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A professional learning community activity for science teachers: How to incorporate discourse-rich instructional strategies into science lessons

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Abstract

In this article we describe current educational research underlying a comprehensive model for building a scientific classroom discourse community. We offer a professional development activity for a school-based professional learning community, providing specific science instructional strategies within this interactive teaching model. This design activity provides a quick and practical means of transforming science lessons to be more engaging for students. Through this activity teachers can redesign any science lesson by focusing on each of the five core components of a scientific classroom discourse community: (a) scientific inquiry, (b) oral discourse, (c) written discourse, (d) academic language development, and (e) learning principles. By using this structure teachers will be better able to meet the *Next Generation Science Standards* and facilitate greater interdisciplinary learning. An example of a redesigned water cycle lesson is provided.

Introduction

In these post-NCLB days of accountability and high-stakes testing we, as teacher educators and professional development providers, often hear teachers express concern about a lack of time to teach using inquiry-based instruction. However, since 1996 U.S. national science education standards have explicitly asked science teachers to teach using more inquiry. With the introduction of the *Next Generation Science Standards* (Achieve, Inc., 2013) and its strong emphasis on teaching scientific practices and process skills, it is clear that inquiry-based teaching practices will continue to be the gold standard for science curricular design and instruction. One way science teachers can brainstorm ways to integrate more inquiry into their lessons is by collaborating with their colleagues to transform standard verification lab activities into more active learning opportunities for students to talk and write about science, thus increasing opportunities to make meaning of core concepts. Teachers can encourage students' higher-level thinking by using a model of a scientific classroom discourse community to teach science. This article outlines a process for science teachers, as participants in their local professional learning communities (PLCs), to incorporate more inquiry-based science instruction infused with oral and written discourse to meet national and state science education standards. We offer a transformed lesson on the water cycle as an example of how this process can result in constructing standards-aligned opportunities for student learning.

Keywords: teacher professional learning community, classroom discourse, instructional strategies, standards-based science lessons

Professional Learning Communities

With the rising popularity of school-based professional learning communities (PLCs) (Dufour, 2004) comes the need for more readily-available, focused and practical science teacher professional development (PD) activities. Schools and districts may mandate PLCs and provide time for teachers to collaborate, but science departments composed of busy teachers are pressed for time to find and vet a regular supply of adequate and reliable activities and materials for their own use. Even when schools and districts provide in-house professional development (PD), the focus is not explicitly on how to improve the quality and effectiveness of science instruction.

The *Communication in Science Inquiry Project (CISIP)* was a National Science Foundation grant-funded research program focused on developing a model for, and aiding teachers in, building scientific classroom discourse communities (SCDC) (Figure 1) (Baker, et al., 2009; Baker, et al., 2011; Lewis, et al., 2011). Another critical aspect of the CISIP's success was that teachers participated in school-based teams. Through their colleagues' support and feedback on their lessons CISIP teachers affected change in their classrooms. From this work we have developed, and present here, a practical activity to similarly encourage PLC members to redesign their science lesson plans for the purpose of boosting student engagement and learning.

Classroom Discourse

When teachers infuse traditional science lessons with specific teaching strategies they can break the pattern of traditional, teacher-directed discourse, known as triadic dialogue (Lemke, 1990) or IRE. Triadic dialogue is a staple of teacher-directed instruction in which the teacher initiates (I) dialogue, often by posing a question to the whole class, one student offers a response (R), and then the teacher evaluates (E) the response by either affirming the student's answer or rejecting it and supplying a correct response. This approach to teaching science severely restricts student engagement and participation by preventing peer-to-peer discourse. While many teachers fear losing control of their classrooms, by shifting discourse to students, for example in small groups with structured activities, teachers can increase student engagement, decrease off-task behavior, and encourage deeper learning and a better understanding of the nature of science and scientific communication (Hand, et al., 2003). As teachers build SCDCs, they provide opportunities for inquiry and meaningful discourse. Such discourse events are important because they elevate the learning experiences of all students, and seek to include students with special needs and English language learners (Fradd, & Lee, 1999) as well as high-performing students.

