the accuracy of science and mathematics content, teacher questioning strategies, and factors that determine choice of content and instructional strategies.	• *Looking inside the classroom: A study of K-12 mathematics and science education in the United States.* Weiss, I.R., Pasley, J.D., Smith, P.S, Banilower, E.R. & Heck, D.J. (2003) Chapel Hill, NC: Horizon Research Inc. (SA 2004) A useful summary report is found in the highlights.pdf document. The 365 page full report can be found in the complete.pdf document.

NOTES:

Instruction Resources

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I Content for Teachers and Students

Effective teaching requires a deep understanding of the central facts, principles, ideas, and important generalizations organized within a common core of science content. An effective curriculum does not focus on facts but rather emphasizes conceptual understanding of the most important topics. Thus, teachers must be able to identify the "big ideas," central concepts and skills, and specific ideas associated with the content they teach. To do this, teachers must be familiar with state and national documents that guide content selection and know how to effectively incorporate these documents into their curriculum.

A. Deep Content Understanding for Teachers
Teachers must have a deep understanding of the content to be effective. This set of strategies and tools will make the case for increasing teacher content knowledge.

◗◗◗ Outcomes

Teachers will consider the importance of scientific literacy and deep content knowledge as foundational to effective teaching.

Strategy/Tool	Description	Source
Importance of deep content understanding of teachers	These short readings can be used as a basis for discussion about the importance of deep content understanding for teachers. *Science for All Americans* defines the knowledge that all adults should have acquired through a K-12 education. *Science Matters* is a trade publication that provides interesting and comprehensible science. CTS provides a bridge between science content standards and research to curriculum, instruction and assessment.	• *Science for All Americans* (1990): Introduction xiii-xxiii, • (SFAA) Web link: http://www.project2061.org/publications/sfaa/online/sfaatoc.htm • *Science Matters* (1991): Introduction xi-xix • *Science Curriculum Topic Study* (Keely 2005) Note: If new to CTS you may want to start with the Introduction to CTS under Collaborative Practices CTS References: Pg. 14-18 also: pg. 91 Vignette#1: A high school integrated science teacher uses CTS to understand gravity-related content.
CTS as a guide to access content	CTS provides a framework that links and aligns content, research, standards, instruction, and assessments to commonly taught science topics and processes. CTS provides an exceptional means to make use of many of the primary Content Resources of NCOSP.	• *Science Curriculum Topic Study* (Keely 2005) Note: If new to CTS you may want to start with the Introduction to CTS under Collaborative Practices CTS Guides pg. 113-271 Also: pg. 92-95 Vignette #2: An experienced middle school teacher uses CTS to revise a unit on biological classification
Adult (teacher) content	*SFAA* defines the knowledge that all adults should have acquired through a K-12 education. *Science Matters* is a trade publication that provides interesting and comprehensible science content. Instructional materials and textbooks are valuable sources for content.	• *Science For all Americans* (1990): Project 2061 URL: http://www.project2061.org/publications/sfaa/online/sfaatoc.htm • *Science Matters* (1991) • District textbooks • Instructional materials: FOSS, STC, SEPUP, BSCS, etc.

B. Determining Appropriate Amount and Level of Content for Students

An effective curriculum does not focus on facts but rather emphasizes conceptual understanding of the most important topics. Teachers must be mindful of the amount of content they are covering and the level at which they are covering it.

◗ ◗ ◗ Outcomes

Teachers will be able to identify the "big ideas,", central concepts and skills, and specific ideas associated with the content they teach.

Teachers will be able to make connections between ideas within and across topics that can promote student understanding.

Strategy/Tool	Description	Source
Selecting appropriate science content	*Unburdening the curriculum* provides a rationale for teaching fewer topics at a deeper level. *Key Findings: How People Learn* provides a broad overview of research on learners and learning and on teachers and teaching. Three of those findings are highlighted here because they have both a solid research base to support them and strong implications for how we teach.	• *Unburdening the curriculum*, Project 2061 – Designs for Science Literacy Ch. 7 http://www.project2061.org/publications/designs/ch7intro.htm Note: click any of the "read more" links to get the whole PDF • *How People Learn* – Donovan, M.S., Bansford, J.D. & Pellegrino, J.W. (1999) National Research Council, National Academy Press, pg. 16-17 http://www.nap.edu/books/0309070368/html/
Topic specific teacher content knowledge	The Curriculum Topic Study (CTS) process contains elements that will help teachers improve their understanding of science content. Choose one of the 147 Topic guides.	• *Science Curriculum Topic Study* (Keely 2005) Note: If new to CTS you may want to start with the Introduction to CTS under Collaborative Practices CTS Guides pg. 113-271 Also, pg. 96-97 Vignette #3: A team of primary teachers uses CTS to identify goals for learning about life cycles.
Science standards	Science standards can be used to determine appropriate content. Standards present a vision of a scientifically literate populace presenting science standards for all students. Standards addressed and discussed include: teaching, assessment, content, and PD for teachers of science.	• *National Science Education Standards*, NRC, National Academy Press. The initial overview and chapters 1 & 2 provide an introduction to the national standards. http://www.nap.edu/readingroom/books/nses/ • *Benchmarks for Science Literacy*, AAAS – Project 2061 (1993) Oxford University Press The publication can be found at: http://www.project2061.org/publications/bsl/online/bolintro.htm
Science standards presentation	PowerPoint presentation that gives a nice overview of the Benchmarks and the Atlas, and relates them to the GLEs.	• Project 2061 GLES and Coherent Curriculum.ppt

Strategy/Tool	Description	Source
Student learning	Research on student learning should guide instruction. The Curriculum Topic Study (CTS) process will help teachers improve their understanding of concepts, specific ideas, level of sophistication and terminology related to a topic at different grade levels. Those familiar with the primary resources may wish to go straight to the research base.	• *Science Curriculum Topic Study* (Keely 2005) Note: If new to CTS you may want to start with the Introduction to CTS under Collaborative Practices CTS Guides pg. 113-271 Also, pg. 103-104 Vignette #6: A fourth grade district team uses CTS to examine alignment of curriculum, instruction and assessment. • *Benchmarks for Science Literacy*, AAAS – Project 2061 (1993) Oxford University Press http://www.project2061.org/publications/bsl/online/bolintro.htm • *National Science Education Standards*, NRC, National Academy Press. http://www.nap.edu/readingroom/books/nses/ • GLEs http://www.k12.wa.us/Ealrs/ http://www.k12.wa.us/CurriculumInstruct/EALR_GLE.aspx • *Atlas for Science Literacy*, Volumes 1 & 2
Connecting content (understanding content relationships)	Science topics should not be taught in isolation. The Curriculum Topic Study (CTS) process will help teachers improve their understanding of prerequisites for learning and connections between ideas within and across topics that can promote student understanding. Those familiar with the primary resources may wish to go straight to the research base.	• *Science Curriculum Topic Study* (Keely 2005) – section 4 of topic guide Note: If new to CTS you may want to start with the Introduction to CTS under Collaborative Practices • *Atlas for Science Literacy*, Volumes 1 & 2

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II Prior Ideas/Knowledge

Students come into the classroom with a wide set of preconceptions about how the world works; some correct, some partially correct, some incorrect. If these ideas are not directly confronted, students may fail to incorporate new concepts into their understanding and will often revert to their previously-held incorrect ideas after instruction has ended. There is a fairly extensive literature on common misconceptions that children hold. These common ideas can and should be used to inform instruction and can be incorporated during the curriculum development process. There are also methods for eliciting preconceptions held by students in specific classrooms and these can be used to inform daily classroom practice.

A. Student Prior Ideas

This set of strategies and tools make the case for considering the prior knowledge students have. These preconceptions must be taken into account when designing and implementing instruction.

◗ ◗ ◗ Outcomes

Teachers will understand importance of eliciting and diagnosing students' ideas.

