
How to Use Textual Materials

The following material was taken from a book called Reading in Math and Science, published by the Calgary Board of Education.

All too often math students expect their teacher to "give them the course" by explaining every concept to them. With *adequate* guidance, many students can accept a share of the responsibility for their own learning. If students can learn to read effectively, they are moving toward mathematical maturity. If students were introduced early in junior high to effective reading techniques, perhaps they would feel more at ease with their texts. One of the objectives of math education should be to give students the techniques for reading materials in these fields. (Not only is the teacher helping students to higher achievement in math, but he is also equipping them for learning on their own in other disciplines.)

Math requires a completely different approach to reading since more information is contained per square centimetre, per sentence, per page, than in any other type of writing. Sentences and paragraphs are packed with concepts. In actual experiments, the slowest readers have often proved to be the best in math. Three pages of *new* reading in math may be equivalent to forty pages in a novel or twenty pages of social studies.

Two types of material follow:

1. Materials to familiarize students with their math or science text.
2. Materials to help students approach a new unit or chapter.

General Lesson on Using a Math Text _____

Objective: To familiarize the student with his math text.

Name of Text _____ Author _____

Copyright Year _____ Publisher _____

A. TABLE OF CONTENTS

This is found near the front of a book.

A book's table of contents is a list of the main topics and where they can be found in the text.

Find the table of contents in your text and answer the following questions:

1. How many chapters? _____
2. What is the main topic covered in chapter 7?

3. Name one of the subtopics listed under chapter 4.

4. On what page does this subtopic begin? _____
5. On which page will you find the following?
 - (a) Beginning of chapter 3 _____
 - (b) End of chapter 5 _____
 - (c) Table of squares _____
 - (d) Index _____

B. INDEX

This is found at the end of a book. It lists all topics in alphabetical order and the pages where they can be found.

An index will allow you to find information about a certain topic without reading the entire chapter.

Find the index in your text and answer the following questions:

1. On what page is "decimal" first mentioned? _____
2. On what pages would you find information on triangles?

3. Pick three new words that you are unfamiliar with, from the index. What is the first page where each is used in your book? Turn to that page and copy the first sentence in which the word is contained.
 - (a) _____
 - (b) _____
 - (c) _____

C. TABLES

Frequently texts have tables at the end of the book with information used throughout the text.

1. Does your text have any tables? _____

2. If so, write the title and page of three tables.

D. OTHER INFORMATION

Near the end of the book you may find other information such as symbols, measures, formulas.

1. Does your textbook have this extra information? _____
2. Which ones? _____

E. ANSWERS

Some books have answers to exercises.

1. Does your textbook have answers to *all* questions or just selected answers? _____
2. If it contains only selected answers, what do you think is the reason for this?

3. Look up one question in chapter 5. Does it have the answer in the back of the book? _____
If not, which question before it has an answer listed?

F. CHAPTER ORGANIZATION

Each chapter in your text deals with a specific topic. Although each chapter is different in content, they all have similar ways of highlighting items. Some of these items are examples, definitions, properties, exercises, end of chapter review, and enrichment ideas. More than likely, your book has several of these.

1. Choose any chapter from your textbook.
Write its number here. _____
2. Turn to this chapter and answer the following questions.
- (a) Which of the following ways are used to highlight the text in that chapter. Put a check mark in the box provided.
- (i) Underlining
- (ii) Boxes

- (iii) Color
- (iv) Different Print
- (v) Graphs
- (vi) Diagrams
- (vii) Photographs
- (viii) Drawings
- (ix) Charts
- (x) List any others here

(b) Which of the following are found in this chapter? Put a check mark in the box provided.

- (i) Worked examples
- (ii) Definitions
- (iii) Formulas
- (iv) Properties
- (v) Exercises or problems
- (vi) End of chapter review
- (vii) Enrichment activities
- (viii) Review of exercises of material from previous chapters
- (ix) List any others here

How to Design Effective Questions

Levels of Questioning -

There are basically three types of questions:

1. Literal - answer is directly stated in the text.
2. Interpretive - answer requires finding information from the text, synthesizing this information, and then restating it.
3. Applied - background knowledge is necessary. Answers cannot necessarily be verified in the text because responses may vary within reasonable limits.

NOTE: It is important to vary your types of questions to suit the abilities of your students. Students of lower ability cannot usually get by the literal level unless they are guided right through to the interpretive level.

Following are examples of the three levels of questioning - literal, interpretive, and applied.

Grades 8 or 9 –

Exercises for Integers and Equations _____

1. LITERAL LEVEL

- (a) $-6 + 8 + -12 - -6$
- (b) $-24 \div -3$
- (c) $-1 \times -1 \times -2 + 6 + 8 - 8$
- (d) -1 squared divided by -1 cubed
- (e) find the sum of -8 and -128
- (f) find the difference of -62 and -62
- (g) $-6(-3 + -2 = -4)$
- (h) $-129 \div 13 \times -1 \div -13$

2. INTERPRETIVE LEVEL

- (a) $n + -6 = -12$
- (b) $2n + -6 = 0$
- (c) $-12n - 6n = 48$
- (d) $-6 + n + -4 = 2$
- (e) $2n + -3n = -6$
- (f) $-5n - -6n = -42$
- (g) $-12 - -24 = n$

Solve for n:

- (h) negative two n plus six equals twelve
- (i) negative ten plus negative five n equals negative thirty
- (j) six n plus negative four n equals negative fifty-two

3. APPLIED

- (a) The temperature rises from -36°C to -4°C on September 25. On September 26 the temperature rose 26° . How much did the temperature rise on September 25?
- (b) The difference between 2 integers is -21 . One of the numbers is -21 . The second number is not -21 . What is the other number?
- (c) The cube of a number is -64 . The number added to itself six times is -24 . This number subtracted from itself is zero. What is the number?

