Strategies for Alleviating Math Anxiety in the Visual Learner

by

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presented

to

Cheryl Cleaves & Ruth Lattimore

Math Anxiety Workshop
University of Maryland University College (UMUC)
September 11 – 22, 2006
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Math Anxiety ranks number one on the list of reasons some persons confront challenges performing mathematic calculations or conducting higher level math reasoning. Definitions of math anxiety differ depending upon who presents it yet a common thread runs through each definition. Harding (2006), for example, defines math anxiety as a learned emotional response which usually comes from negative experiences in working with teachers, tutors, classmates, parents or siblings. Alternatively, Terrell (2006) focuses on the physical manifestation of math anxiety in defining math anxiety as a feeling of anxiousness, fear, nausea, frustration, and uncertainty brought about by a request to perform mathematic operations or use mathematics to problem solve. Adverse reaction is the common thread between Harding and Terrell’s math anxiety definitions.

As the cartoon above illustrates, irrespective of the math anxiety definition one employs…whether the response is “emotional” or “physical”…the consequence is the same. The math phobic person is petrified by the thought of making math errors.

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In this paper, Harding and Terrell develop a set of strategies to alleviate math anxiety. The anti-math-anxiety strategies formulated below are premised on the assumption of differences in learning styles. The literature on learning styles identifies three types of learners—visual learners, auditory learners, and kinesthetic learners, (Gammatis, 1998. Available in 0609CTLA7040911, Course Content Area) This paper offers strategies for math instructors who teach math anxious students that learn visually. The intent of these strategies is to give instructors examples that can be applied in the classroom to help alleviate student anxiety about math. The remainder of the paper summarizes characteristics of the visual learner then describes various techniques instructors may use to present math material to the visual learner. A sample exercise is available in the appendix.

**What is a Visual Learner?**

Visual learning is a proven teaching method in which ideas, concepts, data and other information are associated with images and represented graphically. Visual learners prefer using images, pictures, colors, and maps to organize information and communicate with others. They easily visualize objects, plans and outcomes in their mind’s eye.

Research in both educational theory and cognitive psychology tells us that visual learning techniques are among the very best methods for teaching students of all ages how to think and how to learn. Visual learning when combined with technology enables students to clarify thoughts, organize and analyze information, think critically and integrate new knowledge by visually seeing how items can be grouped and organized. Using graphics provides students with visual ways of working with information and presenting ideas. Working visually inspires students to tap into their own creativity, to clarify their thoughts, reinforce understanding, integrate new knowledge, and identify misconceptions. With visual learning, students use manipulatives, diagrams and plots to display large amounts of information in ways that are easy to understand and help reveal relationships and patterns. Visual learning is a proven method in which ideas, concepts, data and other information are associated with images and represented graphically. On their website at [http://www.inspiration.com/vlearning/index.cfm](http://www.inspiration.com/vlearning/index.cfm), Inspiration Software Inc. describe webs, concept maps, idea maps and plots as some of the techniques used in visual learning to enhance thinking and learning skills:
**Webs**

Webs are visual maps that show how different categories of information relate to one another. Webs provide structure for ideas and facts and give students a flexible framework for organizing and prioritizing information. Typically, major topics or central concepts are at the center of the web. Links from the center connect supporting details or ideas with the core concept or topic.

Webs are used to brainstorm, organize information for writing (pre-writing), as well as to analyze stories and characterization. Webbing is an effective technique to use in small group settings. As students work cooperatively they can build collaborative webs, incorporating the thoughts and contributions of each group member.
**Idea Maps**

When searching for ideas for writing assignments, projects or presentations, students often need a spark to begin the flow of ideas. That's where idea maps come in. This visual learning technique stimulates students to generate ideas, follow them through and develop their thoughts visually. Idea maps help students brainstorm, solve problems and plan their work. Using exercises in word and idea association, idea maps connect keywords, symbols, colors and graphics to form nonlinear networks of potential ideas and thoughts.

Idea maps are used in all kinds of applications, e.g.:
- Prior to field trips, idea maps help students think about what they might see and learn.
- After the field trip, students use idea maps to record their observations.

Idea maps give emerging or struggling writers a boost as they learn to generate ideas, gather and organize their thoughts.
**Concept Maps**

In a concept map, two or more concepts are linked by words that describe their relationship (graphic illustration of the relationships between information). Concept maps encourage understanding by helping students organize and enhance their knowledge on any topic. They help students learn new information by integrating each new idea into their existing body of knowledge. Concept maps are ideal for measuring the growth of student learning. As students create concept maps, they reiterate ideas using their own words. Misdirected links or wrong connections alert educators to what students do not understand, providing an accurate, objective way to evaluate areas in which students do not yet grasp concepts fully.
Plots, Graphs & Charts:

Plots, Graphs and Charts are great ways for the student to visualize the data. As students explore the way data moves through various plot types, they discover meaning from the visual representation. Some of the various plots a student may use include:

- Venn Diagrams
- Axis/Scatter Plot
- Time Series Plots
- Pie Graph
- Stack Plots (Vertical Bar Graph)

are described and illustrated below:

Venn Diagrams

Venn Diagrams are a powerful way to describe and compare attributes by separating objects into groups based on their characteristics. Venn plots show relationships between mathematical sets or can be used to identify the commonalities and differences between things, people, places, historical events, ideas or physical attributes. Venn plots can be drawn with up to three loops.
Axis/Scatter Plots

An axis plot, also known as a scatter plot, is an ideal way to investigate correlations. By choosing different variables for the X and Y axes, students can use the resulting plots to examine relationships between the variables. Is there a correlation between height of largest drop and the top speed achieved on the roller coaster? This axis plot provides an answer: the fastest roller coasters are also the ones with the largest drops. Color-coding the icons also reveals that the fastest coasters have steel tracks.
Time Series Plots

Time Series Plots lets students observe data as it changes over time. As students compare changes over time, patterns and trends emerge, making it easy to analyze historical facts and predict future events. Most commonly represented as a line graph, a Time Series can be displayed with any plot type to show events or results that occur over time.

What factors affect monthly temperature variations among cities?
**Pie Graph**

A Pie Graph shows the distribution of values within one field of a database. The sizes of the pie's slices are proportional to the percentage of records in each category. Pie plots are used to graphically represent the distribution of the entire set of data. Patterns can be easily identified, as well as the values that have the largest or smallest representations. Pie plots can be used to illustrate percentages of a whole or to numerically represent a category of facts.

Students can separate data into two or more pie plots based on distinct characteristics. Viewing the individual pie plots allows students to easily compare the relationships for the unique groups and the whole.
Stack Plots (Vertical Bar Graph)

Stack plots displays the distribution of values within one field of a database. Stack plots are used to represent a range of data for one variable. Frequently referred to as "sorting bins," you can sort or group data by the selected variable into one of the bins. The height of the bar is proportional to the number in the bin. Stack plots are ideal for comparison activities.

What was the average age of heptathlon competitors in the 2004 Olympics?

- **Country**: CER, RUS, USA, GBR, IND, KAZ, UKR, Other
- **Date of Birth**: 12/14/75, 12/13/77, 12/15/79, 12/16/71
- **Max**: 2006, 1994, 1988, 1976

Range Step: 730 Days Options
Application of the Theory in an Actual Online Classroom

Visual learning techniques are very apropos for math classes. Application of the theory in an actual classroom is accommodated in my online class, TMAN621, Systems Analysis and Operations Management. This is an applied mathematics course, where all of the math is performed using a prescribed problem solving format within Excel. Students are expected to write Excel algorithms for the math, then use Excel's Math Functions to check their results. Use of both algorithms and Excel Functionality increases the students' math and computer literacy. The features and functionality of Excel (various fonts, font sizes & font styles; color, graphs, images, maps, pictures, etc.) make Excel an excellent tool for the visual learner. The Week 1 Excel Model used to introduce the students to the use of Excel in TMAN621 is attached. This model contains the following Spreadsheets:

- Index for navigating through the Excel Model
- Problem Template Used for all the math examples
- Excel Formatting Features
- Break Even Analysis

This model demonstrates the extra explanations (material that would be communicated verbally in a face-to-face class) that need to be built into the Excel Model for it to be used in an online class.

Conclusion

This paper presented strategies for teaching visual learners who suffer from math anxiety. Visual learners were defined as people who “prefer using images, pictures, colors, and maps to organize information and communicate with others. They easily visualize objects, plans and outcomes in their mind’s eye.” Idea maps, concept maps, the world wide, diagrams and graphs were described as teaching-aids instructors can use to instruct the visual learner. An example of a teaching exercise using one of these aids is presented in the Appendix. No one teaching-aid is recommended over another so it is left to the reader to choose the type of teaching-aid that works best for their math phobic student.

References
