*READ*MATH: Connecting Literacy and Math

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Overview

Can you possibly *read* math? What about trying to *write* math? These questions might lead to a general answer in the affirmative; however, I am referring to an intertwining of math and literacy that directly support one another. Lewis Carroll's life work certainly pointed to the possibility. The link between communications and math inherent in Carroll's work is the foundation for which this unit, ***READ*MATH: Connecting Literacy and Math,** has been laid**.**

The unit is a creative writing mini-course that spans two curricular areas by combining literacy and mathematics instruction, much in the same fashion as Lewis Carroll connected the two content areas within his writing. It has been designed for the literature-lover and math-miserable (*or the math-lover and literature-miserable*)! We will take a look at how math and writing connect within the real world in a fun, non-threatening way.

This stand-alone course was designed for third-fifth grade students in the Humanities Department of the Pittsburgh Public Schools gifted education support program. These students have extremely high cognitive abilities and need strength-based enrichment activities in addition to what they receive in the mainstream curriculum. Each student attends the center one day per week. The students have the rare, college-like opportunity to choose the courses they will take each semester. Each course meets for one hour each week over a 16-week semester.

Rationale

The rationale for teaching a Humanities course laden with mathematical ideas, activities, and concepts is multidimensional (*Pun very much intended!).* First, as with solving mathematical problems, knowledge of order of operations, problem-solving strategies, and logical sequencing is also necessary when writing. In addition, math can be taught by using manipulatives and this tangible means of teaching can help students to comprehend concepts more quickly. By coupling writing and math, the students can be given the rare opportunity to interact with reading and writing in a physical manner. The students will be able to see and touch the relationships.

The general rationale for creating this unit is based on the gifted model of education. It is my job to help these students increase their creative and higher-level thinking skills. I am to account for the students' academic strengths and interests and provide opportunities for them to work in intellectual-peer groupings. It is common practice to do this by combining content areas within one activity or project.

Each year, the staff decides upon two process skills for which all teachers will place emphasis. We will be focusing on self-directed learning and decision making. The "Self-Directed Learning" projects allow the students to become independent learners while studying a topic of their choice. This insures that class time is never wasted, as the students always know what they are to do when they finish regular class work. For this model to be done effectively, the Creative and Higher-level Thinking models must also be used simultaneously. Typically, the Self-Directed Learning model sequence is referred to as "Plan, Action, and Result". I prefer to use the words "Before, During, and After" to help the students understand that every project is segmented into a logical sequence.

The students need to decide what to do before they begin (*Before or Plan*). This also covers the analysis component of the Higher-level Thinking model. If needed, they should be guided into thinking about such questions as, "Do all members understand the task?", "How do we plan to accomplish this task?", "How do we measure accountability?", "Is this task possible to accomplish with the available materials? If not, what can we substitute or change?"

The second phase (*During or Action*) requires the monitoring of accountability, arising issues, and pacing. This also covers the synthesis component of the Higher-level Thinking model in which the students must take what they know and manipulate it to create a product of their own. The students need a repertoire of strategies to deal with these issues. If needed, they should be guided to answer questions such as "What do we do if…"

The final phase requires the students to look at the both the process and the end product (*After or Result*). This phase also overlaps with the Higher-level Thinking model evaluation component, which is theorized to be the highest level of thought. It requires the students to examine how efficient their process was and how effective the end product is. At this phase, students should always be guided to answer the question, "What could we have done during the process that would have made it faster, easier, etc.?"

The Decision-Making model is imbedded within the Self-Directed Learning model. During decision-making, students need to weigh the positives and constraints of the actions that they plan to take, as well as monitoring these choices for effectiveness while in action.

In order to make worth-while use of the mathematics chosen for this unit, I have averaged the scores of the students that I currently have and taken a sampling of the problems that these students demonstrate difficulty in understanding in each of the following PSSA Communication and Math categories. As a resource teacher, this will allow me to support the mainstream teachers' objectives, while still allowing for the creativity needed in a gifted-education supporting environment.

On standardized testing, Communication problems fall under three categories: Vocabulary, Mechanics, and Comprehension. On standardized testing, Mathematic problems fall under five categories: Numbers and Operations, Measurement, Geometry, Algebraic Concepts, and Data Analysis and Probability. I have chosen to combine these categories in activities that best allowed for an interrelationship between literacy and math.

Types of Problems

As I set out to create this unit, I thought it necessary to do research on the categories in which problems fall. There are two categories of problem solving: mathematical and creative. Problems that actually require some sort of numerical manipulation are considered "mathematical" and problems that require logic, but not numerical manipulation, are considered creative. Within these categories, problems can further be divided into singular-step and multiple-step problems. An example of a singular-step problem might be, "Calculate the perimeter of rectangle A." An example of a multiple-step problem might be, "John had 4 ducks each, inside of 5 different baskets all driving in 6 different trucks. How many ducks legs are there in all?"

Order of operations

When multiple operations are necessary to solve a numerical problem, the acronym "**P**lease **E**xcuse **M**y **D**ear **A**unt **S**ally" can be used as a helpful way to remember the correct order of operations. The beginning letters stand for the sequence: **P**arenthesis,

Exponents, **M**ultiplication, **D**ivision, **A**ddition, and **S**ubtraction. It is important for students to understand that they may arrive at an incorrect answer when this pattern is not followed.

