Materials Design Plan

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Introduction

*A Year in Second Grade Science* has 10 units of instruction. The units flow from exploring what a scientist *is* and what a scientist *does*, into Physical science concepts, including matter, energy and force and motion. Next students investigate Earth science concepts through the study of earth materials, natural resources, weather, the water cycle and space science. Finally, students round out their studies by learning about Life science concepts including the characteristics of living organisms, and exploring organisms and environments.

Theoretical rationale for a cognitive learning theory

The Cognitive perspective focuses on how people group knowledge or develop structures for knowledge. A main part of the cognitive perspective is how people build new knowledge on the previous knowledge or experiences they have had. In addition to learning about how people gain knowledge cognitive theorists want to understand how people retrieve the knowledge they have stored. This perspective does not just look at *how much* knowledge one has but how (or if) they use what they know as it applies to other situations. The cognitive perspective focus is on individual thinking and learning. Assessing cognitive structures takes more than a multiple choice test. A more complex task, such as a performance indicator or performance task would reveal how a student thinks, their reasoning strategies, and application skills.

Multimedia specifications

All the documents and materials are housed on a website with hyperlinks between the information and the documents. Every teacher has a specific login and password to both access and protect their pages. The basic website looks the same for all teachers; however a teacher can customize their page with features such as folders for saving lesson plans and additional lessons they may already have. The website allows teachers access to all four core content area curriculum and instruction (ELAR, SLAR, science, math and social studies) as well as every grade level Kindergarten through high school. All documents, videos and Power Points are bundled by lesson within each unit. The teacher (in theory) has the option of using the instructional exemplar lessons provided on the website. Within each lesson, the teacher has the option (in theory) of choosing to what depth they will use any of the resources provided. When the lessons were developed it was with the understanding that the lessons were ONE option for teachers. Through the four years I have worked as a content writer I have discovered that many instructional leaders have mandated the use of the lessons; I find this to be an insult to the master teachers who year after year have effectively engaged their students with appropriate content and standards.

Content elements organized in a map

Three maps have been created to demonstrate the content elements. One shows the year broken into units. The second shows the organization of one unit. The third shows the content elements of each lesson. Every unit is structured following the same template as is each lesson.
Unit 1
What is a Scientist?
(5 days)

Unit 2
Change Occurs: Investigating Matter
(20 days)

Unit 3
Change Occurs: Investigating Force and Motion
(22 days)

Unit 4
Investigating our Natural World: Earth Materials and Natural Resources
(17 days)

Unit 5
Making Good Choices: Weather Safety
(5 days)

Unit 6
Patterns of Change: Weather
(10 days)

Unit 7
Exploring the Water Cycle
(7 days)

Unit 8
Patterns of Change: Observing the Sky
(8 days)

Unit 9
Characteristics of Living Organisms
(24 days)

Unit 10
Organisms and Environments
(24 days)
Unit 4
Investigating our Natural World: Earth Materials and Natural Resources

Natural Resources: Water
- Fresh water
- Salt water
  - properties
    - color
    - Sinks/float
    - clarity

Earth Materials and Natural Resources
- Observing and Describing Rocks
  - Properties
    - Size
    - Color
      - Black
      - Pink
      - Striped
      - Multi
      - Tan
      - White
      - Grey
      - Brown
    - Texture
      - Rough
      - Sharp
      - Silky
      - Hard
      - Smooth

Respecting Earth's Resources
- Repurpose
- Conservation
- Recycle
- Reuse
  - Metal
  - Paper
  - Plastic
  - Water
  - Cardboard
  - Biomass
  - Aluminum
  - Steel
### Content Elements of a Lesson

