Investigating the Science Reading Apprenticeship Classroom: Opportunities to Consider Teacher Practice

Strengthening Student Success Conference
October 10, 2019
Breakout Session 5 11:10 - 12:10

11:10 - 11:18  Introduction and Reflection on Practice
11:18 - 11:28  The Reading Apprenticeship Framework in Science Classroom Contexts
11:28 - 12:00  Investigating a Classroom Case
12:00 - 12:10  Applications to Your Own Classroom

Questions?

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Reading Apprenticeship is an approach to reading instruction that helps students develop the knowledge, strategies, and dispositions they need to become more powerful readers. It is at heart a partnership of expertise, drawing on what teachers know and do as discipline-based readers, and on adolescents’ and young adults’ unique and often underestimated strengths as learners. Reading Apprenticeship helps students become better readers by

• Engaging students in more reading—for recreation as well as for subject area learning and self-challenge;
• Making the teacher’s discipline-based reading processes and knowledge visible to students;
• Making students’ reading processes, motivations, strategies, knowledge, and understandings visible to the teacher and to one another;
• Helping students gain insight into their own reading processes; and
• Helping them develop a repertoire of problem-solving strategies for overcoming obstacles and deepening comprehension of texts from various academic disciplines.
What Does a Reading Apprenticeship Classroom Look Like?

Teachers can use this snapshot of a Reading Apprenticeship classroom as a reflection tool, for lesson planning, and with colleagues for peer observations. It can also serve as a guide for administrators’ classroom walk-throughs. Three characteristics of a Reading Apprenticeship classroom are paramount: a focus on comprehension, a climate of collaboration, and an emphasis on student independence.

A Focus on Comprehension

- Reading Apprenticeship is embedded in subject area learning: students develop strategies, identify and use text features, build topic knowledge, and carry out discipline-based activities while reading course-related materials.
- The work of comprehending reading materials takes place in the classroom; the teacher scaffolds the learning and serves as model and guide.
- The work of comprehending is metacognitive; how readers make sense of text is as important as what sense they make of it.

A Climate of Collaboration

- Class members draw on each other’s knowledge, serving as resources to make sense of text together.
- Class members respect and value problem-solving processes: classroom norms support risk taking, sharing knowledge and confusion, and working together to solve comprehension problems.
- Grouping arrangements support collaboration and inquiry: students work independently, in pairs, in small groups, and as a class, depending on the task and the text.
- A shared vocabulary to describe reading processes and text features is evident in classroom talk, materials in use, and materials on display.

An Emphasis on Student Independence

- Students are agents in the process of reading and learning: they actively inquire into text meaning, their own and others’ reading processes, the utility of particular reading strategies, and their preferences, strengths, and weaknesses as readers.
- Students are expected and supported to read extensively: course-related materials are available on various levels, and accountability systems are in place to ensure that students read large quantities of connected text.
- Over time, students are expected and able to do more reading, make more sophisticated interpretations, and accomplish more work with texts with less support from the teacher during class time.

Source: Reading for Understanding: How Reading Apprenticeship Improves Disciplinary Learning in Secondary and College Classrooms, pages 337-338. Copyright © 2012 WestEd.
Other Things to Notice

Reading Apprenticeship classrooms can also be recognized by a number of other classroom characteristics, including how materials and student groupings are used, the types of learning activities students undertake, and the roles of the teacher, students, and classroom talk in the learning environment.

Materials
• What materials are present? How are they being used?
• What kind of work is displayed in the classroom? On the walls? On the board?
• What do these displays indicate about how reading is approached and the role it plays in the class?

Groupings
• How is the classroom arranged?
• What kinds of groupings are students in as they carry out classroom tasks?
• What do these arrangements offer students as learning environments?

Tasks and Activities
• What activities are the teacher and students engaged in?
• What activities seem to be routine in this classroom?
• Who is doing the work of reading and comprehending?

Teaching and Learning Roles
• What roles do the teacher and students play in classroom activities?
• Does the teacher model, guide, and collaborate in comprehension as well as give instructions, assign, and question students?
• Do students pose questions and problems as well as respond to questions about course readings?
• Do all members of the classroom community collaborate in comprehension, share their knowledge and experience, inquire?

Classroom Talk
• What does the teacher say—to the class, to small groups, to individual students?
• What do the students say—to the teacher, to each other?
• What do the teacher and the class talk about?
• What kind of language is being used?
### NOT Reading Apprenticeship

This table highlights some common ways implementation can fall short of what Reading Apprenticeship is.

<table>
<thead>
<tr>
<th>NOT Reading Apprenticeship</th>
<th>Because Reading Apprenticeship IS...</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organization of Instruction</strong></td>
<td></td>
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<tr>
<td>Instruction is organized so that students mainly take notes from PowerPoints and lectures.</td>
<td>Reading Apprenticeship requires students' active engagement. Students, not the teacher, do the intellectual work.</td>
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<tr>
<td>When reading happens in class, teachers read to students, ask individual students to read aloud to the class, or orchestrate round-robin or popcorn reading.</td>
<td>In class, all students read—more and to themselves—with the goal of digging into challenging academic texts. They use their peers as resources for solving reading problems or confusions.</td>
</tr>
<tr>
<td>Discussion takes place mostly between the teacher and the whole class (or a few students with the rest of the class not talking).</td>
<td>Students actively discuss in pairs or small groups. Whole class discussion more typically follows small group discussion in the form of group share-outs and reflection.</td>
</tr>
<tr>
<td>Tasks can be completed by scanning the text for the answer or not reading at all, (as when the requested information calls for personal connections or has been explored in a class discussion).</td>
<td>Tasks require students to read closely, and to think.</td>
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<tr>
<td><strong>Implementation of Routines and Strategies</strong></td>
<td></td>
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<tr>
<td>The role of the social and personal dimensions is equated with icebreakers.</td>
<td>Students build recognition of their own agency and the power of collaboration.</td>
</tr>
<tr>
<td>Teachers perform the metacognitive routines, for example, the Think Alouds and Talking to the Text, and students listen.</td>
<td>Students carry out metacognitive routines independently and in collaboration. Teachers occasionally model a new routine or use for a routine, briefly.</td>
</tr>
<tr>
<td>Metacognitive conversation/routines do not go beyond pro forma, general interactions with text; for example, to notice a personal connection or identify an unfamiliar word.</td>
<td>Metacognitive conversation/routines serve the purposes of disciplinary learning; for example, restating the passive voice of science texts to keep track of the subject and action.</td>
</tr>
<tr>
<td>Reading strategies are posted in a fixed list.</td>
<td>Reading Strategies Lists become diverse, depending on the reading purpose (for example, Previewing Strategies List, Word-Learning Strategies List, Reading Poetry Strategies List), and are revisited as is opportune.</td>
</tr>
<tr>
<td>Cognitive strategies like questioning and summarizing are used as checks on content attainment only. Teachers ask most of the questions.</td>
<td>Reading Apprenticeship changes the classroom conversation, with discussion of &quot;how did you figure that out&quot; holding equal space with &quot;what's the answer.&quot; Students ask most of the questions.</td>
</tr>
<tr>
<td><strong>Administrative Support and Progress Monitoring</strong></td>
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<td>Reading Apprenticeship is offered as a one-time “training.”</td>
<td>Reading Apprenticeship professional learning incorporates regularly scheduled time for teachers to meet in teams or learning communities.</td>
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<tr>
<td>Administrators evaluate classes for Reading Apprenticeship “compliance” with a checklist of surface-level behaviors.</td>
<td>Teams of administrators and teachers plan and conduct literacy rounds using Reading Apprenticeship protocols that encourage ongoing improvement.</td>
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</tbody>
</table>
Reading Apprenticeship in College Math

Class: Precalculus; Spring Semester 2016, Pasadena City College, Pasadena, California

Teacher: Richard Abdelkerim

Profile

College: Pasadena City College (PCC), located in California’s San Gabriel Valley, is ten miles from downtown Los Angeles and serves the greater Los Angeles area. Founded in 1924, PCC is one of the largest single-campus community colleges in the nation (enrolling over 30,000 students), and is one of the top 25 community colleges in the US in Latino enrollment.

According to a report complied by the Institutional Effectiveness Office, PCC’s student population, which is 51.7% female and 41.6% male, identify as:

- 48.6% Hispanic
- 23.6% Asian or Pacific Islander
- 9.2% White
- 4.5% African American
- 0.1% Native American
- 9.6% Two or more
- 4.4% Unknown

For the 2013-14 academic year, PCC was awarded the distinction of conferring the most Associate Degrees for Transfer (ADT) of any other California Community College. This honor is representative of the college’s reputation for excellence in the state. At the same time, PCC struggles, like all 113 California community colleges, to see sizable numbers of students attain their stated educational goals and to close a persistent achievement gap.

For example, in 2010, the Office of Institutional Research issued a report studying the 2004 entering class of 5,537 full-time first year students. Of these, 3,408 tested into developmental English and/or Math courses and 2,129 started their college level coursework immediately. The table below shows the educational attainment of these students after 6 years.

<table>
<thead>
<tr>
<th>Developmental Education Required</th>
<th>No Developmental Education Required</th>
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<tbody>
<tr>
<td>N = 3,408</td>
<td>N = 2,129</td>
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<tr>
<td>• 12% earned an AA/AS</td>
<td>• 10% earned an AA/AS</td>
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<td>• 5% earned a certificate</td>
<td>• 4% earned a certificate</td>
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<td>• 25% transferred</td>
<td>• 41% transferred</td>
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<tr>
<td>• 69% had no discoverable milestone</td>
<td>• 55% had no discoverable milestone</td>
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Reading Apprenticeship in Math

The students who did earn a degree, certificate, or transfer reflected typically inequitable achievement rates in California Community Colleges: 55% were Asian, 45% were white, 17% were African American, and 16% were Latino. These statistics reflect the harsh reality that the college’s largest ethnic cohort is by far the least likely to achieve a degree, a certificate, or transfer to a four year school.

Reading Apprenticeship at PCC: Spurred on by these unacceptable success rates, the college has invested in multiple large-scale redesign efforts—creating alternative developmental Math and English sequences, redesigning new student orientation, a comprehensive and scaled First Year Experience program, and a revived new faculty professional learning program, for example—all of which have been infused with Reading Apprenticeship. Probably the most prominent use of Reading Apprenticeship is in the First Year Pathways (FYP) program, which includes a required first year seminar course, College 1, which has been designed specifically to scaffold students’ academic and information literacy through the Reading Apprenticeship framework and metacognitive conversation. Data describing the persistence and success of the 2012 FYP cohort, the first group of FYP students to benefit from College 1, showed encouraging results:

- 620 FYP students persisted from Fall 2012 to Fall 2013 at a rate of 84% compared with 40% of 4,035 non-FYP students.
- FYP students completed an average of 24.1 credits after one year compared with 13.4 credits for non-FYP students.
- FYP students in groups that are typically the college’s lowest achieving persisted at a rate about 20-30% higher than their non-FYP groups: FYP African American students persisted at a rate of 73% compared with 42%, and FYP Hispanic/Latino students persisted at a rate of 77% compared with 58%.

FYP has since been scaled to reach 2,400 new first year students, which means that 70-80 College 1 instructors from across the disciplines are honing their understanding of Reading Apprenticeship, participating in a rigorous professional learning program and benefiting from a model curriculum and faculty mentor program designed to support their development and success. Working on College 1 tends to keep the Reading Apprenticeship conversation alive on campus, so it continues to infuse Math, English, counseling, and tutoring redesign projects and the number of PCC faculty pursuing Reading Apprenticeship professional learning opportunities, including the Leadership Community of Practice, continues to grow. In 2014, PCC put forth a team to participate in the Helmsley funded Reading Apprenticeship Community College STEM Network, and Richard Abdelkerim emerged as the team leader for this three year grant project.
Reading Apprenticeship in Math

**Instructor:** Richard started teaching at PCC in 2011, after having earned a Bachelor of Science in Applied Mathematics at University of California, Los Angeles; a Master of Arts in Secondary Education at Loyola Marymount University; a Master of Science in Pure Mathematics at California State University, Northridge; and a Doctor of Philosophy in Pure Mathematics (Algebraic Geometry) at University of Illinois, Chicago.