Problem-solving Sequence

It is necessary to teach the problem solving process to students of this age group. The problem solving process can be broken into four phases: *interpretation, organization, implementation, and evaluation*. Interpretation requires the problem-solver to analyze what is actually being asked. In the organization phase, the student needs to collect the necessary information in a logical way and then chose a strategy. During the implementation phase, the student works through the chosen strategy. The evaluation phase actually occurs before, during, and after the other three stages are occurring. In order for the student to use the evaluation phase appropriately, they need to first draw on prior knowledge to evaluate whether or not the present problem is like something that they have done before so that they can more efficiently and effectively interpret the problem. The same can be said for the organization phase. During implementation, the students must decide whether the method needs to be altered or abandoned. (**Appendix A)**

In order for a student to be successful in the implementation stage, problem solving strategies need to be taught. Some problem-solving strategies include: find a pattern, draw a picture, make a list, make an equation, make a chart or table, work backwards, guess and check.

Objectives

The process goals for this course are to have the students work though self-directed learning process, decision making process, creative thinking, interactive communication, higher-level thinking, and problem solving. This is appropriate for gifted learners, *as well as for all writers*, because writing is a process that requires many skills and the ability to communicate mathematical concepts is essential. Also, the students must be made aware that what they produce is as important as how they work toward and through the production.

As a standard academic goal, the students need to "write for a variety of reasons" and must "make sense of a variety of texts". This includes being able to use language to explain mathematical concepts.

By the end of the course the students will be able to:

1. Create original pieces of writing that demonstrate not only writing skills, but also demonstrate and articulate a thorough understanding of math concepts embedded within the writing.
2. Diagram the cause-and-effect relationship that carries a story though a logical sequence.
3. Research and logically write a family recipe and manipulate the units of ***measurement*** to account for a variety of situations. For example: doubling the recipe, cutting the recipe from a four-person recipe to a 1-person recipe.
4. Identify two and three dimensional ***geometric*** shapes and calculate perimeter, area, and volume.
5. Use variables to represent missing information in self-written algebra 'code' problems.
6. Create and analyze a multi-dice system to explore the probability of achieving a particular set of data.
7. Evaluate and critique published, peer, and self-written works.

Strategies

This section is oxymoronically divided into two, intertwined sections; strategies for teaching writing and strategies for teaching math. Since each lesson in this series will couple a writing activity with a math concept, it is necessary to find the best-practice for teaching both.

Gifted students master concepts quickly, so a higher level of *guided* autonomy must be granted in order to keep the classroom running smoothly and productively. I use the term 'guided' because the teacher should always deliberately choose the type of independent activity to fit, or at least help to support, the course objectives. I always do the activities that I plan to have the students do. This helps me to be able to more accurately judge the time that a project will really take. It also ensures that I catch any glitches in the directions prior to giving them to the students.

The first component of my *guided* autonomy strategy is the use of class-entry routines. Having structured time immediately upon entering the classroom establishes the classroom as a work place and supports the professional teaching objective of 'using class time wisely.' Additionally, it gives the teacher a few precious minutes to organize and review lesson plans! The class-entry routine that I have chosen includes reading a single chapter of Alice in Wonderland per class, and then "solving" either a mathematical or creative problem based on the chapter. (***See Appendix B***) This routine will help students to utilize their self-directed learning and decision-making skills.

The second component of my *guided* autonomy strategy is the development of long-term, in-class independent projects. Preparing for student success with a long term

project generally requires a considerable amount of planning on the part of the teacher. The long term project that I have selected for this unit revolves around aerodynamics. It includes a "flight" experiments that uses origami to help the students create the "best" construction of a flyer. (***See Appendix C***)

As mentioned in the rationale section, standardized math testing falls into the following categories: Numbers and Operations, Measurement, Geometry, Algebraic Concepts, and Data Analysis and Probability. Each of these categories presents the challenge of finding either literature or writing projects to support the acquisition of the math skills to be learned. The following section will detail the strategies for teaching the skill within the respective classroom activities.

Creative Problem-Solving

This category refers to problems that do not include numerical manipulation. In math, this could also be referred to as logic and reasoning.

Lewis Carroll also devised a type of word puzzle called "Doublets". I have turned the word READ into MATH in 9 steps (10 word total) to demonstrate how to construct such a puzzle. As I worked through this activity, my frustration grew. I began to play with my solution-seeking strategies. I first tried to cycle between the top and bottom words, tying to meet the solution, *quite literally*, in the middle. When that proved to be a futile effort, I tried making a series of side-by-side charts in order to try a series of different words. Finally, I wrote down the beginning and end words like a compound word as such: ***read*math (**which is where the title of this unit was derived). Then, I began to see if a mid-line word could be devised by combining letters from each word while keeping their position in the order that they occurred in their respective words.