CISIP: A Research-based Model for Teaching and Learning in Science

Effective Professional Development

The CISIP program development was guided by research on prior successful professional development activities and frameworks. We focused on developing the knowledge and skills that would enhance teachers' effectiveness in areas such as how to: (a) reveal students' thinking and prior conceptions, (b) leverage cognitive learning principles, and (c) strengthen subject matter knowledge for teaching (Borko, 2004; Guskey, 2002; Wang, Yoon, Zhu, Cronen & Garet, 2008). We provided practical ideas for daily instruction, such as the example lesson we outline in this article. We employed a constructivist approach during the PD activities because it facilitated teacher learning. This included regular and frequent opportunities for teachers to interact with colleagues (Davis, 2003). A constructivist approach allowed us to use *change as a growth and learning model* with teachers as active learners and schools as learning communities (Clarke & Hollingsworth, 2002). The PLC activity we present here is based on research that suggests that teachers cannot create learning communities among students unless they themselves are part of a learning community (Borko, 2004). The CISIP program also provided PD for administrators because teachers who perceive that their principals support standards-based science instruction are more likely to implement what they learn through PD about standards-based instruction in their classrooms (Spillane, 2002; Banilow, Heck & Weiss, 2006).

In conjunction with the CISIP program, we developed and field-tested a classroom observation tool, the *Discourse in Inquiry Science Classrooms (DiISC)* instrument (Baker et al, 2009; Ozdemir, Lewis, & Baker, 2007). Both the program and the observation instrument were based on extant educational research literature on: (a) inquiry-based learning in science (National Research Council, 1996), (b) oral discourse (Newton, Driver, & Osborne, 1999), (c) written discourse (Callaghan, Knapp, & Noble, 1999; Halliday & Martin, 1993), (d) academic language development (Echevarria, Vogt, & Short, 2004; Herrell & Jordan, 2003), and (e) cognitive learning principles (Bransford, Brown, & Cocking, 2000; National Research Council, 2005). Classroom observation items were written and evaluated by the PD providers to ensure that they accurately reflected the CISIP model of a SCDC. The DiISC was then field-tested in secondary science classrooms in an effort to capture how teachers used instructional strategies from the CISIP program. The DiISC observation tool includes a total of 36 teaching strategies in the five aforementioned areas. Each DiISC item has a customized rubric to determine the level of use of the strategy by the teacher. The strength of the selected strategies measured by the DiISC is that they are closely aligned with the *Next Generation Science Standards* (Achieve, Inc., 2013). The use of such strategies support inquiry-based learning as well as prepare students for high-stakes testing (Boardman & Woodruff, 2004).

We found that the longer teachers engaged in the CISIP program activities, the more SCDC instructional strategies they used (Lewis, Baker, Helding, & Lang, 2010). We also found that as compared with teachers who taught in higher SES communities, teachers who taught at schools and communities with more students in poverty initially used fewer inquiry-based strategies. As found in other studies (Oakes, 1986), this was due to teachers' lowered performance expectations when assuming that impoverished students were unable, and/or unwilling, to engage in scientific inquiry. Over time and with professional development, all teachers were able to add more and more SCDC instructional strategies to help all their students learn science. For example, as a result of the