Techniques for Reading of Content Materials

In order to familiarize the pupil with this method of reading content material, it is necessary to work through several selections in a systematic manner with the class and gradually allow the pupil to follow the steps independently with less teacher supervision. The student should acquire some degree of independence on one step before moving to the next. The aim is to give the student a completely independent method of efficiently reading content materials.

A. SQ3R - SURVEY, QUESTION, READ, RECITE, REVIEW.

Survey: Student glances over headings in the chapter or selection and the first sentence of each paragraph in order to get an overview of points to be noted and developed.

Question: Student turns heading(s) into question(s), mainly of the how, what, where, when, why variety. This, then, sets a purpose for reading.

Read: Student needs to answer question(s) derived from a heading(s).

Recite: Student goes over the questions posed and tries to answer the questions formed from what has been read.

Review: Student reviews for main points and the relationships. He tries to recite main points under each heading. In fact, the student then has the ideas in a logical outline (which, if this technique is applied in written form, can be a set of notes.)

Variation of SQ3R for Mathematics - SQRQCQ

Survey: The problem is to read rapidly to determine its nature.

Question: What is the problem?

Reread: Reread for details and interrelationships.

Question: What processes should be used?

Compute: Carry out computation.

Question: Is the answer correct? Check the computation against the problem facts and the arithmetic facts.

B. PQ/R-S-T - PREVIEW, QUESTION, READ, SUMMARIZE, TEST.

Preview: Student secures a general understanding of the selection mainly by reading carefully the topic sentences and summary paragraphs.

Question: While he is previewing, he should be asking himself questions related to the material being previewed.

Read: Student reads the whole selection carefully, trying to think about answers to some of the questions that occurred to him during the previewing he has just completed.

Summarize: Student tries to recall, in correct order, the main ideas of the selection he has just read.

Test: Answering of questions on the selection (main ideas, details, organization, between-the-lines, et cetera).

C. OARWET - OVERVIEW, ASK, READ, WRITE, EVALUATE, TEST.

A useful method for tackling a word problem in math is
S Q R Q C Q -

1. Survey
2. Question
3. Read
4. Question
5. Compute
6. Question

Word problems are often called the "disaster area" of math. Most students are not aware of the slow, concentrated reading that word problems demand. A step-by-step sequence such as is used with the example below should help students to learn to attack word problems.

Willie Mays has 31 hits for 48 times at bat. If he goes 5 for 5 in today's game, by how many points will his batting average increase?

1. *Survey:* Read the problem thoroughly, asking "What is this all about?" Is there a word you don't know? What does "He goes 5 for 5" mean? Find the answers to these first before going ahead.
2. *Question:* Ask yourself "What have I to find here?" "I need to find Mays' present batting average and the batting average after today's game, then find the increase."
3. *Read:* Reread to find what information is already supplied. "I know the number of hits and times at bat right now, and I know that he adds 5 to each of them in the game today." Estimate what a sensible answer would be.

4. *Question:* "What processes will I use to solve the problem?"

$$\text{First batting average} = \frac{31}{48} =$$

$$\text{Second batting average} = \frac{31 + 5}{48 + 5},$$

then find the difference.

5. *Compute:* Carry out the above computation

$$\frac{31}{48} = 0.646$$

$$\frac{31 + 5}{48 + 5} = \frac{36}{53} = 0.679$$

$$0.679 - 0.646 = 0.033$$

6. *Question:* Is the answer correct? Compare the answer you arrived at with your estimated answer.

We will call the above sequence SQRQCQ. This may have to be modified for other types of problems.

Suggestions for Attacking Mathematical Problems

Read and reread the problem using the following questions as guides for attacking it:

1. What am I asked to do? Try to get the general idea of the problem.
(finding the main idea)
2. Can I visualize or diagram the problem?
(getting meaning from the printed word or symbol)
3. What facts am I given? Take a good look at each fact, one at a time.
 - (a) Important facts
 - (b) Irrelevant facts(noting details and discriminating between relevant and irrelevant facts)
4. What "hidden" or unstated facts do I need to anticipate?
(using critical thinking skills)
5. What step do I need to follow to compute the problem? Take each direction separately. Work with only one direction at a time.
 - (a) Known facts given
 - (b) Unstated or implied facts
 - (c) Possible method(s) for use with given or implied facts
(organizing materials and following directions)
6. Can I estimate the answer?
(critical thinking)

7. Does my answer make sense?
8. Have I rechecked my computations for possible errors?

Skills Needed for Efficient Reading of Mathematics

In order to be an efficient reader of mathematics, the student should be able to:

1. Understand specific vocabulary, word roots, symbols of mathematical operations, and spatial, temporal, quantitative relationships.
2. Solve problems which involve reading facts (details), seeing relationships (inference stated - not stated), estimating (predicting outcomes), testing results.
 - (a) Understand and use rules and definitions.
 - (b) Read critically - separate the relevant from the irrelevant.
 - (c) Follow directions.
 - (d) Understand sequence in operations.
 - (e) Read compact word problems.
3. Read and understand visual materials:
 - (a) diagrams
 - (b) graphs
 - (c) geometric forms
 - (d) tables.