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## Important Dates

- May 15: STEP=UP Advisory Board Meeting
- STEP=UP Library open during summer semester upon special request

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## Vocabulary Building in Math and Science for Students with Disabilities

Traditionally, school mathematics focused on doing arithmetic: doing calculations independently and working on the occasional word problem. Teachers demonstrated how to find the answer and students practiced the procedures until they could get the answers independently. Doing and learning mathematics in such a framework makes it difficult to extrapolate to other situations. In real-world situations mathematics functions as a tool to manage and sometimes solve a host of authentic problems: shopping, cooking, making sense of the slew of information on the internet, etc. For these purposes and others math reform advocates encourage students to engage actively in doing mathematics and explaining their reasoning to peers and teachers.

For students with disabilities, doing mathematics through discussion and concrete manipulation of material can pose the need for modifications of curriculum and instruction. Students must comprehend the teacher as well as be able to formulate a careful, typically verbal, response. Often students need to move materials or draw in order to contemplate a solution and debate alternatives. This involves knowing words, terms, and phrases as well as the ability to manipulate materials. What happens when particular students cannot manipulate objects or process as quickly as others?

We asked accomplished special educators about how they modify mathematics and mathematics in science. In both content areas, they strongly believed that vocabulary plays a significant role. Gaining a better vocabulary helps in directing students how to complete a problem. The difference between students hearing a teacher say "calculate the sum of..." rather than "add the numbers...and what do you get?" is major in terms of the language (including understanding that "sum" is not "some.") (Khisty, 1995). Another example is

from geometry. Rather than simply providing step-by-step instructions, a teacher can create a unit around concepts such as "isosceles".

The primary advice given by educators is to teach mathematics vocabulary in multiple ways, be flexible and change the activities, and alter strategies. Many colleagues spoke about computer-based programs used in tandem with instruction when topics included many new ideas. For example, a teacher may demonstrate and allow students to use a program that illustrates planetary orbit, but will include vocabulary activities for learning words like "orbit", "gravity", or "environment". They may, for instance, ask students to look to the program to identify the distance at which a planet orbits the sun of a planet and then have them explain how this effects that planet's environment.

Another useful tool for improving students' vocabulary in math and science classes is the graphic organizer. Four column vocabulary charts, matching activities, Venn diagrams, PowerPoint presentations, videos, art construction, and pre/during/post reading activities are just some of the activities that seem to work best. Several teachers recommended guided reading practice with the QAR method.

Perhaps the most important thing for helping students learn vocabulary in math and science is for them to be active. One teacher finds that when students build things--drawing or moving materials-- they gain "experience with the word (Rench, 2007)." Afterwards, students post their work, take ownership, and continually refer to it rather than simply looking up the meaning of words out of context.

- Khisty, L. L. (1995). Making inequality: Issues of language and meanings in mathematics teaching with Hispanics students. In W. Secada, E. Fennema, & L. B. Adajian (Eds.) *New direction for equity in mathematics education*. Cambridge: Cambridge University Press.
- Rench, D. (2007). Personal communication. STEP=UP meetings.

### Partner's Corner Spotlight on: Jessica Ann Rosenthal

Recent UIC special education graduate Jessica Rosenthal has been described as a terrific science teacher. She worked closely with CPS mentor Cheryl Janusz while at UIC, and now teaches at Basil Charter School. Now in her first year, we asked her to reflect on the role of vocabulary instruction and reading comprehension generally in teaching science and math.

Rosenthal insists that vocabulary is key in teaching math and science. In math, vocabulary becomes extremely important once you move past rote problems. She approaches the vocabulary in math by using key words in math lessons as well as on spelling lists and games to help engrain those terms in students' memories. For science, she picks key words to frame the concept that everyone should know, and then expose

students to the other words as they gain competence. Rosenthal reiterates the importance of learning vocabulary by reminding students that they will see them on tests, in word problems, and text to come. She feels this helps them better understand how to learn vocabulary because it reassures the student they will do this again in the future.

Rosenthal encourages pre-service teachers to meet their students at their individual levels and not get over-ambitious with lessons plans since the concepts in science and math can be complex and difficult. Go through vocabulary instruction creatively but also carefully, she suggests. She also stresses the importance of repetition. In other words, "Try to keep the key vocabulary terms to a manageable level, and use the words frequently over time to allow students to embed [them] in their memory."

### Digital Corner

Explorelearning.com offers computer-based interactive multimedia lessons and assessments to teachers and students. It provides content, lesson plan strategies, as well as assessment tools. It features "Gizmos" that are interactive movies designed to encourage student inquiry and exploration by helping them develop conceptual understanding in math and science. The site offers the worlds' largest library of information on core topics across the high school math and science curriculum. The Gizmos available are compliant to the

federal and state educational standards for each state. This helps educators be sure that the lesson they plan around Gizmos are not only effective, appropriate, and meet federal and State standards. Each Gizmo comes with additional activities and an exploration guide that provides a step-by-step inquiry based lesson for each.

It also offers a homepage for teachers that track students' assessment scores, graph their progress, and summarize areas with which they appear to be having difficulty.

[www.explorelearning.com](http://www.explorelearning.com)

### Research Corner

Richardson, Rita Coombs and Katherine Norman. (1998). *Teaching Science in Content Areas to Students with Special Needs*. ERIC Resource Database, ED 424088

Students with and without disabilities may face difficulties trying to comprehend the content specific language in mathematics and science classrooms. Students with disabilities particularly struggle with the intense need for written or verbal expression in these classes. This paper provides information on teaching science to special education students in general education classrooms. The focus is placed on students with learning disabilities who may behave inappropriately due to frustration about their academic challenges or because of distractions.

These challenges are often furthered by the text-driven, teacher-centered pedagogy. The authors emphasize the importance of integrated curriculum, thematic units that contextualize the concepts, and multi-modal activities that build on strengths of diverse learners with and without disabilities.

They also argue that approaching science and math with diverse instruction so that students can succeed in ways that work best for them could help erase the negative connotations of disability, thereby making these classes more fully inclusive.