Richard says, “I teach community college because I care about teaching. I have always enjoyed figuring out ways to help people understand better, especially in math, a subject in which most people have had cripplingly discouraging experiences. I hope to make a significant impact in both the perception of math by students/society and the reconciliation of the pure beauty of math with the needs and realities of today.” He goes on to articulate: “I think math is an important subject, or more precisely, numeracy and quantitative literacy are important for the everyday individual. I think it’s the other side of the coin of empowerment, reading literacy being the one side.”

Richard constantly strives to find ways to improve his approach to teaching, with the focus being on two aspects: making the classroom experience more student-centered, and keeping his practice as authentic as possible. He was first introduced to Reading Apprenticeship when he was hired to teach mathematics at PCC, during his new faculty orientation. He found the information intriguing but daunting, since Reading Apprenticeship encourages a different approach to math instruction from the more customary one with which he was familiar. He says, “Reading Apprenticeship was something that I didn’t feel ready for yet.”

However, as Richard heard more about Reading Apprenticeship, and worked with it through math redesign projects at PCC, he began to appreciate that the framework complements math instruction. He started to see how he could authentically integrate the approach into his classroom practice, hopeful that it would help his students to be more successful and self-sufficient learners. As Richard points out, “Reading Apprenticeship approaches reading as a problem solving activity; math is all about problem solving.” He also became increasingly convinced that changing how math is often taught would benefit students and that Reading Apprenticeship is an effective instructional approach. “Because it is so text based, Reading Apprenticeship supports students as they develop reading, thinking, and learning proficiencies they can transfer across the curriculum and life.” He also recognized that discipline instructors are the ones best situated to increase students’ reading proficiency in their disciplines, noting that “I think it’s important that faculty across the disciplines learn how to help students unlock text in a way that’s specific to that area of expertise.” Furthermore, Richard says, “By practicing Reading Apprenticeship, I feel that I am helping to close equity gaps and giving people an equal playing field in
Reading Apprenticeship in Math

terms of developing critical thinking skills that they could transfer to any other classes or other parts of their lives.”

“Now I feel like I’ve completely transformed. I’m completely behind doing Reading apprenticeship in Math; I don’t see any disconnect between the two. It makes perfect sense to teach people how to read effectively within Math.”

Students: Richard’s Precalculus class is representative of PCC’s overall student population. He says: “Transfer-level math courses at PCC tend to be mostly Asian and much less Latino—in other words, the usual proportions are switched. Precalculus is an interesting middle zone—students are not yet in calculus, but they have proved themselves in previous courses to be decent math students. Because calculus is quite a turning point in the mathematics curriculum, these students have not yet had the “true” test. This creates an interesting dynamic: motivated students with decent preparation who are finding out whether they are ready to pass through this important threshold (Calculus) that will open many doors for them. So there is pressure to perform well, but there are also major algebra hang-ups that surface. It is a very interesting liminal space.”

Integrating Reading Apprenticeship into Math courses has presented some challenges so far. Richard says, “It’s a cultural shift in a classroom and students have been programmed in a certain way for a long time. Students have been programmed to have teachers dance around the text, and basically regurgitate their version of the text to students, and there’s no critical thinking involved. The students are not used to doing critical thinking and collaborative learning in most of their classes, especially a Math class or STEM class because of the traditions that are so deeply entrenched in our disciplines of how these things are taught. So there is some resistance that could arise, but I think the most important thing is setting a certain tone at the beginning of the semester. The first day is so incredibly critical. If you set the right tone at the beginning of the semester and if you make it come across as completely non-negotiable that you’re going to have a text-based, inquiry-based classroom with collaborative learning, they will go along with it.

The main thing is to be sincere in your practice. If you really believe in what you’re doing and you show that, students will pick up on that and they’ll go along with it.”