R	**E**	**A**	**D**
b	e	a	d
b	e	a	**t**
m	e	a	t
m	e	**l**	t
m	**a**	l	t
m	a	**s**	t
m	a	s	**s**
m	a	**t**	s
M	*A*	*T*	***H***

SAT Smords, fashioned after Lewis Carroll's word portmanteaus in the poem "Jabborwocky" from Through the Looking-Glass, will be used to introduce students to the study of etyemology. By studying SAT-level words, students can make up words by

creating non-sensical ones that actaully do make sense, just as Carroll did. *An example would be*:

wheedle = to persuade
buffoon = a foolish person
The *Smord* = wheefoon (to persuade a foolish person)

A seminar Fellow, Sarah Ricketts, brought in a tangram puzzle set that was created by Lewis Carroll. This coincided with "Through the Looking Glass". It is an excellent visual-spatial problem solving activity. I have found a good copy to cutout and laminate at:

http://dimacs.rutgers.edu/nj_math_coalition/pguide/pguide.html#tgp

*"**You Don't Mean It!"*** allows students to use creative-dramatic techniques to act-out the figurative and literal meaning of idioms. With the goal of capturing both meanings, small teams will have no more than 10 seconds of movement, ending in a still vignette, to demonstrate both the literal or figurative meanings. I had developed this idea after reading a chapter of Alice's Adventures in Wonderland in which Carroll made the other characters use homophones and homonyms to confuse Alice.

"Logical Limerick" will be the classroom activity used to introduce the idea of creative-problem solving. Students typically think of problem solving as involving numbers, but logic requires *order*, but not always numbers. A traditional Limerick is usually vulgar or absurd, as the poem form is thought to have originated in Ireland as drinking songs as created by soldiers. Regardless of content, the traditional poem has five lines in length, contains aabba rhyme scheme, and is to be written and spoken in Anapestic meter, with lines 1, 2, and 5 using three feet and lines 3 and 4 using 2 feet. An anapest is a poetic unit of measurement called a foot. Each anapestic foot has three syllables. The first two syllables are unstressed and the third is stressed. In poetry, this can be noted by marking the unstressed syllable with a smile-shape and the stressed syllable can be marked with a hash mark or strike. A non-traditional Limerick follows all of the forms rules, except that it may contain multiple stanzas.

Here is a self-written example of a non-traditional Limerick that could be used with students:

Here's a riddle for you to ponder.
It is on the board over yonder.
It is really not hard.
Just think like a bard
Or time you will certainly squander!

An entire class thought of the matter:

"*If you say my name I will shatter*."
A raucous broke out!
What's this riddle about?
You're doing it now as you chatter!!

An important thing for students to discuss is the lack of an actual syllable in the last foot of lines 3 and 4 of the second stanza. Since this poem form requires 2 feet in each of these lines, why does this poem not contain the completing syllables? Herein lies a connection between math and writing. In order to complete the requirements for this line, the reader must utilize their knowledge of anapestic meter and add a pause in place of the absent syllable. Not only does this create the missing syllable, it adds a dramatic moment of silence, or rest, just as a composer would use to fulfill the requirements for a measure of music. Additional information about types of poetic meter can be found at: http://www.poemofquotes.com/articles/types-of-meters.php

Numbers and Operations

This category of mathematical concepts includes identification of types of measurement, which includes time-telling, decimals, and fractions. It also includes basic operations, such as addition, subtraction, multiplication, and division.

A fable is a fictional story in which animal-characters divulge a moral. A moral is a standard or acceptable guideline promoted by a particular culture. Morals are usually written as idioms. An idiom is a culturally-based figure of speech. ***(See Appendix G)***

In order to combine math and literacy in this activity, the students will be asked to write their fables based on a moral with a mathematical link, such as: "An ounce of prevention is worth a pound of cure." or "A bird in the hand is worth two in the bush."

In "***Mathematical Mysteries Fables***" instead of using real animals, however, the students will create an animal based on a numerical root word and a cross-breeding of two animals. A *centistark*, for example would be half stork and half shark and have 100 eyes. The characteristics of the animals and the numerical value of the root word would have to lend itself to the evolution of the moral used in the student's fables.

"***Meter Multiple Madness***" builds upon the poetry example in "***Logical Limericks***" and encroaches upon the Geometry category. I am planning on having the students first watch "Flatland: The Movie" and then discuss how math was used as the foundation for the story's plot. Then the students will use meter to create a poetic form of multiplication tables that also requires the reader to solve a problem. For example, they will chose a table-set, such as the "9" tables and make each of the 9 stanzas have the same number of lines as the multiple, which would ensure that all of the syllables in the

stanza would equal the answer to the corresponding multiplication table, i.e., Stanza 1 = 1 line = 9 syllables, Stanza 2=2 lines = 18 syllables**)**

Below is a self-written example for the "9" tables. My character, *Flat Cat*, needs to build a house that he can stand up in and turn around in.

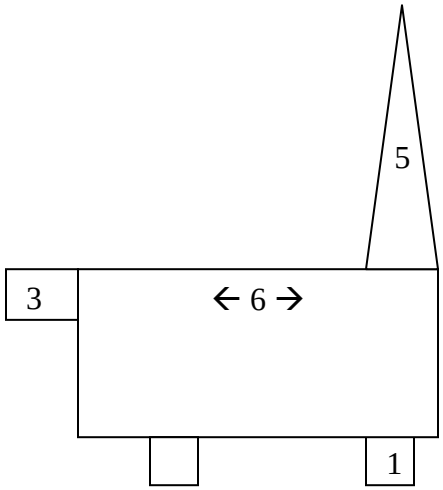
"Adventures of Flat Cat"

My name is Enin. Nine lives I have.

A dandy lion, although I'm flat,
Three inches high, but three times as fat.

In a nonagon is where I sleep,
But I can't turn or stand up or leap.
This house of lines I just cannot keep!

My friend Prism said, I think I know!
Your flat house upward and out must grow!
Not just height and width – *depth* too must show!
To a 3-D house you must now go!



All those extra sides can cost a bunch.
An empty wallet feels like a punch.
We cannot just guess - no silly hunch!
What a fun dilemma for our lunch!
Let's use both our heads and number crunch!

A perfect line from my flat-lined veil,
We measured nine from my tip to tail.
Square little feet, make a one inch trail.
Isosceles ears through the air sails
A height of five - my ears never fail!
From toe-to-ear tip I'm a tall male!

There are things I need in this design.
Remember: I love the number 9!
I will need a floor - one base is fine.
And four upright walls would be divine.
For a pointed roof I surely pine.
Four joining triangles should make mine!
Eight faces and a small "Open" sign!

The last two stanzas have yet to be completed, as I ran into difficulty finding a series of words that both rhyme and make sense within the poem. If students run into this same situation, I suggest having them use a rhyming dictionary and thesaurus.

As I read "*Mathematical Enhancement of Children's Books*", I quite cynically criticized the writing style of the author, which was one laden with oddly unnecessary quantities of adjectives and adverbs. In my momentary fit of cynicism, however, an idea began to unfold: *Could there possibly be a mathematical way to teach writing?* Although this may not have been the intention of the author, she did claim that "Altering Text" (112) was a way to enhance the mathematical use of literature. I began to see numerical implications, both ratios and counts, within her text. In the lesson "***Paragraph Math"***, for example, I will present students with three sets of text – all identical in context, but differing in the amount of descriptive words? The first could contain a plethora of details, as did this author's work. The second could be the "balanced" version which contained an appropriate number of details. The third might have too few, leaving the reader wanting to dress up the writing. As a result of this type of writing, students will be introduced to ratios. In order to teach this "balanced" method of writing, I will be employing the techniques from "Write Tools", the teaching tool adopted by our district. *Write Tools*™ uses a system of graphic organizers and various highlighting colors to help the students organize and detail a piece of writing.

In "***The Clock List***" activity, the students will use a clock to detail a day in their lives. They will turn the list into personal, biographical, 5-paragraph narrative essays using "order" words to sequence the stories in a logical fashion. They will then be asked a series of questions based on fractions of time, such as, "What are you doing at the 180^{th} minute of the day?" or "How many seconds do you spend sleeping?" or "Show three numerical values for the amount of time you spend sleeping."

Measurement

This category of mathematical concepts includes identifying units of measurement, as well as using tools to correctly account for these units.

"The Recipe" is the classroom activity that will address the need for units of measurement. The students will list meals that are made by members of their families during holidays or special events and then research the origin of the main ingredient.

Geometry

This category of mathematical concepts includes identification of two and three dimensional objects, as well as the calculation of perimeter, area, and volume.

Picasso said, “Everyone can draw, but not everyone can see.” The state standard, 2.9 Geometry, is stated as “Find and describe geometric figures in real life.” This mathematical concept can easily be supported in a “picture” book creation by using the best-practices methods for teaching art. When teaching students to draw, the teacher first questions the student about the shapes that they see within a sample drawing. For example, the teacher could ask, “What shapes so you see in the drawing of this hand?” A proper response would be, “The hand itself is like a square, but the fingers are like rectangles with rounded tips.” In the activity “***The Art of Art***” the students will create a “How to Draw” book on a self-chosen animal and its habitat. They will research specific details about the animal and draw the animal using these techniques.

Algebraic Concepts

This category of mathematical concepts includes using variables to represent missing information.

The “***Alphabet Value***” activity will use student-decided values and patterns, assigned to the letters of the alphabet, to create a ‘cost’ for vocabulary words. The vocabulary words will be derived from a study of Latin and Greek root words. (***See Appendix D***)

In the lesson on “***Mathematical Mystery Fable***”, I would like to continue working with Latin and Greek roots. I would like to present the concepts of *morals* to the students as being written as idiomatic phrases (*culturally-based figures of speech*).

“***Smords***” (Smashed Words) will use knowledge of numerical roots. This idea was borrowed from Lewis Carroll’s Jabberwocky poem.

The Centisnarks = 100 snoring sharks

First, take roughly 5 minutes to discuss what knowledge the students have of morals. Discuss the meaning of "morals". A moral is a standard or acceptable guideline promoted by a particular culture. **Give an example that is NOT on the list.** (African proverbs/morals can be found at http://www.sacred-texts.com/afr/yor/yor11.htm)

1. A greedy man never gets much.
2. Secrets should never be told to a tattler.
3. Continual sweeping makes a big dust-heap.
4. Perfect people do not have friends.
5. He who boasts much does not do much.
6. Wounds may heal quickly, but a sharp word cannot always be cured.
7. *He who forgives ends the quarrel.*
8. Brains can lift more than muscle.

9. *Never judge a book by its cover.*
10. Birds of a feather flock together.

Give out moral list and allow the students to figure out as many as they can. Share and correct if necessary. Next, assign each team a sample fable and ask them to try to figure out of which moral the test seems to align. Debrief. Discuss the similarities between the stories (animals/moral). Tell them that the animal/moral genre is called *fable*.

Next, read a series of fables, giving all students each of the 4 fables, but assigning a different one to each table to read FIRST. Ask for a summary and for each student to select the moral they believe is told in the story. What do the stories have in common (*moral, animals tell the tale*)? Which characteristics of the animal make the animal the right choice for such a tale?

