**Davison Community Schools**
**ADVISORY CURRICULUM COUNCIL**
***Phase II, April 1, 2012***

# *Alterative Ed Problem Solving*

**Course Essential Questions:**

1. What are the steps of UPSL and how are they used to solve mathematical problems?
2. What is the scientific method and how is it used to solve problems in science?

## Unit 1: Using UPSL

### Essential Questions:

1. What are the four steps of UPSL and what should be done at each level?
2. How do you use UPSL to solve story problems with proportion, multivariable, and multistep situations?

### Essential Understanding:

- The four steps are Understand, Plan, Solve and Look back.
- There are specific routines that a student should follow for all word problems.

## Curriculum Standards

- *Analyze proportional relationships and use them to solve real-world and mathematical problems.*
  - 7.RP.2 Recognize and represent proportional relationships between quantities.
    a. Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.
    b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
    c. Represent proportional relationships by equations. For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as $t = pn$.
    d. Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, r) where r is the unit rate.
  - 7.RP.3 : Use proportional relationships to solve multistep ratio and percent problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.
- *Analyze and solve linear equations an pairs of simultaneous linear equations.*
  - 8.EE.8 Analyze and solve pairs of simultaneous linear equations.
    a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
    b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. For example, $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6.
    c. Solve real-world and mathematical problems leading to two linear equations in two variables. For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.

**Algebra – (Reasoning with Equations and Inequalities) Solve systems of equations**

5. Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.
6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. *For example, find the points of intersection between the line $y = -3x$* and the circle $x^2 + y^2 = 3$.
8. (+) Represent a system of linear equations as a single matrix equation in a vector variable.
9. (+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension $3 \times 3$ or greater).

| Knowledge/Content<br>Students will know about… | Skills/Processes<br>Students will be able to… |
|---|---|
| • The steps of the problem solving method "UPSL"<br>  ○ Understand – Students read the problem for information to identify what they are given and what they are solving for.<br>  ○ Plan – Students identify whether a formula can be used or steps need to be taken to solve the problem. They also estimate an answer.<br>  ○ Solve – students plug the information into their plan and get the resulting answer.<br>  ○ Look back – Students make sure their answer is appropriate or close to their estimate. Also, they make sure the answer has the correct units of measure. They then decide to either accept their answer or come up with a new strategy to solve.<br>• The reasons to use UPSL<br>• How to identify the given and unknown in a problem<br>• How to write a proportion and an equation with multiple variables<br>• How to write step by step descriptions of how to solve a problem<br>• How to use a calculator to develop matrices | ▪ Write a correct proportion from a contextual situation.<br>▪ Write a multivariable equation from a contextual situation.<br>▪ Write a story problem involving multiple variables<br>▪ Set up a matrix in the calculator<br>▪ Identify Given and Unknown information in a story problem<br>▪ Develop a plan to solve a problem<br>▪ Solve word/story problems involving proportions, multistep and multivariable situations<br>▪ Identify the proper label/units of measure to answer a story problem |

| Phase III Textbook/Materials |
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| Phase IV Summative Assessment Evidence | |
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| **Common Summative Unit Assessments:** | **Agreed Upon Interim Summative Assessments:** (*identifies Performance Task) |

| Phase V Learning Plan |
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## Unit 2: Using the Scientific Method

| Essential Questions: | Essential Understanding: |
|---|---|
| 1. What are the steps of the scientific method and how are they used to answer questions in science?<br>2. How do you critically analyze experiments for accuracy and application to the real world? | • The scientific method has five steps to help scientists to investigate and prove their hypotheses to be valid – Problem, Hypothesis, Experiment, Observation and Conclusion<br>• Every experiment must have five characteristics to be considered accurate – Controlled, Multiple Trials, Large Samples, Random Samples and Good Records. |

## Curriculum Standards

**Science:**

**S1.1 Scientific Inquiry**

Science is a way of understanding nature. Scientific research may begin by generating new scientific questions that can be answered through replicable scientific investigations that are logically developed and conducted systematically. Scientific conclusions and explanations result from careful analysis of empirical evidence and the use of logical reasoning. Some questions in science are addressed through indirect rather than direct observation, evaluating the consistency of new evidence with results predicted by models of natural processes. Results from investigations are communicated in reports that are scrutinized through a peer review process.

S1.1A Generate new questions that can be investigated in the laboratory or field.

S1.1B Evaluate the uncertainties or validity of scientific conclusions using an understanding of sources of measurement error, the challenges of controlling variables, accuracy of data analysis, logic of argument, logic of experimental design, and/or the dependence on underlying assumptions.

S1.1C Conduct scientific investigations using appropriate tools and techniques (e.g., selecting an instrument that measures the desired quantity—length, volume, weight, time interval, temperature—with the appropriate level of precision).

S1.1D Identify patterns in data and relate them to theoretical models.

S1.1E Describe a reason for a given conclusion using evidence from an investigation.

S1.1f Predict what would happen if the variables, methods, or timing of an investigation were changed.

S1.1g Use empirical evidence to explain and critique the reasoning used to draw a scientific conclusion or explanation.

S1.1h Design and conduct a systematic scientific investigation that tests a hypothesis. Draw conclusions from data presented in charts or tables.

**S1.2 Scientific Reflection and Social Implications**

The integrity of the scientific process depends on scientists and citizens understanding and respecting the "nature of science." Openness to new ideas, skepticism, and honesty are attributes required for good scientific practice. Scientists must use logical reasoning during investigation design, analysis, conclusion, and communication. Science can produce critical insights on societal problems from a personal and local scale to a global scale. Science both aids in the development of technology and provides tools for assessing the costs, risks, and benefits of technological systems. Scientific conclusions and arguments play a role in personal choice and public policy decisions. New technology and scientific discoveries have had a major influence in shaping human history. Science and technology continue to offer diverse and significant career opportunities.

S1.2A Critique whether or not specific questions can be answered through scientific investigations.
S1.2B Identify and critique arguments about personal or societal issues based on scientific evidence.
S1.2C Develop an understanding of a scientific concept by accessing information from multiple sources. Evaluate the scientific accuracy and significance of the information.
S1.2D Evaluate scientific explanations in a peer review process or discussion format.

| **Knowledge/Content**<br>Students will know about…. | **Skills/Processes**<br>Students will be able to…… |
|---|---|
| • The steps of the scientific method – PHEOC<br>  ○ Problem – the question you are trying to answer<br>  ○ Hypothesis – the testable answer to the question<br>  ○ Experiment – a list of materials and procedures that will allow anyone to complete your study with high accuracy<br>  ○ Observation – All the data collected and arranged in tables, charts, and graphs<br>  ○ Conclusion – Summary of results identifying the acceptance or rejection of the hypothesis<br>• The types of graphs – Line, Bar, and Circle<br>• The definitions of controlled, independent variable, dependent variable, constants, experimental group, control group and sample<br>• The characteristics of a well designed experiment | ▪ Identify problems that could be tested using the scientific method.<br>▪ Write hypotheses<br>▪ Design a controlled experiment<br>▪ Identify independent variables, dependent variables and Constants<br>▪ Create a table<br>▪ Draw a graph from given data<br>▪ Analyze experiments for weaknesses in design<br>▪ Compare different hypothesis and the evidence supporting them<br>▪ Identify scientific evidence that applies to real world situations |

## Phase III Textbook/Materials

## Phase IV Summative Assessment Evidence

| **Common Summative Unit Assessments:** | **Agreed Upon Interim Summative Assessments:** (*identifies Performance Task) |
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## Phase V Learning Plan