<table>
<thead>
<tr>
<th>I. Lesson Title</th>
<th>Content Elements for Organizing Content</th>
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<tbody>
<tr>
<td>II. Synopsis: describes the content of the lesson</td>
<td>Schemas help people interpret complex data by weaving them into sensible patterns (National Research Council, 2001). People will generally try to link new information to previously learned information for two reasons: to better understand the new information and to move the information from the working memory to long-term memory. Schemas are used for organizing knowledge in ways that are useful. In these science lessons, advanced organizers are used as the schema for organizing content.</td>
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<tr>
<td>III. TEKS</td>
<td>Metacognitive Skills</td>
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<tr>
<td>A. Content TEKS</td>
<td>Weimer (2011) notes that when learners use regulatory metacognitive skills, they do better at paying attention, they use learning strategies more effectively, and they are more aware of when they are not comprehending something they are trying to learn. In these lessons students are expected to reflect in their interactive science notebooks regularly.</td>
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<tr>
<td>B. Process TEKS</td>
<td>Role of Prior Knowledge</td>
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<td>IV. Getting Ready For Instruction</td>
<td>When designing online instructional resources, Vasser (2010) says that course designers must activate the learner’s prior knowledge on the subject and create authentic learning experiences that learners can translate to their work or professional lives. She points out that in traditional classroom settings, the instructional methods and activities are most often determined by the instructor and can be modified based on student responses during the class. In online environments, however, most of the instructional methods and activities are determined prior to the start of the course and cannot be changed during the course. A part of the design of these online resource ways to activate prior knowledge is included</td>
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<tr>
<td>A. Performance Indicator</td>
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<tr>
<td>B. Key Understandings and Guiding Questions</td>
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<td>C. Vocabulary of Instruction</td>
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<td>D. Materials</td>
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<td>E. Attachments</td>
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<tr>
<td>1. Handouts: these are for student use</td>
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<td>2. Teacher Resources: these are keys, samples or instructions</td>
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<td>3. Power Points</td>
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<tr>
<td>F. Resources and References</td>
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<tr>
<td>1. Interactive Websites: URLs are provided for interactive sites suitable for students</td>
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<tr>
<td>2. Suggested literature selections: Integrating literacy is a critical component of the primary units.</td>
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<td>G. Advance Preparation: what the teacher needs to do in order to be prepared for the lesson.</td>
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<tr>
<td>H. Background Information: Information for the teacher. This is a teaching piece for teachers who may need additional content information.</td>
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<tr>
<td>V. Instructional Procedures and Notes for Teacher: a two column format that details the flow of the lesson.</td>
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<tr>
<td>A. Engage</td>
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<tr>
<td>B. Explore</td>
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<td>C. Explain</td>
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<td>D. Elaborate</td>
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<td>E. Evaluate</td>
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</tbody>
</table>
Components for each lesson

Each lesson follows the same format starting with a lesson synopsis followed by the content TEKS and the process TEKS. In the section “Getting Ready for Instruction” the Performance Indicator is listed, along with Key Understandings and Guiding Questions. Below this is the Vocabulary of Instruction. This is a comprehensive list of words that the teacher is expected to use during the lessons; it is not a list of words that students copy, define and are tested on. Students need to see and hear the vocabulary in context, and at the appropriate time use it in their writing or reflections.

A complete list of materials, attachments and resources and references are included in each lesson. There are also instructions for Advance Preparation so the instructor knows what needs to be assembled, gathered or copied in order to facilitate a successful lesson. Additionally a section called Background Information is included for teachers who may need to brush up on their science content.

Instructional Procedures are written in a two-column format. (Figure 1) The left column is the Instructional Procedures written in the 5E format (Engage, Explore, Explain, Elaborate and Evaluate). The right column is called notes for teachers. This column gives information such as suggested time for each days lesson (in second grade it is 50 minutes, whereas Kindergarten and first grade are based on a 30 minute science lesson), materials, instructional notes, safety notes, science notebook opportunities, and places to ‘check for understanding’. In the Evaluate section of each lesson, the Performance Indicator is listed along with specific instructions for conducting the assessment. A student product is created in each performance indicator; the rigor of the performance increases as students progress through each grade level.