Brainstorm the parts of a story with students. A review of the parts of a story (i.e. characters, setting, rising action, conflict, falling action, resolution, etc.) will need to be conducted prior to this lesson.

Data Analysis and Probability

The Sentence Cube game (***Appendix E)*** will cover probability, outcome, event, and mutual exclusivity. In this activity, students will create a 9-dice system by constructing cubes covered by parts-of-speech: *adjective, adverb, article, conjunction, interjection, noun, preposition, pronoun, and verb*.

Probability is the measure of likelihood that a single event will occur out of all possible outcomes. In a probability experiment, an event is the total number of singular occurrences out of all possible outcomes of the experiment.

$$P(\boldsymbol{A}) = \frac{\text{Number of Ways Event } \boldsymbol{A} \text{ Can Occur}}{\text{Total Number of Possible Outcomes}}$$

The concepts will first be introduced using standard numerical, six-sided dice. (The familiarity with the cube will later be used as the foundation for Sadako: Symmetry, and then move into the geometry phase of visual problem solving.)

For example, students need to know that, in a multi-dice system that includes identical die, *for example a standard-numerical six-sided die*, the probability of rolling the number six would be based on the total number of dice used. A single-die roll would have a 1-out-of-6 chance of landing on a six, since there are six possible outcomes, but we are looking for only the number six on the die. A double-dice roll could have 2-out-of 12.

In the system that the students will create, only one series of possibilities will *NOT* be mutually exclusive. On each part-of-speech die, one square will be covered with "Free-space." This will be done so that students can relate the similarities and differences between the numerical dice system to the part-of-speech dice system.

The additional "Literary Device Card Game OR SAT VOCABULARY" game (***See Appendix F)*** will expound upon the concepts learned in The Sentence Cube game.

The Test

The culmination of this class will be the project "test". This test combines skills from all of the previous activities. The "Vacation Planner" will use a series of steps to guide the students to plan a detailed, mock-vacation. Items such as mileage, distance, time-calculation, cost-analysis, budgeting, and an incidentals report will all be included.

Classroom Activities

Class Entry Routine

At the opening of each class, the students will read a chapter of Alice in Wonderland. Either a creative or mathematical problem will be associated with each chapter and the students will use the chapter to help solve the given problem. (***See Appendix B***)

The Long Term Project

When students have finished the daily, assigned class work, they will read, answer questions, and complete mini-projects based on The Wright Brothers. A series of inexpensive materials will be given to the students at a "cost", so that they can design their own flying machine using the principle within the book. (***See Appendix C)***

Introductory Class – Doublets

Students will be introduced to the class objectives and then will try and check the routine. We will then work on "Doublets."

Making Sense of Cents

This activity will help students learn the importance of using the correct unit to identify the meaning of numbers, as well as introducing the idea of using equivalent forms to identify numbers.

The Logical Limerick

The activity serves to help students identify the difference between mathematical problems and creative problems.

The Clock List Narrative

This activity will combine chronological writing, time-telling instruction, and fractions. The students will use a clock to list activities done during a day in their lives. They will use the list to create an order-sensitive, 5-paragraph essay, using morning, noon, and night as the main ideas for each body paragraph.

Family Recipe Research

As a continuation of fractions, as well as an introduction to writing directions in a logical way, students will do a quick write of a narrative about a favorite family meal. The next step would be to have the student interview a family member to find out how far the recipe has traveled, as well as gaining a general idea of the ingredients used to create the recipe.

Smording

Students will learn Greek and Latin roots in order to increase their oral reading fluency. They will create words using a combination of the roots, perhaps in a non-sensical way. (***See Appendix D***)

Alphabet Value

This activity combines phonemic awareness with basic algebraic concepts. It will help to improve students' ability to spell by providing an understanding of the 'value' of learning vowel combinations.

Paragraph Math

This activity builds upon the lessons on fractions used in the "The Clock List" and "Family Recipe Research" in order to introduce the concepts of ratios. Students will first see a sample of 3 paragraphs that contain the same ideas, but contain various numbers of details. The students will categorize and calculate the numbers of details to find the "just right ratio", and then create their own samples.

Sentence Construction Probability

The students will create a series of three dimensional cubes, with each cube containing a noun, verb, adjective, adverb, article, and preposition. This nine-dice system will be used to teach both the parts of speech as well as probability. (***See Appendix C***)

Literary Device Card Game

Continuing with probability skills, the students will do research on and pick 13 literary devices for which they will create four different examples of each. (***See Appendix F***)

Sadako and Origami

This activity falls under the category of creative dramatics. It will combine the dramatic reading of literature with geometry and an introduction to fractions.

Mystery Sleuths

This is a reading logic activity that will teach the students a systematic graphing technique to use when solving mysteries. A chart will be used to help the students learn to organize information. (***See Appendix G***) It will prepare them to write a new genre: *Mystery Fables.*

Math Mystery Fables

The students will create a non-existent animal based on a numerical root word and a cross-breeding of real animals. A *centistark,* for example would be half stork and half shark and have 100 eyes. The characteristics of the animals and the numerical value of the root word would have to lend itself to the evolution of the moral used in the student's fables.

Geometry and Instruction Writing - Emphasis on Written Explanations

Have one group of students use polygon forms to create a 3-D "building" while a second group is not looking. Take/print a picture of the form while the team writes a list of instructions that the other group will use to "blindly" rebuild the structure. Debrief. Ask questions such as, "What did you need to know in order to write the instructions?" and "What words do you feel might have helped the rebuilds be more successful." and "What descriptions were missing?"

Geometry and Paper Game Strategies-Emphasis on Oral Explanations

The students will use paper and pencil to play pool as systematically as possible. The two driving mathematical concepts are: The shortest distance between any two points is a straight line and that the angle in is equal to the angle out.

Learning to Improve Writing through Peer and Self Response

For this lesson series, I plan to work through a number of different response session methods, including a double-read-respond session which means that students first read their own work aloud and the listeners then ask questions or make suggestions regarding improvements or miss-statements.

Standards (*Eligible Content*)

Communication Standards

There are eight categories from which Communication standards are derived. The numerical listing is the category and the italicized list is a description of the skill sets within the category. These skill sets are expounded upon in great detail and are sequentially based on grade level. The details are known as Eligible Content.

Learning to Read Independently

Purposes for Reading
Word Recognition Skills
Vocabulary Development
Comprehension and Interpretation
Fluency

Third Grade

Use knowledge of phonics, word analysis (e.g., root words, prefixes and suffixes), syllabication, picture and context clues to decode and understand new words during reading.

Fifth Grade

Use knowledge of phonics, syllabication, prefixes, suffixes, the dictionary or context clues to decode and understand new words during reading. Use these words accurately in writing and speaking.

Reading Critically in All Content Areas

Detail
Inferences
Fact from opinion

Comparison
Analysis and Evaluation

Reading, Analyzing and Interpreting Literature

Literary Elements
Literary Devices
Poetry
Drama

Types of Writing

Narrative
Informational
Persuasive

Quality of Writing

Focus
Content
Organization
Style
Conventions

Speaking and Listening

Listening Skills
Speaking Skills
Discussion
Presentation

Characteristics and Function of the English Language

Word Origins
Variations
Application

Research

Selection
Location of Information
Organization

Math Standards

Third Grade

Numbers, Number Systems and Number Relationships

Types of numbers (e.g., whole, prime, irrational, complex)
Equivalent forms (e.g. fractions, decimals, percents)

Computation and Estimation

Basic functions (+, -, x, ÷)
Reasonableness of answers
Calculators

Measurement and Estimation

Types of measurement (e.g., length, time)
Units and tools of measurement
Computing and comparing measurements

(Organized as Third Grade / Fifth Grade)

Estimate and verify measurements. / Create and use scale models.

Demonstrate that a single object has different attributes that can be measured in different ways (e.g. length, mass, weight, time, area, temperature, capacity, perimeter).

Mathematical Reasoning and Connections

Using inductive and deductive reasoning
Validating arguments (e.g., if . . . then statements, proofs)

Mathematical Problem Solving and Communication

Problem solving strategies
Representing problems in various ways
Interpreting results

Statistics and Data Analysis

Collecting and reporting data (e.g., charts, graphs)
Analyzing data

Probability and Predictions

Validity of data
Calculating probability to make predictions

Algebra and Functions

Equations
Patterns and functions

Geometry

Shapes and their properties
Using geometric principles to solve problems

Name and label geometric shapes in two and three dimensions (e.g., circle/sphere, square/cube, triangle/pyramid, rectangle/prism). / Give formal definitions of geometric figures.

Find and describe geometric figures in real life. / Describe in words how geometric shapes are constructed

Annotated Bibliography

Book for Teachers

Angelillo, J. Making Revision Matter. New York: Scholastic, 2005.

Illustrates revision methods that help students help themselves.

Bissell, C. Looking Glass Logic: Adventure in Formal Logic. Logan, Iowa: The Perfection Form Company, 1985.

A book of formal logic explanations and activities that demonstrate the logically 'correctness' of Lewis' Carroll's character, Alice.

Edward, R. Algebra Magic Tricks: Abracadabra. Pacific Grove, CA: Critical Thinking Books, 1992.

Volume 1 of a series of mathematically-sound "tricks" that are accompanied by worksheets and questions to help the student discover why the tricks work.

Fletcher, R, Portalupi, J. Writing Workshop: The Essential Guide. Portsmouth, NH: Heinemann, c2001.

A guide to creating and managing effective writer's workshops.

Grafton, Sue (ed.), Writing Mysteries: A Handbook by the Mystery Writers of America. Cincinnati, OH: F&W Publications, 1992

A collection of writing tips from published authors.

Kirby, D., Latta, D. Liner, T. Inside Out: Strategies for Teaching Writing(3rd Ed.). Portsmouth, NH: Heinemann, 2004.

Classroom applications of process-approach to writing.

Molnar, J. Logic Mysteries. Dale Seymour Publications.1999.

A compilation of short logic stories for students to solve.

Romano, T. Clearing the Way: Working With Teenage Writers. Portsmouth, NH: Heinemann Educational Books, 1987.

A teacher's scenario-based guide illustrating how to get kids to write by having the student focus on his/her experience.

Wakeling, E. Lewis Carroll's Games and Puzzles. New York, NY: Dover Publications.

A compilation of puzzles either created by, or produced in the work of, Lewis Carroll.

Websites for Teachers

www.pghboe.net

Using the Boolean search string "pssa math sample", the web user will find samples of past PSSA test questions along with common misconceptions that would lead a student to choose a wrong answer.

Book for Students

Carroll, Lewis. Alice's Adventures in Wonderland and Through the Looking Glass. Barnes and Noble Classics.

The classic tale of Alice and her self-induced romp through a fictitious world.

Hess, K. Out of the Dust. New York, NY: Scholastic, 2002.

This is a historical fiction novel that takes place in 1930's Okalahoma, or *"The Dust Bowl".* The book is written entirely in poems.

Sullivan, G. The Wright Brothers. New York, NY: Scholastic, 1997.

This is an easy-to-understand biography of the Wright Brothers. The book contains descriptions of aerodynamics.

Websites for Students

http://thinks.com/puzzles/carroll/carroll.htm

This website contains lists of "knots", which are problems embedded inside of Lewis Carroll's stories.

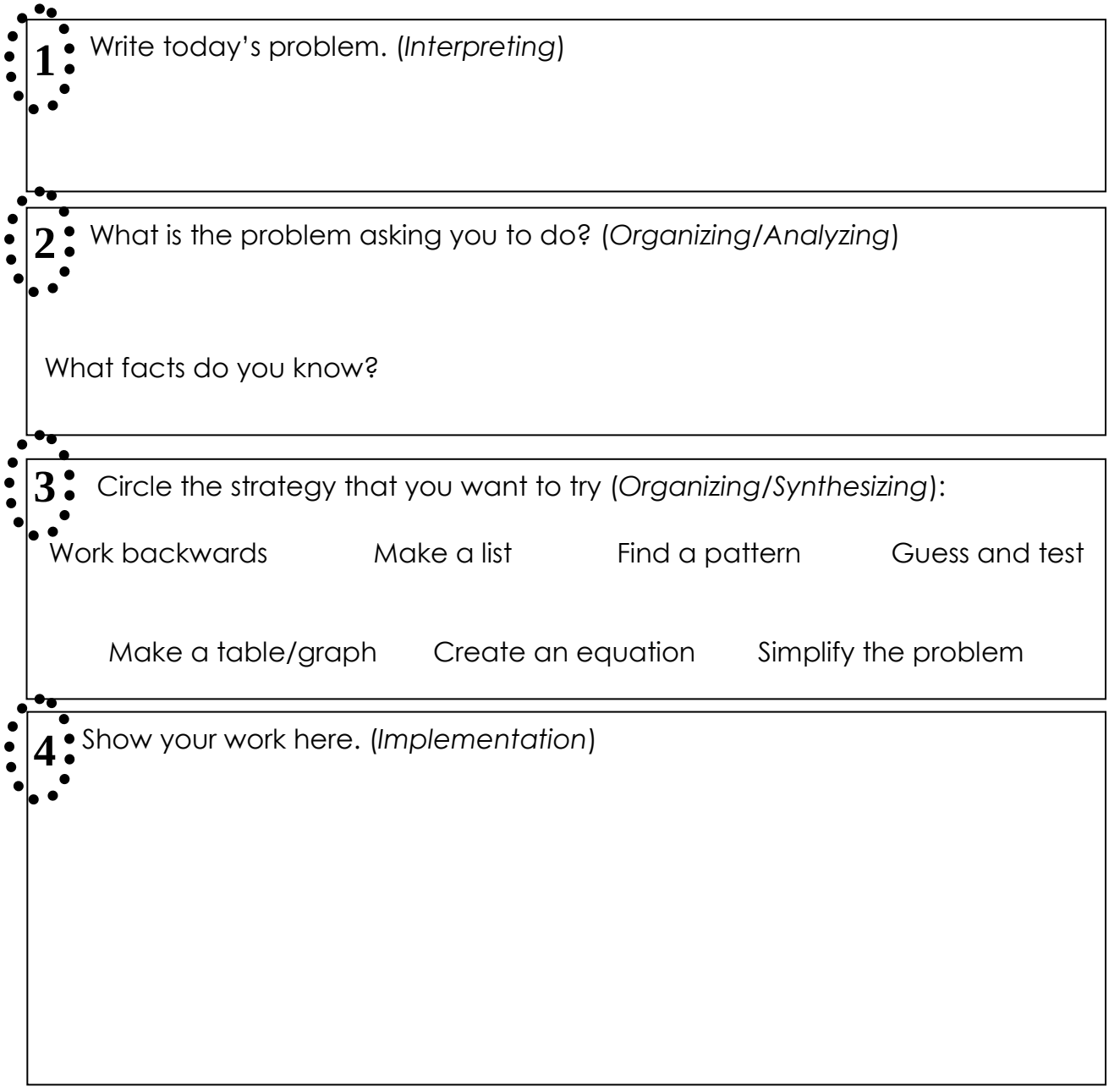
Movies for Students

Travis, J. "Flatland: The Movie" Flat World Productions, LLC. 2007

Based on Edwin A. Abbott's book Flatland: A Romance of Many Dimensions, a young hexagon must help her "Flatland" home inhabitants understand that intelligence has nothing to do with what you look like, and that intellectual repression is foolish.

Appendixes

A- Problem Solving Sequence



B – Sample Activities for Alice in Wonderland by Chapter

(*Place each in a "Chapter Folder" for the students to take as needed.)*

Chapter 1: "Down the Rabbit-Hole"

Summary: As a bored Alice is sitting with her sister, a white, talking rabbit runs past. Alice follows him into a rabbit hole and safely falls quite a distance down.

(The poem is an actual account of how the author entertained the three Lidell sisters, of whom Alice is the middle child.)

Associated Problems: How far and how fast did Alice fall? *(If Alice fell 4 feet per second and she fell for 42 minutes, how far did she actually fall?)*

C - Self-Directed Learning Model: *In Flight*

Name:_____

READMATH *Self-Directed Learning* Project

My goal is to help you learn how to most effectively and efficiently learn about your own interests in a self-directed manner. The **self-directed learning** process is broken into several parts: *choosing a topic, devising a plan of action, taking action, and evaluating both the result as well as the effectiveness of the planning.*

After reading The Wright Brothers, your job will be to design a flying machine and explain why it ***SHOULD*** fly by using your knowledge of aerodynamics. Then, you will build your machine and catalog the changes that you make while systematically experimenting with the design. (***See attached chart.)***

1 Before/Planning

Choose a topic (*Which design will you choose? Why?)*

Devise a plan of action (*What information and materials do you need? How will you log the information? How/when will you complete each task?)*

2 During/Action

Take action (*What is working? What isn't? Why? How will you fix it?)*

3 After/Result

Evaluate the result (*What worked? What didn't? Why?)*

Evaluate the effectiveness of the process (*What would you need or do differently if you did this project again?)*

D - Greek and Latin Word-Part Chart

aequus -equal	hex - six	per - to work through
ago/acta - do things	holos - whole	phobos - fear of
alt – high	hyper - over	phon – sound
anthropos - man, human	hypo – under	photo – light
aqua – water	intro – within	plenus - full
ars - art	ism – forms noun, “act of, state of”	pop – people
ast – star	ist – one who practices	porto - carry
auto - self	ity – forms nouns from adjectives	positum - placed
biblio – book	ject – to throw	possum - to be able
bio – life	jungo - join	post - after
brevis - short	lego, lectum - read, thing read	pre – in front, before
canto - sing, chant	locus a place local, dislocate	psych – mind
cap – head	log – word	pugno -to fight
caput - head	loquor speak eloquent, loquacious	punctum - point
chron – time	man - hand	re – again, back
circum - around	mania – madness	rego - to rule
clino - to lean, bend	medius - middle	rupt – break
cognito - know	ment – forms nouns from verbs	satis - enough satisfy
con – together	meter – measure	scio - know
copia - plenty	metro - city	scope – see into
credo - believe	metry - measure	scrib/script – write
credo - belief	micro – small	se – apart
culpa - blame	mis - wrong	sect – cut
cycl – circle	miss – send	semi – one half
de – away, off	mission - a sending	spec - see
deca - ten	morior - die	spiritus - breath, give life to
dem – people	mort – death	sub - under
derm - skin	multi - many	tele – far away
di, duo - two	nego - deny	term – end
dis – not	nego deny negate	terr – land
dominus - a lord, master	nihil - nothing nihilism, annihilate	tetra - four
duco - lead	nom – name	therm – heat
en – in	nov - nine	totus - whole
ex – away	occido - kill	tract – pull
fido - to trust, believe	octo - eight	trans - across
flect – bend	ology – study of	uni – one
form – shape	pan - all	vac – empty
fundo/fusum - poured	path – feeling	verbum - verbal
genus - kind, origin	pathos - suffering, feeling	vert – to turn
geo – earth	ped – foot	verto - turn
gram/graph – write	pendo - weigh, hang	voc – voice, call
gress – to walk	penta - five	

E - Sentence Cube Game Probability Chart

	adjective Dice 1	**adverb** Dice 2	**article** Dice 3	**conjunction** Dice 4	**interjection** Dice 5	**noun** Dice 6	**preposition** Dice 7	**pronoun** Dice 8	**verb** Dice 9
Side **1**	pink	quickly	the	and	ouch	dog	with	she	mangle
Side **2**									
Side **3**									
Side **4**									
Side **5**									
Side **6**	*Free Space*	*Free Space*	*Free Space*	*Free Space*	*Free Space*	*Free Space*	*Free Space*	*Free Space*	*Free Space*

Game Objective:

Create the largest sentence possible using as many words available on a single roll, in a series of player-decided number of rolls (I.E., *This game will be played to 6 rolls per person.)* within the allotted time-frame.

Game Materials:

9 completed Part-of-Speech cubes
15 second timer

Point System:

1 point for each word used in a sentence, including additional correct usage of a "Free Space" part of speech.

3 *additional* points if all cube words are correctly used in a sentence.

Show and explain the probability of landing on any one side of any one cube:

Show and explain the probability of landing on a free space with a single dye roll:

Show and explain the probability of landing on a free space when all dice are rolled:

F - Device Card Game Sample

Need*:** 13 Devices; 4 examples per device. **(Creates a standard 52 card deck: Device Name is "Number" and examples are the "Suits"***)**

Device **1** *Supporting Image* Example 1 of Device **1**	Device **1** *Supporting Image* Example 2 of Device **1**
Device **1** *Supporting Image* Example 3 of Device **1**	Device **1** *Supporting Image* Example 4 of Device **1**

Show and explain the probability of getting Example 3 of Device **1**:

What strategies could be developed so that you could more easily win this game?

G - Mystery Solving Chart

Suspect	Alibi	Opportunity	Motive	Evidence