Strategy/Tool	Description	Source
Preconceptions (illustrations)	This collection of classroom video clips provides a rich resource that highlights the failures of our current science teaching practice as well as a discussion of what needs to be done to improve. The "Into Thin Air" clip is excellent for illustrating how students revert to previously held incorrect ideas.	• *Private Universe/Minds of Our Own* – Harvard/ Smithsonian Center for Astrophysics (SA 2004) *Private Universe*: http://www.learner.org/ resources/series28.html *Minds of Our Own*: http://www.learner.org/ resources/series26.html *Private Universe/Minds of Our Own* Descriptor Matrix in II Prior Ideas; A. Student Prior Ideas Note: The Descriptor Matrix provides annotations and descriptions of the videos. Use it to select appropriate clips for your work.
Preconceptions (research)	The first key finding in How People Learn directly addresses research about preconceptions and specific implications for teaching are discussed. The introductory chapters of the two Driver books also provide a rationale for addressing student preconceptions.	• *How People Learn* – Donovan, M.S., Bansford, J.D. & Pellegrino, J.W. (1999) National Research Council, National Academy Press Key findings pg. 10-12 Implications for Teaching pg. 15-16 • *Children's Ideas in Science.* Driver, R., Guesne, E. & Tiberghien, A. (1985) Open University Press Ch. 1 pg. 1-9; Ch. 10 • *Making Sense of Secondary Science.* Driver, R., Squires, A., Rushworth, P. & Wood-Robinson, V. (1994) Routledge, Introduction pg. 1-8
Vignettes of students discussing prior ideas	Short transcripts of children discussing scientific phenomena can provide insight into children's preconceptions. They can be used to prompt discussion.	• *Children's Ideas in Science.* Driver, R., Guesne, E. & Tiberghien, A. (1985) Open University Press Ch. 1 pg. 1, 7. • *Making Sense of Secondary Science.* Driver, R., Squires, A., Rushworth, P. & Wood-Robinson, V. (1994) Routledge, Introduction pg. 4-5, 11-12.

B. Identifying Common Prior Ideas

This set of strategies and tools offer practical connections to the research base on commonly held student preconceptions on a variety of topics.

◗◗◗ Outcomes

Teachers will be able to identify commonly held misconceptions for content they are teaching.

Strategy/Tool	Description	Source
Curriculum topic study as a guide to identifying common prior ideas	Choose a specific topic and use CTS to as a guide to sources that will help teachers identify common prior ideas around a that topic	• *Science Curriculum Topic Study.* Keeley, P. 2005. Corwin Press. There are 147 topics represented in CTS for both content and process topics.
Understanding the research into students' prior ideas	There are a number of sources that characterize common misconceptions and the research on student learning for a wide variety of topics. These can be used to investigate specific topics of your choice.	• *Children's Ideas in Science.* Driver, R., Guesne, E. & Tiberghien, A. (1985) Open University Press This book contains several chapters on misconceptions about a variety of topics. It focuses on younger children. • *Making Sense of Secondary Science.* Driver, R., Squires, A., Rushworth, P. & Wood-Robinson, V. (1994) Routledge This book contains several chapters on misconceptions about a variety of topics. It focuses on older children. • *Benchmarks for Science Literacy*. AAAS – Project 2061. 1993. Oxford University Press. Ch. 15 • *Atlas of Science Literacy*. AAAS – Project 2061 Blue column on right throughout Atlas.

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C. Eliciting Students' Prior Ideas
This set of strategies and tools highlights techniques for eliciting student preconceptions.

◗◗◗ Outcomes

Teachers will be able to use multiple strategies to elicite students' preconceptions.

Strategy/Tool	Description	Source
Common techniques	Review the list of techniques found in the Driver book as well as methods of addressing misconceptions in the classroom.	• *Making Sense of Secondary Science.* Driver, R., Squires, A., Rushworth, P. & Wood-Robinson, V. 1994) Routledge, pg. 9-12
Assessment probes	Use assessment probes to identify common ideas held by students about a specific topic. For a description of assessment probes, see "Gathering Evidence of Student Thinking" in the Assessment section.	• *Uncovering Student Ideas in Science*. Vol. 1 & 2. Keeley et al. NSTA Press. These books contain25 assessment probes for a variety of topics
Concept cartoons	Use concept cartoons to identify common ideas held by students about a specific topic. For a description of assessment probes, see "Gathering Evidence of Student Thinking" in the Assessment section.	• *Concept Cartoons in Science Education.* (2000) Naylor, S. & B. Keogh. Millgate House Publishing. This book contains several concept cartoons on a variety of topics.
Immersion activities	Use examples from immersion activities such as questioning, whiteboarding, and "talking heads" to demonstrate and practice how to elicit common ideas	• *Physics for Everyday Thinking* PET Reference URL: http://petproject.sdsu.edu/ • *Physics by Inquiry*; SMATE LRC • NCOSP Life Science Curriculum • NCOSP Earth Science Curriculum

III Constructing Understanding

In order to have lasting, deep understanding of a subject students must be provided with opportunities to construct their own understanding. This requires teachers to teach a subject with sufficient depth while providing a foundation of factual knowledge and opportunities for conceptual understanding. When relevant content is taught in the proper framework and at sufficient depth, students will then be able to apply what was learned in new situations and learn related information more rapidly.

A. High-quality Instruction
This set of strategies and tools highlights the characteristics of high-quality instruction, research on how people learn, and examples of effective curricula.

◗◗◗ Outcomes

Teachers will be able to understand and apply research findings on how people learn in their classroom practice.

Strategy/Tool	Description	Source
Constructing understanding (video)	Video clips that contain illustrations of how little learning occurs when instruction does not attend to the Key Findings of *How People Learn*. SA 2004 used clips from lines 12, 16, and 17 from the Descriptor Matrix.	• *Private Universe/Minds of Our Own* – Harvard/ Smithsonian Center for Astrophysics (SA 2004) *Private Universe:* http://www.learner.org/ resources/series28.html *Minds of Our Own*: http://www.learner.org/ resources/series26.html • *Private Universe /Minds of Our Own* Descriptor Matrix Note: The Descriptor Matrix provides annotations and descriptions of the videos. Use it to select appropriate clips for your work.
Identifying high-quality instruction	During the 2004 SA we used materials from the Horizon Research Institute to develop a common understanding of what constitutes high quality science instruction.	• PowerPoint describing protocol and data on science lessons collected using the protocol: http://www.horizon-research.com/ presentations/2005/clas_nctm_april05.php • Horizon Classroom Observation Protocol PDF
Constructing understanding (*How People Learn)*	An exploration of the *HPL* Key Finding centered on the instructional requirements for developing student competence in an area of inquiry.	• *How People Learn* – Donovan, M.S., Bansford, J.D. & Pellegrino, J.W. (1999) National Research Council, National Academy Press Pages 12-13 and 16-17 of *HPL*
Constructing understanding (PowerPoint)	A presentation that explains constructivism and discusses the key finding from How People Learn	• NCOSP PowerPoint on Constructivism
Biological basis for how people learn	A video that features Dr. Larry Lowery explaining brain function as it relates to learning. Cognitive development from kindergarten through high school is discussed in a clear and concise way. This is a great tool for discussing the biological basis for using effective teaching strategies.	• *Dr. Larry Lowery – The Biological Basis of Thinking* Lawrence Hall of Science Available in the SMATE LRC

Strategy/Tool	Description	Source
Constructing understanding (content immersion)	Many of the content immersions used throughout the Summer Academies employed best practices from *HPL*. Select a section of this content, or some other high quality content that you can use, to explicitly link to the Key Findings of *HPL*.	• *Physics for Everyday Thinking* PET Reference: http://petproject.sdsu.edu/ • *Physics by Inquiry* • NCOSP Life Science Curriculum • NCOSP Earth Science Curriculum • Research-based K12 instructional materials
Constructing understanding (activity)	The "Pendulum Activity" is an excellent way to have workshop participants engage in a compact, hands-on activity that has a content focus and quality instruction. This activity was used during the 2004 SA with all NCOSP participants.	• Pendulum activity (swingers activity from FOSS measurement kit) • Pendulum Activity Teachers Guide • Pendulum Activity Preassessment • Pendulum Activity • Pendulum Activity Postassessment
Inquiry Boards	Inquiry boards are a tool that uses post-it notes and a series of poster boards as a planning organizer for teaching the process of concluding a scientific experiment. They can help students identify the variables tested in a multi-step procedure and focus on controlling those variables.	• An Inquiry Board Lesson plan • Inquiry Boards an Introduction • Inquiry Boards Words • Modified Conclusion Board Words • Inquiry Book

NOTES:

B. Questioning Techniques

Questioning is a powerful classroom tool that can be used to foster student thinking as well as a probe for understanding and initiating inquiry. Questioning can also be used for teacher professional growth.

◗ ◗ ◗ Outcomes

Teachers will be able to incorporate questioning into their classroom practice.

