

Part I. Thinking Logically

1.1 Literacy for the Modern World

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Literacy for the Modern World

Literacy in today's world demands not only reading and writing but also an understanding of the fundamental concepts of logic, mathematics and science.

The focus of this course is *Quantitative Literacy* - literacy in terms of information involving mathematical ideas or numbers.

Quantitative literacy is fundamental to nearly every discipline of study and to different issues in society that an individual faces.

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- Virtually every major issue in the modern world involves mathematical ideas.

Conflicts between nations are analyzed in terms of resource bases, economic policies and the power of weapons.

In the Philippines and around the world, statistical surveys shape the political and economic landscape.

Even personal decisions require mathematical knowledge in choosing a health insurance policy or financing a new house or car.

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Interdisciplinary Thinking

Fundamental ideas from other disciplines other than mathematics are also essential to understanding current issues.

Important issues, whether personal or societal, are *interdisciplinary* in nature. They can best be understood when examined from various perspectives.

Issues are better studied in an approach that recognizes how the various branches of human knowledge are interconnected. The danger of compartmentalized education is the lack of perspective and the inability to see the 'big picture'.

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What is quantitative literacy?

Literacy is the ability to read and write, and this ability comes in varying degrees.

A crucial aspect of literacy is the ability to interpret and reason with *quantitative information* (information that involves mathematical ideas or numbers). This so-called *quantitative literacy* is essential to comprehending modern issues that affect the individual and society daily.

Quantitative reasoning is the process of interpreting and reasoning with quantitative information

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Innumeracy : the lack of quantitative literacy.

- can lead to financial trouble and personal problems
- on the part of government, policies that inevitably involve quantitative information cannot be formulated and achieved
- leads to a misunderstanding of logic, probability and statistics, thus to an inability to distinguish between legitimate science and fraudulent science



Think of a current issue facing our country that has a major impact on your life. How is quantitative information involved in this issue?

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Advantages of Quantitative Literacy

- It enriches the appreciation of both ancient and modern culture.
- It helps you appreciate literature.
- It helps you appreciate the substantial contribution to mathematics, science and technology of achievers in art, literature or politics.
- It provides greater chances for employment.

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How literate quantitatively should I be?

Levels of mathematical understanding

(highest to lowest):

- ① Theoretical mathematics
- ② Applied mathematics
- ③ Vocational mathematics
- ④ Quantitative literacy

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- Theoretical mathematics - discovery of entirely new mathematical principles (mathematicians, theoretical scientists)
- Applied mathematics - known mathematical tools are applied to problems of immediate interest such as analyzing risk in insurance policies, developing mathematical models to assess human impact on the environment, or teaching mathematics (engineers, scientists, teachers, statisticians, business analysts)

Applied mathematics can be viewed as a central resource for addressing and solving problems in a wide and growing variety of disciplines such as business management, economics, engineering, biology/ecology, computer science/artificial intelligence, physics/chemistry, medicine/physiology, and even in psychology/sociology.

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- Vocational mathematics - use of mathematical tools routinely such as computer programming, and accounting and banking wherein mathematical methods are used to analyze financial records and investment strategies, does not involve discovery of new principles or application of principles in new ways (computer programmers, accountants, statisticians)

- Quantitative literacy - necessary for everyone, is survival skill in today's technological society

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What mathematics is not Misconceptions about mathematics

- Math requires special or inherent intellectual abilities.
- Math is gender dependent/ethnic based/hereditary.
- Math in modern issues is too complex for the average person to understand. It is difficult and dull.
- Math makes you less sensitive to the romantic and aesthetic aspects of life.
- Math makes no allowance for creativity.
- Math provides exact answers.
- Math is irrelevant to my life.



How do you confront these psychological barriers in order to find mathematics truly enjoyable, interesting and relevant to your life?

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What mathematics is

The word *mathematics* is derived from the Greek word *mathematikos* which means "inclined to learn" (thus literally, to be mathematical is to be curious, open-minded, and interested in always learning more)

We look at mathematics in three different ways:

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1. Mathematics as the sum of its branches

- logic- study of the principles of reasoning
- arithmetic- methods for operating on numbers
- algebra- methods for working with unknown quantities
- geometry- study of size and shape
- trigonometry- study of triangles and their uses
- probability- study of chance
- statistics - methods for analyzing data
- calculus - study of quantities that change

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2. Mathematics as a way to model the world

- Mathematics can be viewed as a tool for creating models, representations that allow us to study real phenomena
- Models allow us to gain insight into otherwise intractable problems; and point to areas where further research is needed
- Mathematical models take the form of tables, graphs, equations, etc. We will learn numerous techniques for building mathematical models and use them to study meaningful problems.
- However, models are not the “real thing”, they are only as good as the equations and observations from which they are made.

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3. Mathematics as a language

- It is the language of nature because it is very useful for modeling the natural world.
- It has its own grammar and vocabulary.
- You must be “fluent” in this language. Quantitative literacy is the level of mathematical fluency required for success in today’s world.

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How do you attain quantitative literacy?

- Identify your personal goals and strategies.
Goal - an end toward which effort is directed
Strategy - a plan or method for achieving a goal
- Break down your psychological barriers.
- Set your course.

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Conclusion

- Even though you will choose a discipline of emphasis in your studies, remember that real issues and problems are interdisciplinary and best understood through examination from a variety of perspectives.
- Quantitative literacy is a crucial aspect of literacy for the modern world. It is necessary to making wise personal decisions, exercising citizenship through social discourse and voting, and appreciating culture fully. In addition, quantitative literacy is crucial to remaining competitive in a rapidly changing job market.

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Conclusion

- If you are one of the many people who have a particular fear of mathematics, confronting your attitudes may be the most important step in learning to reason quantitatively.
- Perhaps the most insidious of all misconceptions about mathematics is the one that holds that some otherwise intelligent people are incapable of understanding the subject. As you continue your studies, you should constantly remind yourself that you are fully capable of understanding everything about mathematics. It may require a great deal of effort, but success is well within your reach.

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