Mathematical Literacy for College Students (MLCS)

New Life Project

AMATYC Developmental Mathematics Committee

Purpose of course:

The Mathematical Literacy for College Students (MLCS) course prepares students for the quantitative demands found in general education math courses (quantitative reasoning, statistics, etc) as well as those found in basic college courses in other disciplines (science, technology, etc). The focus is on building understanding of basic mathematical concepts, with a primary emphasis on application; most symbolism is presented within a context. The prerequisite skills for MLCS are limited, primarily in the area of number sense; see * note.

GOALS:

1. Numeracy: Students will develop and apply the concepts of numeracy to investigate and describe quantitative relationships and solve problems in a variety of contexts.

Students will:

A. **Demonstrate operation sense and communicate verbally and symbolically the effects of common operations on numbers.**

   For example: Display proficiency in performing calculations by hand and with the aid of technology with numerical operations and their inverses. Determine whether the result of an operation will be larger or smaller than the operands. Demonstrate understanding of inverse operations: addition and subtraction, multiplication and division, powers and roots.

B. **Demonstrate competency in using and an understanding of magnitude in the context of place values, fractions, and numbers written in scientific notation.**

   For example: Order sets of real numbers.

C. **Use estimation skills, knowing how and when to estimate results, solve problems, detect errors, and check accuracy.**

   For example: Write answers to a designated level of precision. Use order of operations in evaluating formulas. Know when it is more appropriate to use the actual number and when it is more appropriate to use a rate.

D. **Apply quantitative reasoning to solve problems involving quantities or rates**

   For example: Find the cost of flooring for a given space or find the cost per mile to operate a vehicle given its MPG and the cost of a gallon of fuel. Compare the total cost of a car loan including the total payments to the sticker price of the car.

E. **Demonstrate measurement sense.**

   For example: Calculate perimeter, area, and volume of irregular shapes. Exhibit awareness of and understanding of estimation, error, and precision related to computation in lengths, areas, and volumes. Find unknowns, use appropriate units, and use formulas from geometry. Convert units within a system. Use dimensional analysis to facilitate conversion. Know units of measure and the relationship of those units to physical situations. Exhibit attention to notation, convention, and accuracy.

*Prerequisite skills: Use arithmetic operations to represent real-world operations, such as putting together, comparing, distributing equally, etc. and use real-number arithmetic to solve stated problems. Use graphical representations on a number line to demonstrate fluency in interpreting interval notation, ordering numbers, representing operations (*i.e.*, addition, subtraction, doubling, halving, and averaging) and representing decimal numbers, including negative numbers.

F. Demonstrate an understanding of the mathematical properties and uses of different types of mathematical summaries of data, such as, measures of central tendency, and mathematical models.

For example: Evaluate the efficacy of a multi-billion dollar governmental expenditure using the interpretation of mean as "fair share." Understand the context under which a mathematical summary is appropriate, such as recognizing that the mean may not represent a typical salary.

G. Read, interpret, and make decisions based upon data from graphical displays, such as line graphs, bar graphs, scatterplots, and histograms.

For example: Critique a graphical display by recognizing that the choice of scale may distort information.

2. Proportional Reasoning: Students will represent proportional relationships and solve problems that require an understanding of ratios, rates, proportions, and scaling.

Students will:

A. Recognize proportional relationships from verbal and numeric representations.

For example: Examine a table of values representing the relationship between two variables and determine whether the relationship is proportional. Solve a problem and find unknowns using proportional reasoning.

B. Compare proportional relationships represented in different ways.

For example: Compare the total cost of a taxi ride in two cities when the cost is written in the form of an equation, such as $C_1 = .25f + 2.5$ or $C_2 = .2f + 3$, or when the cost of the ride is based on fifths of a mile or represented in a table.

C. Apply quantitative reasoning strategies to solve real-world problems with proportional relationships based on an understanding that derived quantities may be described with whole numbers, fractions, or decimals, or in a combinations of these, and that to fully explain these relationships, units must be used.

For example: Convert units and measures using dimensional analysis. Use units consistently in describing real-life measures, including in data displays and graphs. Identify rate of change (linear, exponential, quadratic) from a data set. Determine a relationship and use it to find values of one quantity that correspond to given values of the other quantity.

3. Algebraic Reasoning: Students will reason using the language and structure of algebra to investigate, represent, and solve problems.

Students will:

A. Understand various uses of variables to represent quantities or attributes.

For example: Understand the different uses of variables and the difference between a variable and a constant. Be able to use variables in context and use variables as placeholders, as in formulas. Identify the nature of a variable from the context (place holder, unknown, property, etc). Write an algebraic expression to represent a quantity in a problem. Identify variables as independent or dependent. Identify and interpret the structure of algebraic expressions. Combine simple expressions. Use notation with variables (coefficients, exponents, subscripts) in simple and moderately complex expressions.

B. Describe the effect that a change in the value of one variable has on the value(s) of other variables in the algebraic relationship.

For example: Determine the relationship between the height and width of the volume of a three-dimensional figure, such as a rectangular solid, if the volume is held constant and the length is doubled or increased.

C. Construct and use equations or inequalities to represent relationships involving one or more unknown or variable quantities to solve problems.

For example: Solve linear equations or inequalities in one variable using the rules of arithmetic and the properties of equality and inequality. Identify equivalent forms of a given equation or inequality and use appropriate properties to solve for the unknown(s). Understand the meaning of a "solution." Relate quantities given in a problem and identify quantities not explicitly given in the problem statement. Identify when there is insufficient information given to solve a problem.

4. **Functions: Students will represent relationships between quantities in multiple ways and solve problems that require an understanding of functions.**

Students will:

A. Translate problems from a variety of contexts into a mathematical representation and vice versa.

Representations will include linear, exponential, and an introduction to squaring functions.

For example: Given a statement of how the balance in a savings account grows because of monthly interest, use that information to construct a table of months and balances and then write a mathematical model that provides the balance for a given month.

B. Describe the behavior of common types of functions using words, algebraic symbols, graphs, and tables.

For example: Identify any interval over which a curve is increasing using either numerical or graphical representation and construct an appropriate graphical representation of a data set.

C. Identify when a linear model or trend is reasonable for given data; when a linear model does not appear to be reasonable, know how to explore the applicability of other models.

For example: Discuss the trend of a model, make predictions about the model, and identify and explain appropriate input values within a context.

D. Identify important characteristics of functions in various representations.

For example: Identify the maximum or minimum value of a function from a graph or approximate from a table. Identify appropriate input values from a context. Predict the behavior of a curve from a graph or table. Identify the relationship between the variables in context.

E. Use appropriate terms and units to describe rate of change.

For example: Describe the rate of change using appropriate units: slope for linear relationships or average rate of change over an interval for non-linear relationships. Interpret and understand relationships between units within a given context, such as the difference between miles per gallon and gallons per mile.

F. Understand that abstract mathematical models used to characterize real-world scenarios or physical relationships are not always exact and may be subject to error from many sources, including variability.

For example: Estimate a line of best fit that describes a scatterplot, given the data in context.