Strategy/Tool	Description	Source
Questioning as a teaching tool	This article provides an introduction to the effective use of questioning as a teaching tool. It also illustrates the importance of questioning as a teaching and learning strategy.	• *Using Questioning to Assess and Foster Student Thinking*, Minstrell and Van Zee
Questioning strategies (video)	Two video clips of NCOSP teachers (high school and elementary) making effective use of questioning strategies. "Minds of Our Own" contains clips of one-on-one questioning sessions.	• NCOSP teacher leader videos (SMATE LRC) • *Private Universe/Minds of Our Own* – Harvard/ Smithsonian Center for Astrophysics *Private Universe:* http://www.learner.org/resources/series28.html *Minds of Our Own*: http://www.learner.org/resources/series26.html • *Private Universe/Minds of Our Own* Descriptor Matrix Note: The Descriptor Matrix provides annotations and descriptions of the videos. Use it to select appropriate clips for your work.
Embedded questions	Look at embedded questions in an established curriculum such as PbI. PbI uses extensive use of questioning to facilitate student thinking.	• *Physics by Inquiry*, SMATE LRC
Reform-based instructional materials	Many reform-based instructional materials have example questions that can be used to promote student thinking. You may want to examine these materials.	• Research-based K12 Instructional materials: FOSS, STC, SEPUP, BSCS, etc.

IV Metacognition

Metacognition is the ability to monitor one's own understanding; evaluating when new information is consistent with current understanding and identifying when further information is needed to further learning. Although it often takes place as an internal dialogue, children can be taught metacognitive skills. As they become more adept at monitoring their own comprehension, they rely less on teacher support and become more independent learners.

A. Incorporating Metacognition into Teaching and Learning

The last of the three key findings in "How People Learn" addresses the importance of incorporating metacognition into classroom instruction. This set of strategies and tools offers readings and video that support this research.

◗◗◗ Outcomes

Teachers will understand the importance of incorporating opportunities for metacognition in their classroom instruction.

Strategy/Tool	Description	Source
Metacognition (text)	Use short readings as a basis for discussion about the importance of providing students an opportunity to monitor their own learning. These readings make the case for incorporating metacognition into learning activities.	• *How People Learn* – Donovan, M.S., Bansford, J.D. & Pellegrino, J.W. (1999) National Research Council, National Academy Press Pages 13-15 and 17 • *Science Curriculum Topic Study.* Keeley, P. 2005. Corwin Press. pg. 10-12
Metacognition (video)	This short video clip shows a boy in a "metacognitive moment." Use in combination with HPL reading above.	• HRI video – boy monitoring his own understanding about how sand forms Available at: http://www.learner.org/channel/courses/essential/earthspace/session6

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B. Facilitating Metacognition in the Classroom
This set of strategies and tools can be used to help students learn to monitor their own thinking.

◗◗◗ Outcomes

Teachers will be able to facilitate metacognition with their students.

Strategy/Tool	Description	Source
Questioning	This article has an excellent discussion of how to use questioning to help students monitor their own learning.	• *Using questioning to assess and foster student thinking.* Minstrell, J. & van Zee, E.
Notebooking	This PowerPoint has slides associated with using notebooking to facilitate student metacognition. It also has examples of student work to illustrate the point.	• NCOSP Science Notebooks Presents PowerPoint
Immersion curricula	Use parts of immersions curricula to illustrate how metacognition is incorporated into learning experiences.	• *Physics for Everyday Thinking* PET Reference URL: http://petproject.sdsu.edu/ • *Physics by Inquiry*, SMATE LRC • NCOSP Life Science Curriculum • NCOSP Earth Science Curriculum

NOTES:

◗◗◗ Professional Learning Community

Collaboration in peer groups can greatly enhance the effectiveness of instruction and the performance of students. High performing schools create a culture of collaboration by breaking down barriers that isolate teachers. Building such a culture does not happen by chance; it must be structured, taught, learned, and practiced. Developing collaborative cultures is the work of leaders who realize that even "superstar" teachers working in isolation cannot produce the same results as teachers who share and develop professional practices together.

The professional learning community (PLC) model is a research-based approach to education reform that enables schools to develop and sustain a collaborative culture. In a PLC group, members work interdependently to impact classroom practice in ways that lead to better results for students, teachers, and schools. PLCs enable educators to measure current student performance, set clear goals for improvement, work together to meet those goals, and then monitor teaching and learning to ensure continuous progress. The fundamental goal of a PLC is to ensure that all students are learning.

Making the Case for Professional Learning Communities

Professional Learning Communities are a fundamental shift from common forms of "collaboration" or "meetings". When groups make this shift school climate improves, teacher satisfaction increases, and student learning increases.

◗◗◗ Outcomes

Teachers will understand the importance of professional learning communities for improving school culture and student learning.

Tool or Strategy	Description	Source
Evidence of effectiveness of PLCs	A searchable database of schools and districts that have built successful professional learning communities that includes data on strategies, implementation, and student performance.	• www.allthingsplc.org A website of research, articles, data and tools to provide educators with relevant, practical knowledge and tools as they work to create and sustain Professional Learning Communities
Establishing a Vision for PLCs	A reading introduced in Summer Academy 2004 that describes the elements of a professional learning community	• Importance of Professional Learning Communities • *The Adaptive School*, pages 15-19

Professional Learning Community Resources

I **Structures to Support Effective PLCs**	II **Facilitating Effective PLCs**	III **Characteristics of Effective PLCs**
Specific scaffolds, structures, and protocols enable PLC members to perform tasks that they may not yet be able to perform without support. They help enforce norms of collaboration before such norms become routine. The structures highlighted here ground the work of the PLC in standards, research, practice, and evidence.	The role of the facilitator is to ensure that the needs of the group are met so that the group's goals can be achieved. Groups address student learning through facilitated problem solving and planning. Facilitation provides the focus, direction, and organization necessary for a PLC to see positive results for students. Time spent planning and preparing facilitation strategies reaps enormous benefits by increasing the efficacy of the group.	A skilled facilitator is insufficient to generate an effective group. Group members must also embrace habits of mind and behaviors consistent with collaborative practices. While working to become an effective group it is important to explicitly identify the desired behaviors, practice applying them, and evaluate the extent to which they influence the group's work. When these behaviors become routine, the cohesion, energy, and commitment to shared work increase dramatically.
❑ A. Lesson Study ❑ B. Curriculum Topic Study ❑ C. Looking at Student Work Protocols ❑ D. NCOSP District Action Plans	❑ A. Four Hats of leadership ❑ B. Skills and Settings that Facilitate Learning	❑ A. Elements of Professional Learning Community ❑ B. Behaviors of Effective PLC Members

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Structures to Support Professional Learning Communities

Specific scaffolds, structures, and protocols enable PLC members to perform tasks that they may not yet be able to perform without support. They help enforce norms of collaboration before such norms become routine. The structures highlighted here ground the work of the PLC in standards, research, practice, and evidence.

A. Lesson Study

Lesson Study is a process by which teachers collaborate to plan, observe, and refine a lesson. Lesson Study employs a backward design process which starts with the clarification of the lesson's learning goal and then focuses on the design of instructional experiences that lead to the goal. It is a form of professional development grounded in classroom practice with the goal of gradually improving student learning through structured reflection on teaching.

◗◗◗ Outcomes

Teachers will understand the essential elements of the Lesson Study process and the habits of mind applied within that process to effect instructional improvements.

Teachers will be able to implement and facilitate effective Lesson Study groups.

Tool or Strategy	Description	Source
Learning About Lesson Study	A collection of powerpoint presentations, handouts, and references for help in forming and support new Lesson Study Groups.	• Brief Guide to Lesson Study by Catherine Lewis • Catherine Lewis PowerPoint • Enlisting Support for Lesson Study PowerPoint by Jeanne Harmon • Intro to Lesson Study PowerPoint • Lesson Study Norms • Lesson Study Resources • Lesson Study Cycle • Observing Evidence of Learning • Outline • Planning Tool • Steps for Observing and Debriefing a Lesson • Three Strands • What are the Essential Elements of Lesson Study?
Integrated Curriculum Topic Study and Lesson Study, abridged version (Orange Book)	A tool to guide teams through a step-by-step discussion process utilizing science curriculum topic study as the basis for a lesson study. The Orange Book is a revised version of the original Green Book used in Summer.	• CTS LS Flowchart PowerPoint • LS CTS Template • LS Template • Orange Book
Integrated Curriculum Topic Study and Lesson Study, Facilitators Guide (Purple Book)	A guide for facilitators of CTS/Lesson Study including background information about lesson study, guidelines for facilitating, and reflective questions for participants.	• Purple Book