Description of assessment tools for learners

In A Year in Second Grade Science there are both formative and summative assessments. The formative assessments are imbedded in the lessons and are indicated through the icon of a checkmark along with the phrase “Check for Understanding”. The summative assessments are presented in two formats: Performance Indicators, and Unit Assessments. In the online module, the Performance Indicators are listed on the unit description (called the Instructional Focus Document) and in the lesson. The lesson also includes detailed instructions for the teacher for presenting the performance indicator to the class. The unit assessment is available through a different tab in the online module, indicated by a tab “Unit Assessment”. These are multiple choice tests that include an open-ended question. Rubrics are provided for the open-ended question. There are no unit assessments for Kindergarten or grade one because cognitively they are inappropriate ways of assessing this age group. Students in Kindergarten and grade one are expected to complete performance indicator assessments.

Description of assessment tools for program assessments

There are two ways the program is assessed. Teachers have the opportunity to provide feedback through a “Feedback” folder provided on the home page of the website. In addition, teachers and administrators are asked to complete a survey about the science units at the end of the year.

Feedback can be submitted in three categories: Content, Grammar, and Assessment. The content section is where teachers can give feedback on the science content; for example if they
have questions about the accuracy of the content, an activity, the number of days suggested for a lesson or materials needed. The grammar section is for feedback on English grammar or spelling mistakes. The assessment section is for questions or comments about the multiple choice assessment. The feedback mechanism is monitored daily with a response going directly to the teacher as well as a posting on the feedback page. Teachers can view all responses to feedback before they post their comments.

The survey at the end of the year helps the developers of the units make improvements to the instructional documents or curriculum documents. In addition, representatives throughout the state who are part of a science workgroup gather information from teachers during the year. These representatives share comments and concerns with the developers of the science curriculum and instruction in order for changes to be made in a timely manner.

**Project team organization chart and management plan**

The project team has many layers and it is not a one-way system. The upper management gives directives, but has no part in development of the science product. The development starts with the High school science specialist and the elementary science specialist. They direct a team of content writers. Once a document is developed it must be reviewed by a content editor and a copy editor. If there are any issues with the document, the content specialist may need to work on the document. The formatter ensures that all documents formatted to specifications set by the leadership team. The assessment team is a separate group but depends on the work of the content writers. The Technology specialist uploads every document with the assistance of support staff. For a visual of the Organizational Chart, please see figure 2.

**Team member roles**

Their (2001) discusses the diverse team of specialists it takes to design, develop and refine guided inquiry lessons. Our team includes science specialists, content writers, content reviewers, copy editors, a formatter, a technology specialist, an assessment team, science workgroup members, and several upper management members.

Content Writers: These members are responsible for developing both the curriculum documents (year-at-a-glance, vertical alignment document, instructional focus document, TEKS verification document) and the instructional documents (exemplar lessons). They were chosen because of their experience as exemplary science teachers and their knowledge of curriculum and instruction.

Content Reviewers: These members review every lesson for science accuracy and for flow, cognitive rigor, and adherence to a rubric standard. They meet with the lead science specialists to discuss every lesson before it is uploaded onto the science site.

Copy Editors: These members are the experts in English grammar. They review every lesson and every attachment to edit any grammar or spelling errors. They are not science teachers, but rather technical writers who are qualified to review documents.

Formatter: This team member is responsible to format all documents according to the specifications listed by the upper management. There is a master document that specifies how lessons and attachments are to be formatted in the on-line site. Only one person does the formatting in order to ensure all documents are consistent.
Technology specialist: This team member is responsible for changing the word documents into a PDF format and then uploading them onto the website. She has been with the curriculum program for five years and is an expert in her area.

Assessment Team: These members create the multiple choice assessments. They do not work with the content writers directly, but instead work off of the documents that are created by the content writers.

Science Workgroup members: These specialists work with teachers throughout the year in support roles as well as ‘go-betweens’ with the science content writers. They are not directly associated with the online site but are integral members of the science community as conduits of information from teachers.

Upper Management: These members make the decisions about site lay-out, content, deadlines, and funding. They are not experts in science content or curriculum but are instead in supervisory positions.