Figure 1

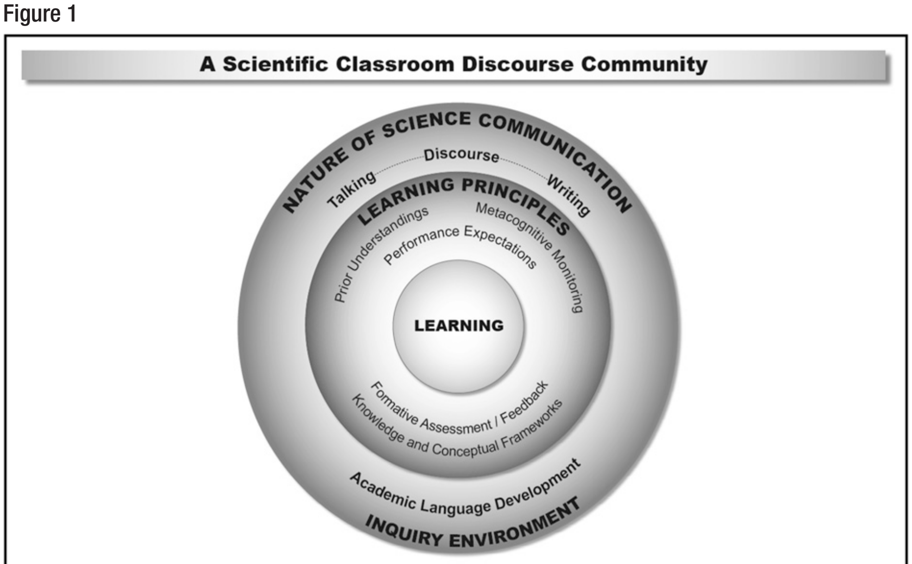

Figure 1: The CISIP model of a scientific classroom discourse community (Baker, et al., 2009).

CISIP program, an experienced 11-year veteran high school biology teacher in an inner city, low SES, majority-minor school, for the first time engaged her students in a self-directed genetics research project. The students selected a genetics problem, crafted a research question, worked in small groups in their school's library to research their question, and finally presented their findings to their class. While this teacher and her students initially struggled with a social-constructivist approach to learning, in the end, she prioritized more authentic opportunities for student learning and her students learned more about how to work in groups, communicate their ideas to others, and engage in learning about complex genetics issues (Lewis, 2011).

Another teacher who participated in the CISIP program, taught in a middle school with a large ELL population of students with Mexican heritage. This teacher designed an integrated unit on earthquakes with her language arts colleague. As part of their language arts assignments the students interviewed their Mexican relatives about their personal experiences at the time of the 1985 Mexico City earthquake, an event that occurred before they were born. With their science teacher the students engaged in inquiry-based science activities to better understand earthquakes. After both activities they wrote a newspaper article that included both scientific information and "eyewitness" reports about the magnitude 8.0 earthquake that killed approximately 10,000 Mexican citizens. Because this event had affected some of their own immediate and extended families they were strongly motivated to learn more about both the science behind earthquakes and how natural disasters impact people's lives.

We also gave a 17-item questionnaire, "My Science Class" (MSC), to over 1,100 students to measure middle and high school students' assessment of four instructional dimensions: *Scientific Inquiry, Learning Expectations, Writing,* and *Use of Science Notebooks*. The student sample was roughly split between two groups of teachers, teachers who had engaged in the CISIP program and those who had not. The instrument used a four-point scale, with ratings ranging from 1 = "the statement does not describe what happens in this classroom" to 4 = "the statement describes what always happens in this classroom." MSC items included: (a) "*We design our own scientific investigations,*" (b) *"We know what the teacher expects us to learn,"* (c) *"We use science notebooks to record our data,"* (d) *"We reflect on our own learning,"* and (e) *"We revise what we write."* An analysis of the data indicated that students taught by CISIP teachers perceived their classroom environment as different from other students taught by non-CISIP teachers. Students were more likely to see science notebooks taking an active role in the classroom, an increase in the quantity and quality of scientific writing, an environment that supported learning science through scientific inquiry, and activities that supported academic language acquisition. In short, these students found themselves in an environment in which meaningful scientific learning could take place, a scientific classroom discourse community.

Due to the success of the CISIP program activities on teachers' classroom instruction we devised an activity using the DiISC tool designed to allow any science teacher to revise an existing lesson to improve students' opportunities to make meaning of science concepts while participating in a SCDC. This approach allows teachers to meet national standards and teach meaningfully at the same time. As teachers try new instructional strategies in their classrooms and discuss the results of their efforts with their PLC colleagues, teacher educators and PD providers must keep in mind that these efforts should not be viewed as a single event, but as a long-term process of change (Louks-Horsley, Hewson, Love, & Stiles, 1998).