Tool or Strategy	Description	Source
NWREL Resources on Lesson Study	Resources on Lesson Study including research references and protocols for conducting pre-observation meetings, classroom observations, and post-observations debriefings.	• Northwest Regional Education Laboratory • Debriefing Protocol • Knowledgeable Others • Lesson Study Debriefing Protocol • Lesson Study Journal Articles 2001 • Lesson Study Journal Articles 2003 • Observation Protocol • Post-Lesson Discussion • Pre-Observation Meeting Outline • Protocol Lesson Debriefing and Observation • Lesson Study Resources • Teacher's Log Post-Debriefing

Other recommended resources:

- Leading Lesson Study: a Practical Guide for Teachers and Facilitators (2007, 207pp)
  http://www.nwrel.org/comm/catalog/detail.asp?RID=17333
- Lewis, C. (2002) "Lesson Study: A Handbook of Teacher-led Instructional Change".
- "The Teaching Gap", Stigler, J. and Hiebert, J. Summit Books (1999)
- Lesson Study Videos: How Many Seats? How much is 100 kg?
  http://lessonresearch.net/res.html
- The Lesson Study Research Group at Columbia University
  http://www.tc.edu/lessonstudy
- Lesson Study information and resources on the website for the Center for Strengthening the Teaching Profession
  http://www.cstp-wa.org/Accomplishedteaching/Lesson_study/LessonStudy.htm

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B. Curriculum Topic Study

Curriculum Topic Study (CTS) is a systematic study process and a set of tools and strategies designed to help educators improve the teaching and learning of science by moving beyond personal opinions and assumptions to consider key ideas and practices developed through consensus by the science education community. The goal of CTS is to help improve the understanding of science content, clarify the big ideas, identify potential learning difficulties or misconceptions, apply effective teaching strategies, and improve coherence of topic development across curriculum.

◗◗◗ Outcomes

Teachers will understand the methodological study process and set of tools that define Curriculum Topic Study.

Teachers will be able to embed the CTS process into a variety of professional development strategies.

Tool or Strategy	Description	Source
Introduction to CTS	A process to develop awareness of CTS as a tool you can use for connecting standards and research on learning to classroom practice and provide guided practice in using CTS.	• CTS Learning Cycle • Curriculum Topic Study Handout • Introduction to CTS PowerPoint
CTS and Developing Assessment Probes	A process to design research-based assessments that can identify student conceptions before, during and after instruction.	• *Curriculum Topic Study* pages 80-83 • Assessment Probe Scaffold • CTS Probes Next Steps • Probe Worksheet • Probes PowerPoint • Step 4 Chart • Suggestions for Types of Two-Tiered Probes • Folder with multiple examples of Assessment Probes
CTS and Examining Student Work	A process to clarify the learning goals and research on children's ideas to improve the ability to analyze and diagnose student thinking based on their written work.	• *Curriculum Topic Study* page 90 • Analyzing Student Ideas • Analyzing Student Ideas Recording Sheet • Categories for Analyzing Student Ideas • Food for Corn Data Set • Task Scaffold for Analyzing Ideas • What Were They Thinking?
CTS and Curriculum Implementation	A process to improve understanding of the content, clarify the meaning and intent of the curricular goals, and become aware of research that may impact student learning to support the teaching in using the curriculum effectively.	• *Curriculum Topic Study* pages 69-74 • CTS Learning Cycle
CTS and Study Groups	Use of CTS within the context of a traditional study group to focus participants learning on science content, standards, and research.	• *Curriculum Topic Study* page 88 • CTS Study Group PowerPoint • CTS Study Group Handout

Tool or Strategy	Description	Source
CTS and Examining the Hierarchical Structure of Content Knowledge	A process to "unpack" a topic, by identifying the concepts, the specific ideas, and important facts and terminology in order to better understand the topic and how it connects with other ideas.	• *Curriculum Topic Study* pages 57-61 • Card Sort for Hierarchy PowerPoint • CTS MN Hierarchy PowerPoint • CTS MN Hierarchy for Printing • Example of a Hierarchy of Content Knowledge • Hierarchy Guiding Questions • Hierarchy of Scientific Content Knowledge Examples • Hierarchy Plan B • Hierarchy Content Knowledge • Level Labels • Scaffold for Hierarchy of Content Knowledge
CTS and Collaborative Inquiry into Examining Student Thinking (CIEST)	A process by which groups construct their understanding of student thinking through asking questions, analyzing relevant data, and engaging in constructive dialogue.	• *Curriculum Topic Study* • CIEST Introduction PowerPoint • Examining Student Thinking PowerPoint • Examples of Categories of Reasoning • Mitten Problem HS Student Work • Mitten Problem Grade 8 Student Work • New CIEST Task Scaffold • The Mitten Problem Explanation
CTS and Identifying Content Knowledge Needed to Teach a Topic	A process to identify relevant grade-level science content while also increasing their own knowledge of the content.	• *Curriculum Topic Study* pages 55-57

Other recommended resources:

- Curriculum Topic Study Database: An up-to-date database of additional resources, including books, videos, CDs and articles to support each topic in the CTS guides.
  http://www.curriculumtopicstudy.org/user_database/index.php?typeID=1

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C. Looking at Student Work Protocols

Protocols provide a vehicle for buildings the skills and culture necessary for collaborative work focused on student preconceptions and content knowledge. The goal of these discussions is to promote a collaborative approach to monitoring student thinking and informing classroom instruction.

◗◗◗ Outcomes

Teachers will understand the structure and purpose of protocols for looking at student work.

Teachers will be able to use protocols within collaborative groups to focus discussions on improving teaching practices and student learning.

Tool or Strategy	Description	Source
High-Medium-Low Protocol	A protocol to examine patterns in student work to develop shared expectations for student learning and performance.	• Introduction to LASW Slide Show • LASW High-Medium-Low Protocol • Scientists' Ideas on Light
Understand and Respond Protocol	A protocol for teachers to discuss students' content knowledge based on evidence and how to respond based on that evidence.	• LASW Session 2 Slide Show • Scientists' Ideas on Density • Understand and Respond Protocol
Peer Review Protocol: Standards in Practice	A protocol to examine the direct relationship between students' work and the standards.	• LASW Session 3 Slide Show • Scientists' Ideas on Mittens • Standards Protocol

Other recommended resources:

- Allen, D., Blythe, T., Thompson-Grove, G. (DATE) "The Facilitator's Book of Questions". Teachers College Press (NY).
- Blythe, T., Allen, D., and Schiefflen-Powell, B. (1999) "Looking Together at Student Work". Teachers College Press (NY).
- McDonald, J., Mohr, N., Dichter, McDonald, E. (2004) "The Power of Protocols: An Educator's Guide to Better Practice" National Staff Development Council (Oxford).
- A website with protocols for looking at student work: www.lasw.org

D. NCOSP District Action Planning

This data-driven planning process allows teachers and administrators to align their education reform activities with real, verifiable problems that they have the potential to influence. The goal of the process is to use data to inform decisions and monitor improvements, to increase cross grade-level collaboration, and to strengthen collaboration among teachers and administrators.

◗◗◗ Outcomes

Teachers will be able to strategically use data in both planning professional development activities and monitoring the impact of those activities.

Tool or Strategy	Description	Source
DAP: Making Predictions and Assumptions	A process to activate prior knowledge, surface assumptions, and make predictions to create a readiness to talk about data.	• NCOSP District Action Plan
DAP: Analyzing Data	A process to assure that data is used to understand and solve problems based on evidence.	• NCOSP District Action Plan
DAP: Explaining Patterns and Themes	A process to scan data to identify patterns or themes and factors responsible for those patterns.	• NCOSP District Action Plan
DAP: Defining Focus Area	A process to evaluate which factors responsible for observed patterns can be verified by data, influenced by teachers, and important to students.	• NCOSP District Action Plan
DAP: Setting Goals	A process to establish specific, measurable, and attainable goals based on data.	• NCOSP District Action Plan
DAP: Developing an Action Plan	A process to agree upon a set of strategies to enact to achieve goals.	• NCOSP District Action Plan
DAP: Monitoring and Evaluating Effectiveness	A process to improve the link between goals and actions and to apply evaluation strategies to monitor progress toward achieving goals.	• NCOSP District Action Plan Report • Evaluation Section, November 16

Other recommended resources

- Love, N. (2002) "Using Data, Getting Results: A Practical Guide for School Improvement in Mathematics and Science". Christopher-Gordan (Norwood, MA)
- OSPI, School Improvement Planning Process Guide: http://www.k12.wa.us/SchoolImprovement/Guide.aspx

II Facilitating Effective Professional Learning Communities

The role of the facilitator is to ensure that the needs of the group are met so that the group's goals can be achieved. Groups address student learning through facilitated problem solving and planning. Facilitation provides the focus, direction, and organization necessary for a PLC to see positive results for students. Time spent planning and preparing facilitation strategies reaps enormous benefits by increasing the efficacy of the group.

