MATH
PEDAGOGICAL CONTEXT: TEACHING WITH LEARNING SITUATIONS

• Starts with a scenario that is meaningful/relevant to the adult learner.
• Ends with a task that ultimately asks student to provide an explanation, state an opinion, make a decision, etc
  • Your task is to explain/justify/state…

Complex tasks build the mathematical knowledge and processes that are required to solve the situational problem. They can be purely mathematical by design.
Evaluation Criteria

Competency 1
1.1 Indication that the situational problem has been understood.
1.2 Application of strategies and appropriate mathematical knowledge.

Competency 2
2.1 Correct use of appropriate mathematical concepts and processes.
2.2 Proper implementation of mathematical reasoning suited to the situation.
2.3 Proper organization of the steps in an appropriate procedure.

Comprehension and Representation
Organization, Application and Communication
LITERACY STRATEGIES THAT SUPPORT COMPETENCY 1

COMPREHENSION: WHAT DO I KNOW? WHAT AM I LOOKING FOR?

REPRESENTATION: WHAT STRATEGIES WILL I USE TO REPRESENT THE EXPLICIT INFORMATION AND DECODE THE IMPLICIT INFORMATION?
### COMPREHENSION: CONTENT VOCABULARY ACQUISITION

**Vocabulary Tables**

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition in my own words</th>
<th>Example or Picture</th>
</tr>
</thead>
<tbody>
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</table>

Students can complete this table as they progress through the SOFAD book and/or teacher-made Learning Situations.
**COMPREHENSION: CONTENT VOCABULARY ACQUISITION**

**Verbal and Visual Word Association (VVWA)**

<table>
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</table>

**Vocabulary Term**

**Visual Representation**

```
\[ \text{Angle} \]
```

**Definition**

- Formed by two rays with the same endpoint.

**Personal Association or Characteristic**

- A hinge
- A T-square
- A roof

The extra step in making a personal association helps with retention.
COMPREHENSION: MATHEMATICAL SENTENCES

CUBE Method:

Mr. Johnson's class has 21 students. If the seven of his students are absent due to heavy rainfall on a particular day, how many students does he have left in his class on that day?
COMPREHENSION AND REPRESENTATION: OF COMPLEX TASKS AND COURSE CONCEPTS

Graphic Organizers for Representation

3-Square Problem Solving Template

Great way to make a memory aid!
LITERACY STRATEGIES THAT SUPPORT COMPETENCY 2

Organization: Which course concepts will help me solve this problem? How can I present the steps to my solution in a coherent fashion?

Application: Which formulas/rules/laws/techniques must I apply? Are my calculations correct?

COMMUNICATION: Is my work clear and easy
MATHEMATICAL REASONING: ORGANIZATION AND APPLICATION

Task List Graphic Organizers

Step 1

Step 2

Step 3:

Will help students who have difficulty with Executive Function
More-than-One-Strategy

Problem #1:

__________

Asking students to offer more than one way to arrive at an answer for a word problem or complex task.

Class Inventory

Collecting and reviewing a list of strategies that students use to solve a particular complex task or LS.
MATHEMATICAL REASONING:
COMMUNICATION

Helps the student convey a mathematical message using mathematical rules, formulas, and conventions.

Geometry Writing Activity

Review the following written responses with your group. Revise response A and B together. How can you enhance each response to make the explanations stronger? Based off your discussion, come up with some “do’s” and “don’ts” when writing math explanations. At the end, write your own response.

1. $X$ and $Y$ have the following endpoints: $A(-7, 4)$ and $B(-1, 4)$ and $D(5, 4)$ and $E(-7, 1)$. Use the slope formula to determine if the two line segments are parallel, perpendicular or neither. Explain your response in complete sentences.

Student Work:

$m_{AB} = \frac{4 - 1}{-7 - 4} = \frac{3}{-11} = \frac{1}{-\frac{11}{3}}$ and $m_{DE} = \frac{4 - (1 - 1)}{5 - (-7)} = \frac{3}{12}$ and $\frac{1}{\frac{11}{3}}$.

Response A: They are neither because the two segments have $\frac{1}{11}$ and $\frac{1}{12}$ as the slope.

Response B: The slopes are not parallel because $\frac{1}{11} \neq \frac{1}{12}$ and the slopes are not perpendicular because the numbers are not flipped or opposite.