Course: The goal of Math 7B, Precalculus II, is to prepare the students to succeed in calculus. Students in Math 7B are introduced to concepts of trigonometry and go more in depth with functions and graphing than in previous courses. They are expected not only to become familiar with math terms, theorems, and definitions, but also to interpret graphs and charts in order to notice patterns at the Precalculus level.
The official Student Learning Outcomes for the course are:

1. Work with expressions and solve equations involving trigonometric functions.
2. Analyze and graph parametric and polar equations, and convert these to and from Cartesian coordinates when appropriate.
3. Correctly model a real world situation using algebra, geometry, logarithms, exponentials and/or trigonometry and use this model to solve problems.
4. Use mathematical notation to denote various mathematical objects, solve problems, and write proofs.

In addition, Richard says, “Another learning goal I have for them is to understand clearly the relationship between algebra (symbolic reasoning) and geometry (graphical reasoning). I also want to introduce students to the ‘culture’ of calculus, which is why throughout the semester I pointed out connections and preludes to calculus.”

Semester Long Routines

• **Math Reading Homework.** One of the practices Richard incorporated as a result of Reading Apprenticeship is quite simply requiring that students read before each class. He says: “Students and faculty alike treat the math textbook as just a source of problems . . . and that’s a shame.” At first, he assigns sections of the classroom text or of open-source materials relevant to the upcoming topic and prepares study questions to guide students’ reading. In order to increase students’ learning independence over time, Richard makes the pre-class reading assignments more open-ended as the term goes on. Rather than assigning specific parts of the text for students to read, later he tells students the topic they will be addressing and asks them to find sections in the text that will help prepare them.

• **Metacognitive logs.** Richard models for students how to keep a metacognitive log as they read by noting on an Evidence/Interpretation Notetaker sections of the text they found interesting, challenging, or that raised questions for them. Students return to class with their E/I Notetakers, prepared to share with one another what in the reading sparked their thinking.

• **Capturing Problem Solving Processes.** Richard apprentices students into reasoning and problem solving by routinely surfacing his own problem solving process and asking students to do the same.

• **Think Pair Share.** Richard often has students think about and discuss sticking points in pairs or small groups, rather than quickly addressing an important question.
Reading Apprenticeship in Math

• **“Flipping the classroom.”** Recognizing the value of collaborative learning in math, Richard tries to shift “content delivery” modes of instruction to homework (largely through the reading assignments) so that students spend a good amount of classroom time teamed with a partner or small group to question, to develop and test hypotheses, and to identify errors or confusions.

• **Developing Math Identities.** Throughout the term, Richard works with his students on the Personal and Social Dimensions, helping them develop their identities as potentially successful math students, their engagement in collaborative learning, and their willingness to share their ideas, thoughts, confusions, insights.

Richard says, “Overall, my second semester Precalculus class is not going quite as well as I would like. I’m not getting students to be as vocal as I would like. I try to get students to talk to each other and to share out in class, and this has been a challenge with this particular group. Also I feel like I’m putting a lot on them, expecting a lot of them as independent learners, and trying to support them, but they are not always taking me up on my offers of support.”

**Texts:** The math department at PCC has decided on an official text for the course, which is *Precalculus*, by Michael Sullivan III. Richard adds, “We are starting to incorporate some open source materials as well. This week, we used an open source text from openstaxcollege.org.”

**Lesson at a Glance**

Richard taught the videotaped lesson in March 2016. The students were learning about Gaussian elimination for systems of two or three equations. Before class, students read sections 9.6 in the OpenStax *Precalculus* textbook and were asked to keep a metacognitive log. Richard was hoping that students would be somewhat familiar with the heavily procedural topic by the time they got to class. Richard’s goal is to provide students with practice in noticing patterns and in sense-making. He also wanted students to make connections with the geometric interpretations of the mathematical objects (matrices) that they were working with.

Richard has asked students to use a different procedure—to use matrices—to solve systems of linear equations. The students are learning to see and understand a problem in a way different from the way they have seen and understood it before. He says, “In later Math, this use of matrices is something you do almost instinctively. It’s the beginning of linear algebra, and it’s a gateway into a higher level, more abstract math that STEM students need to know about.” Furthermore, he says, “It’s extremely important in Math
to be able to not only know what step to do next, but to be able to read an example or an already completed problem and identify correctly what was done from one step to the next.”

Richard reflects that the class went “decently well. Students revealed confusions and understandings quite freely in this session. A couple of interesting things happened during the lesson. I made two sets of matrices, so there were at least two types of problems being done by the groups. In one set of matrices, there was a duplication—an extra copy...and in the other I noticed, when students pointed it out to me, that there were a couple of typos within the matrices! But I would say that about half the groups that got the set with typos noticed them and pointed them out to me, giving me the opportunity to say, ‘Well, what do you think you should do?’ That was actually a happy accident, because what happens with this type of problem, if I just give this to students to do, they will possibly just mindlessly go through what they think the steps are. They may make arithmetic mistakes along the way, and they may not notice because the work is so tedious. The value of that mistake, the typos, is that hopefully students will be more mindful of correcting their own mistakes before submitting work.”
Math Videocase Framing Question:

Based on the documents you just read, what do you notice about this classroom, how do you see metacognitive conversation supporting the learning. Focus on teacher moves and student talking. Use the E/I notetaker to record your observations and interpretations.
<table>
<thead>
<tr>
<th>Evidence</th>
<th>Interpretation</th>
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<tbody>
<tr>
<td>I saw, I heard, I read in the text...</td>
<td>I wondered, I made a connection, I thought...</td>
</tr>
<tr>
<td>Evidence</td>
<td>Interpretation</td>
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<tr>
<td>----------------------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>I saw, I heard, I read in the text…</td>
<td>I wondered, I made a connection, I thought…</td>
</tr>
</tbody>
</table>
Classroom Connections Notetaker:

Brainstorm some ideas for classroom inquiry routines with your course content. Think about content that requires some critical thinking or problem solving skill, a threshold concept perhaps. What metacognitive routine(s) could support students' shared learning and meaning making?
As students become increasingly able to internalize metacognitive conversation, the teacher’s role fades and students become more independent.

6 *Reading for Understanding*, p.132
<table>
<thead>
<tr>
<th>Week</th>
<th>Topics, Texts &amp; Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>• Introduction to Course</td>
</tr>
</tbody>
</table>
| 2    | • Organic Chemistry  
|      | • Chapter 1  
|      | • Lab #1 Significant Figures/Safety |

**Reading Apprenticeship Implementation**  
Literacy goals & routines & Assessments for the personal, social, cognitive, knowledge & building, and metacognitive conversation dimensions

**Week 1**  
GOAL: Develop safety and engagement; Initiate metacognitive conversation routines with textbook to begin inquiry into our reading process  
- Elicit/build class NORMS  
- Introduce/practice think-pair share with quick personal science reading/learning history  
- Capture reading process & build reading strategy list (RSL) using Chemistry Connection 1A.  
- Introduce dual entry reading logs(show examples) & assign chapter 1 reading log  
- Ask for 2 volunteers to bring in texts for me to read that they read well that I probably don’t read well.  
ASSESS: Who is talking? When? Who is aware of their own reading process?

**Week 2**  
GOAL: continue inquiry into our reading process using metacognitive conversation, model my reading process focus on identifying/clarifying a confusion, initiate metacognitive conversation routines for reading/problem solving  
- Mon. - Think-pair-share reading process for Chapter 1 -- students highlight and share two most important R-log reflections -- key ideas, questions, confusions. Add to RSL  
- Mon. - Model my own reading process with student provided text students using think-aloud/talking to the text (model identifying and clarifying a confusion, making connections, predictions and questioning) and have discussion of my reading process – connect to RSL  
- Mon. - Collect r-logs on Monday to assess return on Wednesday - I’ll comment on highlighted entries only  
- Wed. - Model and practice TAPPS for with example practice problem # 1.?? Elicit reading/problem-solving strategies - Add to RSL or make new reading/problem solving strategy list.  
- Wed. - Revisit NORMS  
- Wed. - Assign chapter 2 R-log and note due dates for all other textbook chapter R-logs.  
ASSESS: Who is talking? When? Who is aware of their own reading process? How much stamina for reading?
## Planning Model