A. Four Hats of Shared Leadership

In adaptive schools, leadership is shared. Administrators, teachers, and support staff must have the knowledge and skills to recognize their changing roles or "hats of leadership." When all parties understand the distinction among the major functions of leadership they can affect change.

◗◗◗ Outcomes

Teachers will understand the distinct contributions facilitation, presentation, coaching, and consulting make to supporting PLCs.

Teachers will be able to effectively use the "four hats of leadership" to support PLCs

Tool or Strategy	Description	Source
Facilitating	An approach used to direct the process used in a meeting, maintaining focus on one content area and one process at a time.	• *The Adaptive School* , page 27 • Four Hats PowerPoint • Protocol for Jigsaw Activity • TAS Resource • The Four Readings
Presentating	An approach used to extend and enrich knowledge, skills, or attitudes and to enable these to be used in team's work.	• *The Adaptive School*, page 27 • Comparing Learners • Design Teams Working Document • Presentation PowerPoint • Presentation Design Worksheet • Presentation Planning Matrix • Presentation Resources • Public Agenda
Coaching	An approach to help another take action toward his or her goals.	• *The Adaptive School*, page 28 • Coaching and Consulting PowerPoint • Coaching and Consulting Definitions • Jigsaw Protocol January LCF • Pausing and Paraphrasing • Probing
Consulting	Applying expertise as an information specialist or an advocate for content and/or process.	• *The Adaptive School*, page 28 • Coaching and Consulting PowerPoint • Coaching and Consulting Definitions • Jigsaw Protocol January LCF • Pausing and Paraphrasing • Probing
Reflection Tools	Supporting documents to assess knowledge and experience with the 4 hats of leadership.	• 4 Hats Quadrant • Stages of Experience in the 4 Hats

Other recommended resources

• Garmston, R. and Wellman, B. (1998) "The Adaptive School Syllabus". Four Hats Seminars (El Dorado Hills, CA)

B. Skills and Settings that Facilitate Learning

For workshops, classes, seminars, or meetings to be effective, the facilitator must attend to both the physical environment as well as the interactions among participants occurring minute by minute. The goal is create an emotional, cognitive, and physical environment that is matches the intended learning experience and minimizes barriers that may inhibit participation and learning.

◗◗◗ Outcomes

Teachers will understand the role of the facilitation in supporting effective PLCs.

Teachers will be able to use facilitation strategies to strengthen and support collaboration focused on student learning.

Tool or Strategy	Description	Source
Principles for seating arrangements to support effective groups	Strategies for arranging seating, posting tasks and norms, and charting discussions.	• *The Adaptive School*, page 71-76
The Confident and Skilled Facilitator	Facilitation strategies to address: becoming a group, engaging participation, focusing attention, activating and engaging thinking, generating ideas, exploring ideas, sorting and deciding, clarifying commitment, monitoring and evaluating.	• *The Adaptive School*, page 105-131
Non-verbal Communication	Intentional use of voice patterns, gestures, position, and breathing during facilitation to support and enhance group dynamics.	• *The Adaptive School* page 113 • Glossary of Facilitation Skills
Guide to "The Adaptive School"	A helpful reference guide to information within the Adaptive School to address specific facilitation problems.	• *The Adaptive School*, pages xviii-xx

Other recommended resources

- Zoller, K. (2004) "Keep an Eye on the Hand". Journal of Staff Development. 25(1):52-53.
- Garmston, Robert J., and Bruce M. Wellman. (1992). *How to make Presentations that Teach and Transform.* Alexandria, Virginia: Association for Supervision and Curriculum Development.

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III Characteristics of Effective Professional Learning Communities

A skilled facilitator is insufficient to generate an effective group. Group members must also embrace habits of mind and behaviors consistent with collaborative practices. While working to become an effective group it is important to explicitly identify the desired behaviors, practice applying them, and evaluate the extent to which they influence the group's work. When these behaviors become routine, the cohesion, energy, and commitment to shared work increase dramatically.

A. Elements of Professional Learning Community

Professional learning communities are more than just a group of educators conducting a meeting. PLCs reflect a set of research-based characteristics and their members embrace particular habits of mind. Understanding and enacting these elements results in improved interactions among educators and improved results for students.

◗ ◗ ◗ Outcomes

Teachers will understand the elements of effective professional learning communities and their significance in supporting a student-centered school culture.

Teacher will be able to introduce these elements to their colleagues and practice them in their collaborative groups.

Tool or Strategy	Description	Source
Shared Norms and Values	Reading to explore the importance of norms and values in developing shared expectations for PLC members.	• *The Adaptive School*, page 17
Collective Focus on Student Learning	Reading to explore the distinction between exchanging activities and materials, and focusing more on student learning as an end and teaching as the means.	• *The Adaptive School*, page 17
Collaboration	Reading to explore collaboration as a means to share expertise, examine data, and develop a sense of mutual support and shared responsibility for effective instruction.	• *The Adaptive School*, page 18
Deprivatized Practice	Reading to discuss the significance of making teaching public so that teachers can learn with and from one another.	• *The Adaptive School*, page 18
Reflective Dialogue	Reading to explore dialogue as a means to gain perspective and develop shared understandings as distinct from discussions that lead to decisions.	• *The Adaptive School*, page 19

Other recommended resources:

- DuFour, R. and Eaker, R. (1998) "Professional Learning Communities at Work". National Educational Service (Bloomington, IN).
- A website on professional learning communities: www.allthingsplc.org

B. Behaviors of Effective Group Members

An effective facilitator is only one ingredient in a collaborative group. Group members must also develop their skills and become effective contributors as well. When group members themselves are knowledgeable and skilled, the group is able to develop a shared purpose and make decisions.

◗◗◗ Outcomes

Teachers will understand how the behavior of group members and the application of group norms can influence the effectiveness of a collaborative group.

Teachers will be able to monitor their personal behaviors, and help groups monitor their collective behaviors, to become a high performing group.

Tool or Strategy	Description	Source
Four Group Member Capabilities	A reading to raise awareness of how and when to personally use – or not use – a skill to influence the effectiveness of the group, including choosing congruent behaviors, setting aside unproductive patterns of listening, asserting or integrating, and supporting the group's purpose.	• *The Adaptive School*, page 33-37
Seven Norms of Collaboration	A reading on a set of skills to develop among group members to promote effective communication.	• *The Adaptive School*, page 37-47
Dialogue vs. Discussion	A reading on professional discourse used to develop understanding as distinct from that used to make a decision.	• *The Adaptive School*, page 51-61, 89

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Assessment

Assessment begins with the processes and products used to generate evidence of student thinking. These processes can be initiated by teachers or by students. Once gathered, this evidence must be interpreted and acted upon if learning gains are to be secured. Summative assessment measures the learning attained after instruction has been completed. Assessment becomes formative when it is used to adapt learning and teaching activities based on student needs. The fundamental goal of assessment is to measure student understanding so that instruction can target student needs.

Making the Case for Assessment

For meaningful learning to occur, instruction must take into account what students already know, what they believe they 'know,' and what they find challenging. This allows teaching strategies to be adjusted to best match the needs of students. Research has shown that the practice of formative assessment can produce substantial learning gains while decreasing the gap between low achievers and other students. The resources described below can be used to stimulate reflection on and discussion about the critical role of assessment in promoting student learning.

Title	Description/Application	Source
Inside the Black Box: Raising Standards Through Classroom Assessment (Black and Wiliam)	In this article, the authors cite evidence to make a strong cased that for students to succeed, assessment must play an integral role in instruction.	• *BlackBox*
How People Learn	This summary of findings from research on human learning describes important implications for the role of assessment in the design of instruction.	• *How People Learn* • *How People Learn: Bridging Research and Practice* Chapter 2 is especially relevant. See, for example, "Key Findings" (pgs 10-15) and "Formative Assessment (pgs 21-22).
Private Universe and Minds of Our Own	This video includes powerful vignettes that illustrate the mismatch between what is taught and what is learned. It can be used to emphasize the need for effective assessment in order to ensure that instruction has the intended effect on student learning.	• *Private Universe* and *Minds of Our Own* - see pg. 9, R1-C3 • Private Universe Descriptor Matrix
Learning through Assessment: Assessment for Learning in the Science Classroom (Anne Davies)	In this article, the author discusses the central role of the teacher in ongoing assessment. This discussion is grounded in an extended example from a middle school science classroom.	• *Everyday Assessment in the Science Classroom,* Chapter 2, SMATE LRC
Examining Students' Work (Cary Sneider)	In this article, an experienced educator recounts the development of his assessment practices in many settings. The emphasis is on assessment as the critical link between teaching and learning.	• *Everyday Assessment in the Science Classroom,* Chapter 3, SMATE LRC

Assessment Resources

I Gathering evidence of student thinking	II Making sense of the evidence	III Deciding how to respond
While written tests may be most familiar, information about student thinking can be gathered in many ways and at many stages of instruction. The integration of assessment throughout instruction allows teachers to track the development of student ideas over time. Some assessments generate written work that teachers can later review. Others involve observing student discussions and actions during class. The resources below provide a variety of strategies that can be used to elicit student thinking.	The data that are generated through assessment can be difficult to interpret. The resources described here provide guidance for making sense of student responses or other types of evidence of student thinking. In the day-to-day practice of classroom assessment, teachers may use these resources individually. However, discussion in collaborative groups can increase the depth to which student thinking can be understood. Some of the tools below are designed expressly for use in peer groups.	Once assessment data is collected and analyzed, the results can be used to guide the modification of instruction. If this step is absent, then gains in student learning are unlikely to result. A cycle of assessment, improvements to instruction, and further assessment can support a positive spiral of increasing student learning. Changes to instruction may take many forms, from providing additional time for students to assimilate and reflect on new ideas to redesigning an entire instructional sequence. Making decisions about instructional change can be challenging. This section of the tool helps make connections between assessment data and instructional decisions, linking back to the "Instruction" resources in Section I.
❑ A. Classroom probes ❑ B. Science notebooks ❑ C. Assessments drawn from existing curricula ❑ D. Assessment resources drawn from research literature ❑ E. WASL ❑ F. Classroom observation ❑ G. Questioning	❑ A. Interpreting written evidence ❑ B. Interpreting observational evidence	❑ A. Examining the efficacy of the assessment ❑ B. Instructional decision-making

Gathering Evidence of Student Thinking

While written tests may be most familiar, information about student thinking can be gathered in many ways and at many stages of instruction. The integration of assessment throughout instruction allows teachers to track the development of student ideas over time. Some assessments generate written work that teachers can later review. Others involve observing student discussions and actions during class. The resources below provide a variety of strategies that can be used to elicit student thinking and bring it out into the open.

A. Classroom Probes

Effective classroom assessment probes are based on content standards together with knowledge of specific student difficulties. Probes are used to identify the variety of ideas students bring to their learning and to design and modify instruction based on these preconceptions. (From: *Uncovering Student Ideas in Science* Vol. 2)

◗ ◗ ◗ Outcomes

Teachers will understand how to use classroom probes to uncover student preconceptions.

Teachers will be able to use information from probes to modify instruction.

Strategy/Tools	Description/Application	Source
Formative Assessment Probes	Probes designed to be used during the elicitation, exploration and/or concept development stages of an instructional sequence. A set of 50 classroom ready formative assessment probes for use or modification in grades K-16.	• *Uncovering Student Ideas in Science*¸ Vol. - Physical Science Concept Matrix p. 24 - Life, Earth, and Space Science Concept Matrix p. 116 • *Uncovering Student Ideas in Science*¸ Vol. 2 - Physical Science Concept Matrix p. 18 - Life Science Concept Matrix p. 92 - Earth and Space Science Concept Matrix p. 150
Concept Cartoon Probes	Cartoon style drawings about the science involved in everyday situations showing a range of viewpoints used to elicit student understanding and thinking. Useful in eliciting student thinking about complexity in scientific problems, confusion and misconceptions, as well as in stimulating discussion about complexity for K-16 students.	• *Concept Cartoons in Science Education*, SMATE LRC - Ch. 4: Concept Cartoons and Assessment Cartoons about: - Ch. 6: Life Processes (animals & plants) - Ch 7: Living Things & Environment - Ch 8: Nature of Materials - Ch 9: Changes in Materials - Ch 10: Electricity & Magnetism - Ch 11: Forces and Motion - Ch 12: Light - Ch 13: Sound Ch - Ch 14: The Earth & Beyond - Ch 15: Energy Resources & Transfer
Using CTS to Develop Formative Assessment Probes	PowerPoint and accompanying documents to introduce the development of formative assessment probes.	• Using CTS to Develop Formative Assessment Probes" PowerPoint • Probe Type Examples • Anatomy of a Study Guide • Designing Assessment Probes Scaffold • Content and Research Map • Sample Probe • List of Science CTS Guides

Strategy/Tools	Description/Application	Source
Teacher Leader Probes	Draft probes developed by NCOSP teacher leaders.	• Completed Probes folders - Are the Oceans Growing - What Makes Clouds - Convection Currents Air - Plate Techtonics - Mass and Dissolving - Cause of Seasons - Earth-Sun-Moon Relationships - Food Chains - Genetic Variation Plants - Heat and Temperature - Is It a Model - Magnets - Pendulums - Experiment Design - The Meaning of Matter
Whiteboarding	A technique used to make student thinking public.	• Whiteboard

B. Science Notebooks

Science notebooks are instructional tools to help students develop and articulate their ideas in making predictions, gathering and analyzing data, drawing conclusions, and other process Using science notebooks helps students refine their science understanding, while also enhancing reading, writing, mathematics and communication. Teachers use science notebooks to assess students' understanding and provide the feedback students need to improve their performance.

◗◗◗ Outcomes

Teachers will understand how science notebooks can be used for teaching, learning, and assessing science.

Teachers will be able to engage students in a variety of science notebook entries to generate multiple sources of evidence of learning.

Strategy/Tools	Description/Application	Source
Implementing science notebooks	An introduction to implementing instructional use of science notebooks in the classroom. Accompanying documents support this work. Once the use of notebooks is established in your science class you can look to evaluate entries. Note: See "Assessing Science Notebooks" in Section II for interpreting student notebook entries.	• Science Notebooks Part I-pencils or Science Notebooks Part I-Seashells PowerPoint • Compare and Contrast • Observations Organizer • Int Sci Inv Template • Char of Sci Notebooks • Notebook Components • Pow Learning Exp • Pri Sci Inv Template • Work Habits Refl Template • Box_T-Chart • Attitude Scoring Rubric • Table of Contents • Work Habits Scoring Guide • Primary Rubric
Science Notebooks in K12 Classrooms	This website includes samples of student work, writing frames, rubrics, and other teacher resources. Assessment connection?	• www.sciencenotebooks.org

C. Assessments Drawn from Existing Instructional Materials

Many publishers include assessments within their instructional materials. The purpose and quality of these assessments vary from publisher to publisher, but generally include tools for both formative and summative assessment. These materials provide many starting points for creating relevant formative assessment tools within the context of the existing curriculum.

◗◗◗ Outcomes

Teachers will be able to use assessments form existing instructional materials to generate evidence of student learning and inform instructional decision-making.

Strategy/Tools	Description/Application	Source
Using assessments and questions drawn from existing curricula	Summative assessment embedded in existing curriculum can be utilized in creating formative assessment tools. Some curricular materials have formative assessments embedded.	• Refer to the teacher guides or teacher resources of your instructional materials. • *Physics for Everyday Thinking* PET Reference URL: http://petproject.sdsu.edu/ • *Physics by Inquiry,* SMATE LRC • NCOSP Life Science Curriculum • NCOSP Earth Science Curriculum Assessment probe formats for K-12 assessment

D. Assessment Resources and Questions Drawn from Research

Sources of questions used with students exist throughout the research literature. These sources offer particularly concentrated collections of questions which can be used directly or with modification for formative assessment to address local instruction in your classroom. The value of these resources is their effectiveness in eliciting a rich set of student ideas.

◗◗◗ Outcomes

Teachers will be able to use assessment resources from the research literature to generate evidence of student learning and inform instructional decision making.

Strategy/Tools	Description/Application	Source
Student science ideas and questions for probes	Rich source of questions and summaries of children's prior ideas about science. Can be used to construct assessment probes and to anticipate prior knowledge.	• *Children's Ideas in Science*, SMATE LRC - Ch 2 Light - Ch 3 Simple Circuits, - Ch 4 Heat and Temp - Ch 5 Force and Motion - Ch 6 Gaseous State - Ch 7 Particulate model (gas) - Ch 8 Mass Conservation - Ch 9 Cosmic Earth
Student science ideas and questions for probes	Rich source of questions and summaries of children's prior ideas about science. Can be used to construct assessment probes and to anticipate prior knowledge.	• *Making Sense of Secondary Science*, SMATE LRC - Part I: Life & Living Systems, Living Things, Nutrition, Growth, Responding to the Environment, Reproduction & Inheritance, Microbes, Ecosystems. - Part II: Physical &Chemical Properties, Materials, Three Phases, Chemical Changes, Particles, Water, Air, Rocks. - Part III: Physical Processes, Electricity, Magnetism, Light, Sound, Heat, Energy, Force, Motion, Gravity.
Common misconceptions and articulation of scientific ideas at K-12 levels, and associated research references	The *Atlas* contains conceptual maps expressing how ideas in science are correlated. Each map has a sidebar discussion which delineates common misconceptions and associated relevant research reference about those ideas.	• *Atlas of Science Literacy*, Vol. 1 & 2
Statements of expected knowledge/skills by grade band	*Benchmark* statements can be used to create questions to elicit prior ideas and current understandings.	• *Benchmarks For Science Literacy*, SMATE LRC • Benchmarks Online - see pg.13, R3-C3

E. Washington Assessment of Student Learning (WASL)

Washington students are regularly tested by the state to find out if they're on track to learn the important skills they need to be successful while in our schools and after graduation. Students are tested on basic academic skills as well as more advanced skills.

OSPI develops or selects and administers all state assessments and reports achievement data for individual students, schools, districts and the overall state. WASL measures student learning of the state's academic standards. Students are tested each spring in science in grades 5, 8, and 10. **The results from the WASL help districts and schools refine instructional practices and focus curriculum**.

Instructors may wish to view WASL released test items and Powerful Classroom Assessments (PCAs) in order to become familiar with testing formats and scoring criteria.

◗ ◗ ◗ Outcomes

Teachers will be able to use assessment resources from OSPI to understand the expectations of the state assessment and apply them in their classroom practice.

Strategy/Tools	Description/Application	Source
WASL	The WASL compares students to Washington's state academic standards – not to each other. The WASL is not a diagnostic test – that is, its purpose isn't to pinpoint where an individual student is struggling and what kind of help is needed. Teachers use a variety of diagnostic, classroom-based assessments to tailor instruction to students' needs.	• WASL Release Items http://www.k12.wa.us/assessment/WASL/Testquestions.aspx • Note: This webpage has links to Frequently Asked Questions, Test Items and other general WASL information.
Powerful Classroom Assessments	Released scenarios and items are refined into Powerful Classroom Assessments (PCAs) for use in science classrooms. PCAs include pilot and template items reflecting the whole test map of the Science WASL (Systems, Inquiry and Application) and ten annotated student responses for each constructed-response item. Using Science PCAs to help students get involved in their assessment has been demonstrated to be an effective method for improving student learning and achievement. PCAs are available through the OSPI website.	• www.k12.wa.us Note: This link will take you to the Office of the Superintendent of Public Instruction webpage. • PCA Weblink: http://www.k12.wa.us/assessment/WASL/Science/ClassroomAssessments.aspx Note: This link will take you to the WASL released items (PCAs).

F. Classroom Observations

Classroom observations by peers or knowledgeable others can be useful in helping teachers understand the myriad ways students engage with and interpret the lessons they take part in. It is quite difficult to observe your own classroom objectively while in the process of teaching. The following tools and strategies provide powerful ways to assist teachers in understanding the dynamics of their classrooms from the learners' perspective, diagnosing student understanding, and finding strategies for revisions to classroom practice.

◗◗◗ Outcomes

Teachers will understand how classroom observation data can be used as formative assessment.

Teachers will be able to conduct classroom observations to collect evidence of student understanding to inform instruction.

Strategy/Tools	Description/Application	Source
Classroom Observation Protocol	This tool is a structured observation protocol for observing classroom lessons. The tool is broken into four broad categories: lesson design, lesson implementation, content addressed, and classroom culture. Each category is then further broken down into a number of key indicators. These tools can be modified to allow observers to focus on specific attributes of a lesson.	• Horizon Classroom Observation Protocol (PDF) Note: The key indicators for content can be found on page 5.
Lesson Study	Lesson Study is a form of professional development grounded in classroom practice that seeks to gradually improve student learning through structured reflection on teaching. In Lesson Study, teachers plan a lesson collaboratively, observe students during the lesson, and debrief the lesson in order to make improvements to their general practice.	• *NCOSP Abridged Integrated Curriculum Topic Study and Lesson Study* (The "Orange Book") - Sections I-III (Selecting a Goal for Research; Examining the Unit; and Designing the Research Lesson) can be used to carefully design a lesson to gather evidence of student learning
Lesson Study Facilitator's Guide	This 'behind the scenes' document for facilitators has background information, debunks common Misconceptions, and details observer roles during Lesson Study. There are many guiding questions facilitators might ask of groups as they move through a Lesson Study cycle.	• Lesson Study Facilitator's Guide • Observer Guidelines

G. Questioning

The role of questioning in classrooms can be quite complex. Questioning often takes the form of a 'three turn exchange' where a teacher questions, a student responds, and the teacher evaluates the student response. Questioning at this level does not generally encourage student generated questions or allow instructors to find out 'what conceptions and ways of reasoning their students are using.' Questioning can be used strategically to gather data on student thinking. (Quotes from: *Using Questioning to Assess and Foster Student Thinking* by Minstrell and van Zee)

◗◗◗ Outcomes

Teachers will understand the nature and quality of questioning strategies needed to elicit student thinking.

Teachers will be able to use questioning strategies to diagnose student understanding and inform instruction.

Strategy/Tools	Description/Application	Source
Reflective Discourse	This article explores the role of *reflective discourse* in a high school physics class. The article examines the central purposes and types of questions useful for learning science, as well as how the use of questions can inform instruction.	• *Everyday Assessment in the Classroom,* SMATE LRC Note: This book contains nine additional essays on assessment. • *Using Questioning to Assess and Foster Student Thinking* by Jim Minstrell and Emily van Zee, pg. 61-73.
Questioning Matrix	This document includes descriptions and examples of Narrow (Memory and Convergent) questions and Broad (Divergent and Evaluative) questions. How and when to ask these types of questions are included in this matrix.	• Adapted from: Exploratorium Institute for Inquiry, Larry Lowery, Wynne Harlan, Angelo Ciardiello • *Questioning For Understanding*

NOTES:

II Making Sense of the Evidence

The data that are generated through assessment can be difficult to interpret. The resources described here provide guidance for making sense of student responses or other types of evidence of student thinking. In the day-to-day practice of classroom assessment, teachers may often use these resources individually. However, discussion in collaborative groups can increase the depth to which student thinking can be understood. Some of the tools below are designed expressly for use in peer groups.

A. Strategies and Tools for Interpreting Written Evidence

The resources described here provide guidance for making sense of student written responses. Most involve work among collaborative groups.

◗◗◗ Outcomes

Teachers will understand the role of protocols, rubrics, and scaffolds in interpreting student thinking.

Teachers will be able to use a variety of tools to analyze student work for evidence of learning.

Strategy/Tools	Description/Application	Source
Looking at Student Work (LASW)	A set of protocols to guide teachers in examining written work. Focus is on developing shared expectations for student learning, using evidence to assess content understanding, and examining the role of standards.	• The Power of Protocols • Reflection Matrix • Role strips • LASW Intro PowerPoint - Session One Facilitator's Notes - H-M-L Protocol - Blank probe (Can it Reflect Light?) - Student Responses (Hard copy only) - Scientists Ideas on Light • LASW Session 2 PowerPoint - Session Two Facilitator's Notes - Understand and Respond Protocol - Blank Probe (What is Density?) - Adult Responses (Hard copy only) - Scientists Ideas on Density • LASW Session 3 PowerPoint - Session Three Facilitator's Notes - Vertical Team PLC Scenario - Standards in Practice Protocol - Blank Probe (The Mitten Problem) - Student Responses (Hard copy only) - Scientists Ideas on "The Mitten Problem"
Additional protocols for examining written work	Other protocols for examining student work are available online.	• Looking at Student Work Website www.lasw.org

Strategy/Tools	Description/Application	Source
Collaborative Inquiry into Examining Students' Thinking (CIEST)	A protocol for analyzing written work. Includes steps to identify the required content knowledge, to sort responses and characterize reasoning, and to consider the implications for instruction. A slideshow provides a step-by-step introduction to CIEST.	• Examining Student Thinking PowerPoint • CIEST Task Scaffold
Assessing science notebooks	A step-by-step strategy for assessing notebooks for student proficiency with entry types and for students' conceptual understanding. A slideshow and accompanying handouts describe the strategy.	• Looking at Science Notebooks PowerPoint • Science Notebook Entry Types (PDF) • Science Notebook Entry Types + Characteristics • MINI Notebook for Phase II Presentation • Science Notebook Conv Analy • Science Notebook HPL + Conc Analy • Science Notebook II Fac Agenda
Rubrics for assessing science notebooks	A set of rubrics that teachers may use in assessing notebooks. Rubrics can be downloaded as Word files and modified to match a teacher's specific context.	• www.sciencenotebooks.org/tools/assessment.cfm
Samples of student work	A set of student responses to formative assessment probes is available in hard copy. These can provide opportunities to practice and discuss the analysis of written work.	• SMATE LRC

Additional Resources:

- *"Using Data/Getting Results: A practical guide for school improvement in mathematics and science with CD-ROM"* by Nancy Love. Presents ideas, strategies, and tools that can help those responsible for leading science and mathematics reform at the school or district level. Emphasizes data-driven reform. See pg 44 ("Organizing data-driven dialogue") for discussion of how groups can look for trends in data, plausible explanations, and implications for action. Available at WWU SMATE.

Additional Resources for Protocols:

- David Allen and Tina Blythe, *The Facilitator's Book of Questions, Tools for Looking Together at Student and Teacher Work*. Oxford, OH: National Staff Development Council, 2004.
- Joseph P. McDonald, Nancy Mohr, Alan Dichter, Elizabeth C. McDonald, *The Power of Protocols, An Educator's Guide to Better Practice.* NY: Teachers College Press, 2003.
- David Allen, ed., *Student Work, Teacher Learning*. NY: Teachers College Press, in press.
- David Allen, Tina Blythe, and Barbara S. Powell, *A Guide to Looking Collaboratively at Student Work.* Cambridge, MA: Harvard Project Zero, 1996.
- David Allen, *The Tuning Protocol: A Process for Reflection*. Providence: Coalition of Essential Schools, 1995.

B. Strategies and Tools for Interpreting Observation Evidence

Evidence of student learning doesn't always come in written form. Observations of student-student and student-teacher discourse are a rich source of evidence of student thinking. Listening, diagnosing, and responding to this evidence in the moment is a critical form of formative assessment.

◗◗◗ Outcomes

Teachers will understand that student discourse is an important source of data on student thinking.

Teachers will understand how to use protocols to collect evidence of student learning through observation.

Strategy/Tools	Description/Application	Source
Horizon Protocol for Classroom Observation	A standards-based instrument designed to measure the quality of an observed K-12 science lesson. Focus is on the design, implementation, content, and culture of the lesson.	• www.horizon-research.com/instruments/clas/cop.php • Horizon Class Obs Protocol (PDF)
Lesson Study	Lesson Study is a form of professional development grounded in classroom practice that seeks to gradually improve student learning through structured reflection on teaching. In Lesson Study, teachers plan a lesson collaboratively, observe students during the lesson, and debrief the lesson in order to make improvements to their general practice.	• NCOSP *Abridged Integrated Curriculum Topic Study and Lesson Study* (The "Orange Book") • Sections IV and V of the "Orange Book" (Evaluation and Revision), can be used to carefully analyze evidence of student learning. • Lesson Study-Orange Book (PDF)
Lesson Study Facilitator's Guide	This 'behind the scenes' document for facilitators at the Summer Academy has background information, debunks common misconceptions, and details observer roles during Lesson Study. There are many guiding questions facilitators might ask of groups as they move through a Lesson Study cycle.	• Lesson Study Facilitator's Guide • Section IV of the "Lesson Study Facilitator's Guide" (*Reflective Questions* on page 9) includes questions that may help your group reflect consider new ways to interpret/view the data collected in class. • Observer Guidelines (Handout)
NWREL Resources on Lesson Study	Contains protocols for conducting observations of a K12 classroom science lesson.	• Northwest Regional Education Laboratory

III Deciding How to Respond

Once assessment data is collected and analyzed, the results can be used to guide the modification of instruction. If this step is absent, then gains in student learning are likely to remain elusive. A cycle of assessment, improvements to instruction, and further assessment can support a positive spiral of increasing student learning.

Changes to instruction may take many forms, from providing additional time for students to assimilate and reflect on new ideas to redesigning an entire instructional sequence. Making decisions about instructional change can be challenging. This section of the tool helps make connections between assessment data and instructional decisions, linking back to the "Instruction" resources in Section I.

A. Efficacy of the Assessment

The assessment itself must accurately measure the intended learning target.

- Does the assessment measure student understanding of the intended learning target?
- What degree of certainty do you have that answering the question correctly is evidence of understanding? Are there factors you can identify that might contribute to a student who **does not** know the content while getting the answer right?
- What degree of certainty do you have that answering the question incorrectly is evidence of a lack of understanding? Are there factors you can identify that might contribute to a student who **does** know the content while getting the answer wrong?
- Are there sufficient opportunities for students to express their reasoning for answering the assessment question(s) as they did?

◗◗◗ Outcomes

Teachers will be able to determine the quality of their assessment tools.

Strategy/Tools	Description/Application	Source
Determining the accuracy of the assessment	When the assessment itself is flawed, revisions to assessment are needed. If the flaws exceed what can be accomplished through revisions, you need to develop or acquire a new assessment that will measure your intended learning target.	• For Modifying or Developing Assessments: see Assessment Part 1. A. Classroom Probes. "Using CTS to Develop Formative Assessment Probes." • For finding Classroom Ready Assessments, see Assessment Part 1. A. Classroom Probes. "Formative Assessment Probes."

B. Instructional Decision-Making

Interpreting evidence collected through assessment provides a diagnosis of student understanding. The next step is to implement an instructional response appropriate to the diagnosis. This section of the tool offers strategies to assist in that instructional decision making process.

◗◗◗ Outcomes

Teachers will understand the factors to consider when making an instructional decision in response to assessment evidence.

Teachers will be able to respond to assessment evidence diagnostically to support student learning.

Strategy/Tools	Description/Application	Source
Clarifying student thinking	When the evidence of student understanding is *insufficient or unclear*, and you are reasonably certain that the assessment given is appropriate, you need to elicit further student comments to clarify what students do or don't understand.	• See Section I: Instructional Practice "Prior Ideas and Knowledge."
Ensuring mastery of the learning target	When assessment evidence indicates that *students clearly have not mastered the intended learning targets* both the number of students struggling and the potential for future learning opportunities are critical considerations in determining the instructional response.	• See Section I: Instructional Practice "Constructing Understanding." • When a **low number of students** are struggling with important content simply provide additional time and practice for these few students. • When **future lessons within the unit will provide additional learning experiences**, make note of the learning targets are not well developed and "flag" the future lessons which will address those targets. When you reach those lessons, focus on the opportunities to address the students learning needs identified previously. Additional assessments administered within the unit at this stage should be used to reveal whether student learning is improving. • When a **high frequency of students** are struggling with important content that will serve as a foundation for continued understanding and there are **few or no opportunities to develop this understanding** later, additional learning experiences are necessary to ensure students develop the necessary content knowledge.

Strategy/Tools	Description/Application	Source
Facilitating sense-making	When assessment evidence indicates that *students emerging understanding of the intended learning targets is accurate*, you may decide to provide students opportunities to examine how they came to understand this content.	• See Section 1: Instructional Practice "Metacognition" • Students often develop accurate understandings of discrete ideas, but may not fully appreciate how those ideas relate to one another. Moreover, as they come to learn new ideas, they may not be fully aware of what experiences or evidence facilitated that learning. Opportunities for sense-making and reflection are important for deepening their understanding of the content and developing their ability to facilitate their own learning.
Communicating assessment results	Assessment results are important for students not only during an instructional sequence, but for future learning experiences. Effective professional learning communities share assessment evidence among teachers to ensure this data is used as students pass from one grade level to the next.	• In your school-based collaborative groups, define mechanisms to communicate assessment evidence to inform future learning experiences for students. • What learning targets are understood by the majority the students? What is the evidence that students understand this content well? • Which students have understandings that have been developed well beyond the standard? • What understanding is still emerging at this time? What is your evidence that students' understanding of this content is still emerging? • What content is not well understood by a majority of students? What is your evidence that students' understanding of this content is incomplete? • What opportunities for students to engage with this content in the near future can be provided?

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