The Summative Writing Prompt

Each student will be asked to respond in writing to the following prompt:

PROBLEM: You are asked by the parents of a younger friend to explain what their child can expect to learn in Algebra I class. wishing to sound as though you have learned some useful mathematics this year, summarize what you would tell them concerning the main concepts covered in algebra class.

HINTS: Remember to use complete sentences, and since you are speaking to adults, use accurate mathematics terminology. Your discussion will be strengthened by organizing related topics together.

Can be enhanced with a concept map.
### Competency 1: Uses problem-solving strategies

<table>
<thead>
<tr>
<th>1.1: Reading Strategies</th>
<th>1.2: Problem-Solving Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify the problem:</td>
<td>What am I trying to find?</td>
</tr>
<tr>
<td>Visualize the problem:</td>
<td></td>
</tr>
<tr>
<td>Understand the problem:</td>
<td></td>
</tr>
<tr>
<td>Plan the solution:</td>
<td></td>
</tr>
<tr>
<td>Execute the solution:</td>
<td></td>
</tr>
<tr>
<td>Evaluate the solution:</td>
<td></td>
</tr>
</tbody>
</table>

- Are there any words that I don’t understand?

### Competency 2: Uses Mathematical Reasoning

| 2.1: Show my work (I must correctly label and execute the steps that I listed above). |
| 2.2: What list of steps must I use to solve this problem? |
| Step 1:            | Step 2:            |
|                   | Step 3:            |

- Is my work clear and easy for my teacher to follow?
- Did I write my answer in a complete sentence and use the appropriate units?
- Does my answer make sense?

<table>
<thead>
<tr>
<th>2.3: Is my work clear and easy for my teacher to follow?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.3: Did I write my answer in a complete sentence and use the appropriate units?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>2.3: Does my answer make sense?</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
**TYING IT ALL TOGETHER: DBE PROBLEM SOLVING CHECKLIST**

<table>
<thead>
<tr>
<th>What the teacher must see</th>
<th>Mark Total (Over all three questions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 That you know what numbers and information are important.</td>
<td>10</td>
</tr>
<tr>
<td><strong>Ways: highlight, list of known values</strong></td>
<td></td>
</tr>
<tr>
<td>1.2 That you know the general form/ method that you will use.</td>
<td>20</td>
</tr>
<tr>
<td><strong>Ways: write down formulas, state correlations type,</strong></td>
<td></td>
</tr>
<tr>
<td>2.1 Correct steps used to find answer</td>
<td>15</td>
</tr>
<tr>
<td><strong>Ways: show and label your work</strong></td>
<td></td>
</tr>
<tr>
<td>2.1 Exactly correct answers</td>
<td>5</td>
</tr>
<tr>
<td>2.2 You show that you know how to fit the known information into the formulas</td>
<td>20</td>
</tr>
<tr>
<td><strong>Ways: Show all your work and where you got your numbers</strong></td>
<td></td>
</tr>
<tr>
<td>2.3 You’re neat</td>
<td>5</td>
</tr>
<tr>
<td>2.3 Your answer makes sense with your process</td>
<td>5</td>
</tr>
</tbody>
</table>
SCIENCE & TECHNOLOGY
EVALUATION

Evaluation Criteria

Competency 1
Seeks answers or solutions to scientific or technological problems

1.1 Appropriate representation of the situation
1.2 Development of a suitable plan of action
1.3 Appropriate implementation of the plan of action
1.4 Development of relevant explanations, solutions or conclusions

Competency 2
Makes the most of his or her knowledge of science and technology

2.1 Accurate interpretation of the problem
2.2 Relevant use of scientific and technological knowledge
2.3 Appropriate formulation of explanations or solutions

Competency 3
Communicates in the languages used in science and technology

1.1 Comprehension
1.2 Representation
2.2 Organization
2.1 Application
2.3 Communication
LITERACY STRATEGIES THAT SUPPORT COMPETENCY 1

THE PRACTICAL COMPONENT OF THE COURSE

C1 requires that the student understand the situational problem, represent the scientific principles involved in the problem, design an experiment/prototype to solve the problem, and communicate the results.
Frayer Model

These graphic organizers allow students to focus on words/terms that are essential to the conceptual understanding of the text.
COMPREHENSION AND REPRESENTATION: OF SCIENTIFIC PRINCIPLES

Guiding Questions

1. What is this problem about?
2. What are the math vocabulary words in this problem?
3. What prior knowledge can you bring in to help?
4. What information do you know?
5. What are we trying to find out?
6. Ideas for solving process:

Can be used for the situational problem presented in a lab exercise.