Professional Learning Community Activity

This activity was designed for and implemented in a session at an annual conference of the National Science Teachers Association (Lewis, Beard, Perkins, Bueno Watts, & Baker, 2010) and has since been used successfully with preservice secondary science teachers in a science teaching methods course that taught students how to design discourse-rich science lessons. The lesson directions that follow are written for the PLC facilitator to prepare for and conduct the session and follow-up activities.

Preparing for the Activity

1. Make a color photocopy of the master DiISC tool (Appendix). If you plan to use this activity more than once you may want to laminate one copy and then cut each of the 36 strategies into their own separate tiles. Keep the strategies in their color-coded groups organized by title (i.e., inquiry, oral discourse, etc.) by putting each group of strategies into a separate envelope.
2. Make additional copies of the whole DiISC tool (keep intact) and the example lesson plan on the water cycle, one for each teacher.
3. Ask each teacher to bring an upcoming science lesson to the PLC meeting that they are planning to teach soon and would like to revise.

Pre-activity: Accessing Prior Knowledge about SCDCs (20 minutes)

At the PLC meeting, begin the activity by directing the teachers to answer the following questions individually to access their prior ideas about SCDCs (5 minutes):

1. How would you define a scientific classroom discourse community? In other words, what would you expect to see happening? What are students doing? What is your role?
2. How is the discourse in a scientific classroom discourse community different from other discourses (e.g., math, social studies, art)?

Once teachers have written their individual responses, they can then share their ideas with a colleague for 5 minutes. After the paired discussions, conduct a brief, 10-minute whole-group discussion to share their ideas about how to generate scientific discourse.

Activity Part I: Practicing with the SCDC Strategies (15 minutes)

Using the strategy cards, randomly provide one card from each category to each pair of teachers, for a total of five cards. Note that the emphasis of each strategy is generally on how the teacher provides students with opportunities to learn. Each pair should create a general or specific way to integrate their assigned strategies into a science lesson. After the teachers have brainstormed some ideas, have each pair share their ideas (with or without whiteboards or chart paper) with another pair of teachers to receive feedback.

Activity Part II: Transforming a Science Lesson (30 minutes)

Supply the example lesson plan on the water cycle to show the teachers how the DiISC strategies can be used to transform a science lesson; discuss each of the changes that were made to reform the lesson plan explicitly highlighting how each instructional strategy was used to improve the lesson. Give each teacher a copy of the full DiISC tool for the final activity of the PLC session. Invite the teachers to purposely select at least one of the teaching strategies from each of the five categories to revise the lesson plans they brought with them. Provide 15 minutes for them to do this individually and then form groups of three or four so that they can share their transformed lesson plans and receive feedback. On whiteboards or chart paper, have the groups summarize how they plan to teach their transformed science lessons and also answer the following general questions:

1. What could you do to build a scientific classroom discourse community with your students?
2. What are your priorities for student learning?

After this discussion, post the ideas around the room for everyone to read. To encourage whole group discussion ask the teachers to look for similarities and differences among the lists to identify common shared priorities for teaching science.

Post-activity Challenge and Follow-up

At the end of the meeting, ask your PLC members to reflect on the revised lessons after they have taught them. At a future PLC meeting (i.e., in about a month's time, to provide adequate time for teachers to teach their lessons) have everyone share their experiences of trying their new lessons. Teachers initially may find change difficult, and this is common if students are confused by a new instructional strategy they have not experienced very often and may consequently resist this new approach. However, it is important to encourage patience, practice and small-scale changes over time. The entire DiISC instrument can also be used by the PLC to observe other teachers' revised lessons and provide focused feedback; the DiISC users' manual and research papers on the CISIP program can be found at: http://digitalcommons.unl.edu/do/search/?q=DiISC&start=0&context=52045&sort=date_desc

Example: A Science Lesson Before & After the PLC Activity

Through transforming a basic lesson on the water cycle we describe how to develop a scientific classroom discourse community with the five core ideas of the CISIP model. Each part of the lesson is described in separate sections and Figure 2 shows how the selected strategies from the DiISC were used to revise this lesson plan.