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics, Texts</th>
<th>Reading Apprenticeship Implementation</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Literacy goals &amp; routines for the personal, social, cognitive, knowledge &amp; building, and metacognitive conversation dimensions</td>
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<tr>
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<td>GOAL:</td>
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<td>ASSESS:</td>
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<tr>
<td>Cognitive Routines</td>
<td>Metacognitive Routines</td>
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<tr>
<td>Students Know what</td>
<td>Students Know how</td>
<td></td>
</tr>
<tr>
<td>Intro to Course:</td>
<td>Ch 23 Electric Fields:</td>
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</tr>
<tr>
<td>1. Who are my peers and instructors?</td>
<td>1. Properties of Electric Charges</td>
<td></td>
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<tr>
<td>2. Course learning objectives</td>
<td>2. Charges</td>
<td></td>
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<tr>
<td>3. Course norms</td>
<td>3. Coulomb's Law</td>
<td></td>
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<tr>
<td>4. My text book and online resources</td>
<td>4. Electric Field Lines</td>
<td></td>
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<tr>
<td>5. LMS and alternative resources</td>
<td>5. Distance Charge Distribution</td>
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<tr>
<td>6. Elective Field Lines</td>
<td>6. Motion of a Charged Particle</td>
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<tr>
<td>7. Motion of a Charged Particle</td>
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</table>

Pre-reading: Read section 23.1

1. How did we learn about the properties of charge?
   - What did we already know?
   - How am I going to use my experiment?
2. How did we learn about another property of charge? What would I do if I want to learn about another property?
3. How did I design an experiment?
4. How do I conclude/summarize the experiment? How do I describe the outcome?

Ch 23 Electric Fields:

1. How am I going to use my peers' and instructors' help in my learning?
2. How am I going to achieve peers' and instructors' goals to use my peers?
3. How am I going to apply the Coulomb's Law in problem solving?
4. What do I already know about problem solving?
5. How am I going to apply the experimental outcomes?
6. How do I conclude/summarize the experiment?
7. How do I describe the outcome?

Lesson Planning Notetaker (with Physics examples)
Cognitive Task / Strategy
Ex: Knowledge of finding the sum of a set of numbers

* Cognitive strategies are basically knowing how to reach a goal, such as how to add the numbers to find the sum. Cognitive strategies are helpful by knowing how to reach a goal.

Metacognitive Task / Strategy
Ex: Add the numbers up again

* Metacognitive strategies are to make sure that the goal is reached, such as double the number or add the numbers to find the sum. Metacognitive strategies are helpful by making sure that the goal is reached.

Metacognition is a subdivision of cognition, or a type of cognition. Metacognition is defined as the scientific study of an individual's cognitions about his or her own cognitions.

<table>
<thead>
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<th>When to Use</th>
<th>What is it for?</th>
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<td>Skim/Survey</td>
<td>Search for headings, highlighted words, previews, summaries</td>
<td>Before you read a long piece of text</td>
<td>Gives an overview of the key ideas, helps you to focus on the important points</td>
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<td>Slow down</td>
<td>Stop, read and think about information</td>
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<td>Fit ideas together</td>
<td>Relate main ideas to one another</td>
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<td>Once you know how ideas are related, they are easier to remember than if they are separate facts</td>
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Sample Strategy Evaluation Matrix

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Cognition is a mental process that includes memory, attention, producing and understanding language, reasoning, and learning, problem-solving, decision-making, and applying knowledge, and deciding. Cognition is a mental process that includes memory, attention, producing and understanding language, reasoning, and learning, problem-solving, decision-making, and applying knowledge, and deciding. Metacognition is a subdivision of cognition, or a type of cognition. Metacognition is defined as the scientific study of an individual's cognitions about his or her own cognitions.
Also helps to understand them more deeply. Draws diagrams to identify main ideas, connect them, classify ideas, decide which information is most important and which is supporting.

When there is a lot of factual information that is interrelated, it helps to identify main ideas and organise them into categories. Reduces memory load. May be easier to visualise.