**Development timeline**

<table>
<thead>
<tr>
<th>Timeline</th>
<th>Objective</th>
<th>Details</th>
<th>Person Responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td>September 2009</td>
<td>Develop the Year at a Glance</td>
<td>Bundle the TEKS into manageable units.</td>
<td>Content writers</td>
</tr>
<tr>
<td>January 2010</td>
<td>Develop the Instruction Unit plans</td>
<td>Determine the number of lessons necessary for each unit, including the number of days for each lesson.</td>
<td>Content writers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Develop a rationale for the unit including research on why the content is important at that grade level.</td>
<td></td>
</tr>
<tr>
<td>March 2010</td>
<td>Develop the Transition Documents to bridge content from the 1998 TEKS to the 2009 TEKS.</td>
<td>Outlines of suggested activities for teacher use until new lessons are developed.</td>
<td>Content Writers</td>
</tr>
<tr>
<td>April 2010</td>
<td>Develop new lessons for the 2011-2012 school year</td>
<td>This process is ongoing and will take until August 2011 for completion.</td>
<td>Content writers, Content editors, Copy editors, Formatter, Technology Specialist, Support Staff</td>
</tr>
<tr>
<td>March 2011</td>
<td>Review of all Performance Indicators</td>
<td>Performance Indicators revised to ensure they contain a content TEKS, a process TEKS and a product. At middle school and up they are</td>
<td>Content writers, science workgroup</td>
</tr>
</tbody>
</table>
also to have a “real world” application.

<table>
<thead>
<tr>
<th>Date</th>
<th>Activity</th>
<th>Details</th>
<th>Responsible Party</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 2011</td>
<td>Development of Assessments Grades 2-12</td>
<td>Multiple choice assessments developed. Will be ongoing.</td>
<td>Assessment team Science Specialists</td>
</tr>
<tr>
<td>August 2011</td>
<td>Revisions based on feedback</td>
<td>As the curriculum documents and the instructional documents become available, revision will begin based on teacher feedback. Ongoing.</td>
<td>Content reviewers</td>
</tr>
<tr>
<td>August 2011-2013</td>
<td>Development of products or services to assist with implementation</td>
<td>Science notebook manuals Lab books with all data recording sheets (developed for Grades K-3)</td>
<td>Content writers Upper management</td>
</tr>
</tbody>
</table>

Figure 1

**Instructional Procedures**

ENGAGE - What is a Property?

1. Working in pairs or small groups, and using sets of Property Cards, have the students sort and classify the pictures.

2. Repeat the sort or classification several more times.

3. Ask:
   In what ways did you sort and classify the pictures?
   Allow several students to respond. The most common suggestions will be by color, size, and shape. Others may also suggest texture, solid and liquid. Accept all responses at this time.

4. 

5. Students should record the ways they sorted and classified the pictures in their science notebook.

6. Ask:
   Can an object fit into more than one of these categories? Allow students to respond.
   What are some examples of an object belonging to more than one category? Students might suggest that The bricks are rough (texture) and also a rectangle (shape), or that the tennis ball is round (shape-circle/sphere) and fuzzy (texture) etc.

   **MATERIALS:**
   - Property Cards

   **Science Notebook:**
   Record ways pictures have been sorted.

   If students need a sentence stem for language support, a suggested stem is:

   I sorted my pictures into _____ groups. The groups are ___________, ___________, ___________, and ___________.

   Students will generally sort by color, shape and size. Deeper thinking usually occurs after the third sort.

   **Notes for Teacher**

   NOTE: 1 Day = 50 minutes
   Suggested Day 1

   Quality instruction involves opening and closing a lesson on a daily basis. During the opening refer to the key understanding that applies to the lesson. For example- Today we are going to focus on understanding that (key understanding) by completing (activity). At the end of each period of instruction, close the lesson by asking students how (activity) helped them understand (key understanding)? This could be done through an oral response. Always expect students to respond in complete sentences.
Content Reviewers- review every lesson for science accuracy and for flow, cognitive rigor, and adherence to a standard.

Copy Editors- review every lesson and every attachment to edit any grammar or spelling errors.

Formatter- Formats all documents to ensure a regulated product.

Assessment Team- Develops the multiple choice assessments.

Technology Specialist
Uploads all documents into the Developer

Science Workgroup members assist on an as-needed basis
References