Science Lesson before Changes

The "before" lesson plan is a traditional approach to teaching science with no inquiry-based instructional strategies. The teacher delivers a lecture to introduce the science vocabulary used in the water cycle, has students read about it in their textbook, and complete a worksheet about the parts and processes of the water cycle. Finally, the students are given a quiz to demonstrate their understanding of the science concept.

Science Lesson after Changes

By using one strategy from each of the five core areas of the SCDC model (Items 1, 8, 15, 20, and 26) from the DiISC tool we have easily revised the lesson plan. We describe each strategy that we incorporated and how we changed the activities.

Inquiry. We used the 5E model of inquiry-based instruction as a framework for this lesson because it has been used widely and teachers are generally familiar with its components. By redesigning the water cycle lesson with these components, this addresses DiISC Item #1, *"Teacher creates an environment that supports inquiry."* The lesson is now organized by 5E phases, *Engage, Explore, Explain* (students first, then teacher to refine any misconceptions), and *Elaborate*. The fifth E, *Evaluate,* focuses on assessment throughout the lesson, for which we also provide examples.

Learning principles. As part of the *Engage* phase we are led naturally to use DiISC Item #26, "*Accessing students' prior knowledge."* At the beginning of the lesson, the teacher asks students to diagram the water cycle to demonstrate what they already know, or think they know. After drawing, students are directed to write three questions about the water cycle. These questions can be shared as a whole group and posted on a question wall for later reference.

Oral discourse. The teacher then shifts the lesson into *Explore* mode and has students assume an identity as a water molecule and engage in collecting data using a hands-on activity from the NOAA website (see link in references). The students roll the dice at each of the stations to follow their water molecule's journey through the water cycle and record their data. Once this task is completed the teacher uses the next strategy (Item #8, "*Teacher promotes peer-to-peer discussion"*) to structure the oral discourse in the classroom by having the students share their data with others.

Written discourse. To improve opportunities for students to write about science, the teacher has student groups discuss their findings and draw pictures of their water molecule moving through the water cycle and write a summary of the journey and how long the water molecule stays in each place and state of matter. This addresses another item from the DiISC, Item #15, "*Engaging students in writing to acquire the language patterns and vocabulary to communicate*

Figure 2

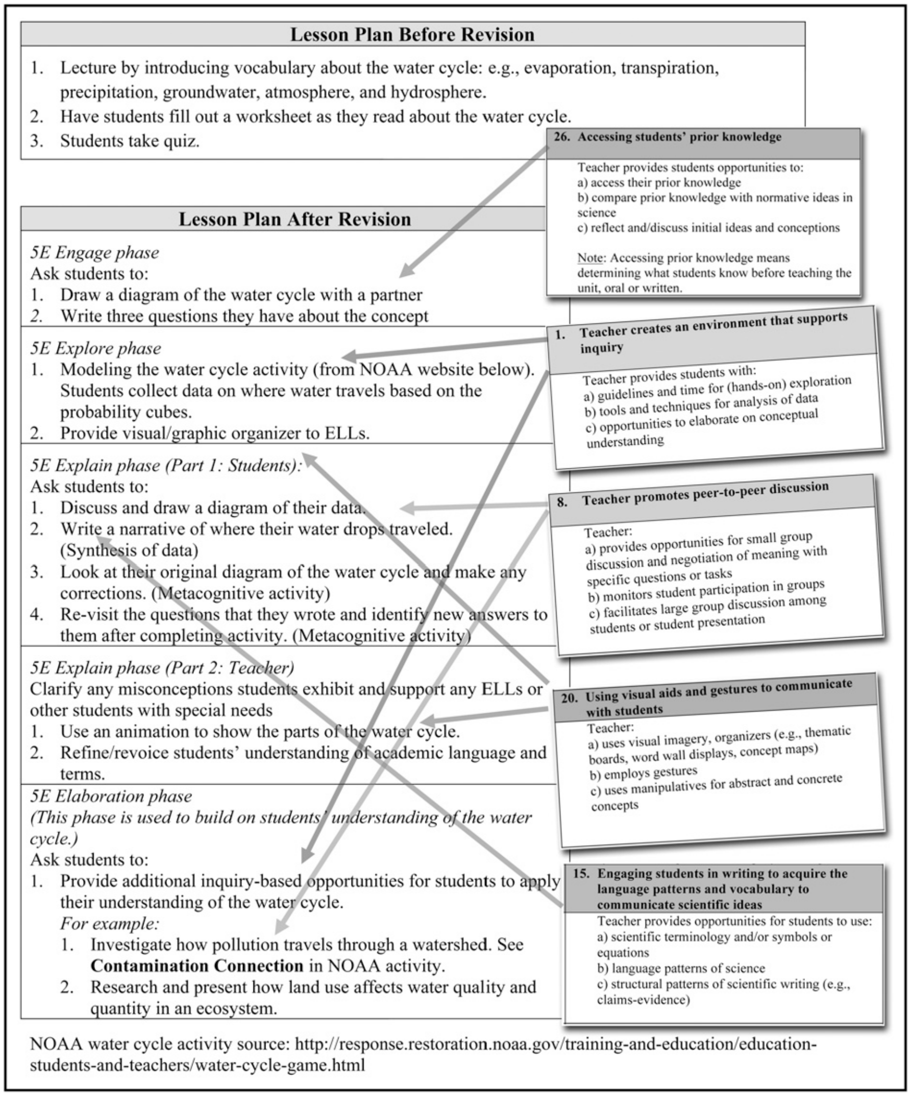

Figure 2: Using SCDC Strategies to Transform a Science Lesson on the Water Cycle.

scientific ideas." By providing students with more opportunities to draw and write about scientific concepts in the genre of scientific writing, teachers can support student learning.

Academic Language Development. Throughout the lesson the teacher uses Item #20, "*Using visual aids and gestures to communicate with students,"* to support academic language acquisition and provide comprehensible input to all students, especially ELLs and students with special needs. This is accomplished in our example when the teacher provides: (a) water cycle cubes with pictures and descriptions of the parts of the water cycle on each of the six sides to help collect data in the *Explore* activity, (b) a graphic organizer to collect the data, and (c) an animation of the water cycle during the *Explain* phase later in the lesson.

Concluding the lesson. In the final inquiry phase the teacher provides students with an opportunity to elaborate on their understanding of the water cycle. The students repeat the cube activity, now collecting (e.g., when water runs off to the river) or leaving (e.g., when water evaporates to the clouds) "contamination tokens" at various stages of the water cycle. As a second follow-up activity the students are directed to investigate how real pollution affects the quality of life in an ecosystem and as a final assessment make class presentations about their findings.

Conclusion

We have presented one model of a scientific classroom discourse community in this article. The CISIP model has been refined through iterative formative assessment and research on the professional development program activities. We have found that the SCDC strategies summarized in the DiISC tool can be incorporated into instruction over time as teachers' comfort levels with them increases. The 5E model of inquiry is just one useful structure for incorporating CISIP instructional strategies as students engage, explore, and explain science with classmates or others. Evaluation of science concepts can be woven into lessons both formatively, throughout the activities, and summatively. By regularly using these CISIP instructional strategy cards to redesign traditional teacher-directed science lessons, science teachers' students will soon be talking and writing like scientists and engaging in authentic inquiry experiences.

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Appendix

Discourse in Inquiry Science Classrooms (DiISC)

(I) Inquiry Scale

1. Teacher creates an environment that supports inquiry	**2. Teacher engages students in asking scientific questions for the purpose of investigation (hands-on or other means)**
Teacher provides students with: a) guidelines and time for (hands-on) exploration b) tools and techniques for analysis of data c) opportunities to elaborate on conceptual understanding	Teacher provides students opportunities to: a) formulate questions about the natural world b) present explanations for questions c) distinguish between scientific and non-scientific questions
3. Opportunities for students to design and plan exploration of the natural world individually or in groups	**4. Opportunities for early stages of scientific exploration: making observations, recording data, and constructing logical representations (e.g., graphs)**
Teacher provides opportunities and guidance to: a) plan and conduct scientific investigations individually b) plan and conduct scientific investigations in groups c) justify procedures before carrying out investigations	Teacher provides opportunities to: a) make observations through doing the activity b) record and use data c) record and represent data in logical forms that show patterns and/or connections
5. Opportunities for later stages of scientific exploration: explaining phenomena via claims and evidence, making predictions, and/or building models	**6. Generating scientific arguments and constructing critical discourse about limits and sources of error**
Teacher provides students opportunities to: a) make claims, provide evidence, and develop explanations b) revise explanations and models using data and logic c) make predictions and build models	Teacher provides students opportunities to: a) think of other ways to interpret data using scientific knowledge and logic to generate scientific arguments b) identify limits and exceptions of interpretations of data c) discuss the effects of error on results and suggest ways to reduce error in collecting data

(OD) Oral Discourse Scale

7. Teacher promotes discourse through questioning	**8. Teacher promotes peer-to-peer discussion**
Teacher asks questions: a) that require analysis and comparison b) that are divergent and have multiple possible answers c) to redirect for more information, to evaluate answers, and to uncover students' reasoning	Teacher: a) provides opportunities for small group discussion and negotiation of meaning with specific questions or tasks b) monitors student participation in groups c) facilitates large group discussion among students or student presentation
9. Teacher (or instruction) bridges everyday experiences and scientific discourse	**10. Teacher models scientific discourse and vocabulary**
Teacher: a) is sensitive to gender issues of discourse (using topics of interest to all students) b) connects everyday (e.g., pop culture) and scientific discourse c) distinguishes between everyday meaning of words and their scientific meanings	Teacher models how to: a) use scientific terminology b) use logical connectives in explanations (why-because) c) argue from evidence, compare, and analyze
11. Teacher engages students in discussion that emphasizes the nature of science	
Teacher provides students with opportunities to: a) discuss that science is tentative and fallible b) discuss results and methods (replication of experiments) with skepticism and openness c) engage in public sharing of knowledge (incorporating NOS)	

(W) Writing Scale

12. Formal writing in a genre that reflects the nature of science	13. Engaging students in prewriting associated with science concepts
Teacher provides students with opportunities to: a) write for different audiences and purposes b) use expository, reflective, and expressive formats (e.g., newspaper article, poster, a lab report / scientific investigation report) c) emphasize the nature of science	Teacher provides opportunities for students to: a) use brainstorming strategies and/or create concept maps b) develop questions and outlines c) take notes and/or use scientific terminology or symbols during scientific inquiry investigations
14. Engaging students in recursive writing processes using rubrics to review and revise	**15. Engaging students in writing to acquire the language patterns and vocabulary to communicate scientific ideas**
Teacher provides time and opportunities for students to: a) review and revise through multiple drafts b) engage in peer-to-peer editing c) use rubrics that guide revision * Homework does not qualify here.	Teacher provides opportunities for students to use: a) scientific terminology and/or symbols or equations b) language patterns of science c) structural patterns of scientific writing (e.g., claims-evidence)
16. Teacher provides direct instruction in writing content, forms, and processes	**17. Engaging students in using science notebooks as a learning tool**
Teacher: a) provides instruction about the nature of scientific writing b) provides templates for each genre (lab report, brochure) c) explains function and appropriate time to use genres	Teacher provides instruction in how, or opportunities, to: a) use notebooks as a learning tool b) organize science notebooks c) record data, reflections, and/or handouts

(ALD) Academic Language Development Scale

18. Providing students opportunities to acquire vocabulary	19. Teacher uses clear instruction throughout lesson by modeling expectations
Teacher provides opportunities for: a) reviewing and repetition of vocabulary and tasks b) building academic language from the vernacular c) interpreting words from contextual clues	Teacher: a) varies speech and enunciates clearly b) explicitly defines content and language objectives of the lesson c) gives simplified directions
20. Using visual aids and gestures to communicate with students	**21. Building lesson on students' language *(vernacular or non-English)* OR culture**
Teacher: a) uses visual imagery, organizers (e.g., thematic boards, word wall displays, concept maps) b) employs gestures c) uses manipulatives for abstract and concrete concepts	Teacher incorporates into instruction: a) culturally-relevant examples (family, pop culture, ethnic traditions) b) native language when appropriate c) cultural artifacts (*anything human-made*) and community resources (*eating rice & beans, force on tortilla press, force on toes of a ballerina*)
22. Teacher addresses multiple levels of academic language proficiency *(differentiated instruction and/or assessment)*	**23. Provides direct instruction for using academic learning strategies**
Teacher: a) provides activities of varying academic linguistic demands b) uses assessments that match academic language proficiency c) adjusts pedagogy to the language proficiency	Teacher provides instruction in: a) summarizing b) organizing information for understanding (taking notes, data organization, mnemonics) c) making inferences from data (evidence supported)
24. Teacher provides instruction for interactions among students	**25. Uses supplemental resource material *(Note: lesson could be done without these)***
Teacher provides instruction in: a) how the groups will be organized and function (defines roles, collaborative structure, social norms of behavior in a group, inclusive interactions) b) using collaborative inquiry skills (how to paraphrase and ask questions for clarification) c) structures of accountability (academic and socially as a group)	Teacher: a) provides supplemental materials (e.g., trade books) b) provides access to reference materials (e.g., bilingual dictionary) c) uses technology to support language development (e.g., Internet)

(LP) Learning Principles Scale

26. Accessing students' prior knowledge	**27. Teacher modifies instruction based on students' prior knowledge**
Teacher provides students opportunities to: a) access their prior knowledge b) compare prior knowledge with normative ideas in science c) reflect and/discuss initial ideas and conceptions Note: Accessing prior knowledge means determining what students know before teaching the unit, oral or written.	Teacher: a) identifies alternative conceptions b) revises instruction based on students' understanding c) uses conceptual change strategies
28. Teacher and/or students situate factual knowledge (experiences, ideas, data, and explanations to past lessons and/or real-world experiences) within a conceptual framework *(fact to concept relationship)*	**29. Teacher provides opportunities for students to review key concepts *(focus on the review, not the discourse)***
Teacher provides opportunities to: a) link facts and experiences to promote patterned reasoning b) assimilating new information into existing frameworks of past lessons and real-world experiences c) place factual knowledge in a conceptual framework	Teacher provides opportunities for conceptual understanding: a) through multiple and rich representations b) by linking formal science to ideas beyond the classroom c) by reviewing key concepts
30. Teaching with embedded metacognition for students to elaborate and summarize their understandings	**31. Teaching self-monitoring for understanding *(focus on direct instruction of strategies)***
Teacher: a) models thinking in analysis of tasks or learning b) provides advanced organizers and/or develops graphic tools c) provides opportunities for students to elaborate and summarize	Teacher directly instructs students how to: a) reflect on their understanding, abilities, and affective states b) evaluate their own progress and quality of completed tasks c) identify what they have and have not been learned
32. Teacher provides students opportunities to develop awareness of their own learning strengths and challenges	**33. Promoting executive control of learning *(student choice about what and how they learn)***
Teacher provides opportunities for students to: a) self-assess effectiveness of their learning approaches b) understand unique learning approaches c) set the intensity or the speed of work	Teacher provides opportunities for students to: a) make choices and decisions about what and how to learn b) recognize that learning is under their control c) organize and sequence their own activities
34. Teacher establishes or reminds students of community norms for discourse	**35. Communicating lesson expectations with guidelines *(oral or written)*, or rubrics, or exemplars**
Teacher: a) negotiates, or reminds students of, guidelines for respecting each other's ideas b) establishes clear rules and expectations for discourse to promote everyone's participation c) provides opportunities for internalizing norms	Teacher: a) uses rubrics to inform students of performance expectations b) provides exemplars of student work c) provides easy to follow guidelines
36. Teacher uses feedback strategies that have an academic focus *(NOT just praise; "be more specific")*	
Teacher: a) uses both oral and/or written feedback b) give timely feedback c) encourages student self-reflection	