Students can depict the scientific principles involved in a situational problem via a flow chart/concept map.

Flowchart
ORIENTATION, APPLICATION AND COMMUNICATION:
OF A LAB PROCEDURE AND THE RESULTS

Lab Template With Writing Prompts

Writing prompts keep the writing focused. They also help students understand and correctly respond to each section of the lab report.

<table>
<thead>
<tr>
<th>TITLE: (on a few words, write a title that describes what you are about to determine with this experiment)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective: (Why are you conducting this experiment?)</td>
</tr>
<tr>
<td>Hypothesis: (What do you think the results will be when you conduct this experiment? Write an if...Then statement and explain.)</td>
</tr>
<tr>
<td>Materials: (Write down the items you will need to conduct this experiment. List all materials with exact quantities. Be sure to include all safety equipment, where necessary.)</td>
</tr>
<tr>
<td>Procedures: (Write step-by-step directions. Each step must begin with a verb)</td>
</tr>
</tbody>
</table>

Common Physics Verbs: spin, rotate, swing, roll, pull, push, lift, topple, balance, bounce, stick, shine, reflect, float, sink, adjust, connect, etc.
LITERACY STRATEGIES THAT SUPPORT COMPETENCY 2

THE THEORETICAL COMPONENT OF THE COURSE

C2: REQUIRES THAT THE STUDENT UNDERSTAND THE TASK, CONSIDER THE SCIENTIFIC PRINCIPLES INVOLVED, AND DEVISE AND COMMUNICATE A SOLUTION THAT INVOLVES FORMULAS, EXPLANATIONS, OPINIONS, AND JUSTIFICATIONS.
Frayer Model

COMPREHENSION: CONTENT VOCABULARY ACQUISITION

Frayer Model

Verbal and Visual Word Association (VVWA)

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Allows students to focus on words/terms that are essential to the conceptual understanding of the text.
**Comprehension, Representation, and Application**

**Annotation of Texts**

The student sees reading as an active process of comprehension or way of learning. Slows the reading down and provides students with a visible record of their thoughts. Provides students with practice in finding supporting evidence concerning (controversial) topics.

**Anticipation Reading Guides**

<table>
<thead>
<tr>
<th>Statements</th>
<th>What I think</th>
<th>What the text says</th>
<th>Evidence from the text</th>
</tr>
</thead>
<tbody>
<tr>
<td>The earth travels around the sun once per year.</td>
<td>True, False</td>
<td>True, False</td>
<td>Text says: earth makes one revolution around the sun.</td>
</tr>
<tr>
<td>The amount of energy the earth receives from the sun varies significantly at different points in the earth’s orbit.</td>
<td>True, False</td>
<td>True, False</td>
<td>Text says: earth gets the same energy from sun year round.</td>
</tr>
<tr>
<td>When it is summer in the northern hemisphere, it is winter in the southern hemisphere.</td>
<td>True, False</td>
<td>True, False</td>
<td>Text says: seasons north and south are opposite.</td>
</tr>
<tr>
<td>The axis of the earth’s rotation is perpendicular to the plane of the earth’s orbit around the sun.</td>
<td>True, False</td>
<td>True, False</td>
<td>Yes — text says earth is tilted 23.5 degrees.</td>
</tr>
</tbody>
</table>

**Graphic Organizers (KWS)**

<table>
<thead>
<tr>
<th>K</th>
<th>What Do I Know?</th>
<th>What does the problem tell me?</th>
<th>W</th>
<th>What do I want to know or need to know in order to solve the problem?</th>
<th>S</th>
<th>Solve the problem</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
<td>Show my thinking in an orderly fashion. Include drawings, formulas, tables, graphs, etc. when possible. Check my work.</td>
<td></td>
<td></td>
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</tbody>
</table>
Reflection Questions by Edutopia:
Teacher can encourage writing in science class by administering one or two reflection questions at any point in the course and incorporating reflection questions into lab exercises.
REFERENCES:


