SAGE 2YC
Supporting Student Success in Geoscience at Two-year Colleges

18 July 2013 Afternoon Breakout Sessions

Students with Disabilities and Universal Design

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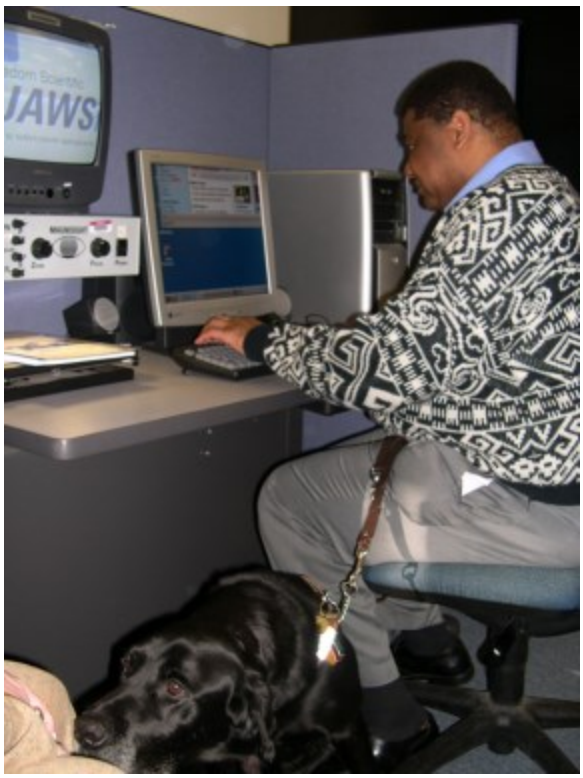


Image provided by the UALR Disability Resource Center Student and service dog using "JAWS" software . Learn more at http://www.freedomscientific.com/

What to address during our session:

- major needs of learners that include Students with Disabilities
- strategies that work well at addressing the diversity of students including those with identified disabilities
  - **Universal Design**
- discussion with the participants (ya'll) about how best to serve our population in geosciences courses

Data compiled by SAGE 2YC facilitators to characterize workshop participant's institutions % student population reported as *Person with Disability* (using the National Center for Educational Statistics (NCES)).

Integrated Postsecondary Education Data System 2012-13

Institution	Percentage
El Paso Community College	<4
Flathead Valley Community College	5
Frederick Community College	4
Highline Community College	<4
Hillsborough Community College	<4
Illinois Valley Community College	<4
Ivy Tech Community College-Central Indiana	<4
Lone Star College System	<4
Los Angeles Valley College	<4
Mesa Community College	<4
Metropolitan Community College-Blue River	<4
Miami Dade College	<4
Nassau Community College	5
North Idaho College	<4
NorthWest Arkansas Community College	<4
Palomar College	<4
Pasadena City College	<4
Patrick Henry Community College	5
Portland Community College	5
Quinsigamond Community College	9
San Jose City College	7
Scottsdale Community College	4
Thomas Nelson Community College	<4
Trinidad State Junior College	<4
University of Oregon	<4
University of Wisconsin Colleges	<4
Wake Technical Community College	<4
Walla Walla Community College	<4
Waubonsee Community College	5

https://surveys.nces.ed.gov/ipeds/

Examples of ways we may already work with our students:

Best practices for English Language Learners
(ELL; see http://ell.nwrsd.org) include:

- cooperative learning
- using cues, questions and advance organizers
- activating prior knowledge & building background knowledge
- thematic instruction
- using technology
- differentiated instruction

Or more specifically when teaching science to ELL
(from http://www.csun.edu/science/ref/language/teaching-ell.html) :

- speak slowly, distinctly and write down key terms
- use captioning
- emphasize visual literacy
- use graphical organizers
- Think / Pair / Share
- consistency in routines

Strategies for students with Learning Disabilities:

- mnemonic strategies
- spatial organizers
- computer-assisted instruction
- peer mediation
- hands-on or activity-oriented learning
- explicit instruction (4.3%).

Learner-Centered techniques involve:

- Instructor models; students interact with instructor and one another
- students work in pairs, in groups, or alone depending on the purpose of the activity
- students have some choice of topics
- classroom is active

Note the overlap in techniques…

Universal Design incorporates and supports many current research-based approaches to teaching and learning. This includes:

- ✓ cooperative learning
- ✓ differentiated instruction
- ✓ performance-based assessment
- ✓ project-based learning
- ✓ multisensory teaching
- ✓ theory of multiple intelligences
- ✓ student-centered learning

Here are several sites from leaders in the Universal Design Network:

National Center for Universal Design for Learning
http://www.udlcenter.org/

CAST UDL YouTube Channel
http://www.youtube.com/watch?v=viLC9FIo2a4&feature=channel

DO-IT / Access STEM
https://www.washington.edu/doit/Stem/

http://www.udlcenter.org/aboutudl/udlguidelines

Three primary principles guide UDL—and provide structure for the Guidelines:

To learn more, click on one of the Guidelines below.

I. Provide Multiple Means of Representation	II. Provide Multiple Means of Action and Expression	III. Provide Multiple Means of Engagement
Perception	Physical action	Recruiting interest
Language, expressions, and symbols	Expression and communication	Sustaining effort and persistence
Comprehension	Executive function	Self-regulation

Universal Design for Learning

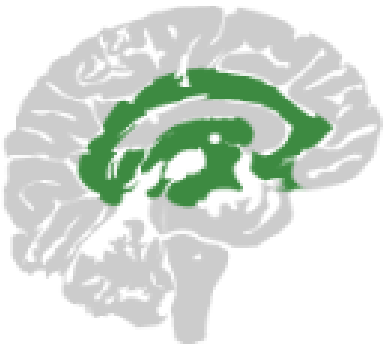
Recognition Networks
The "what" of learning

How we gather facts and categorize what we see, hear, and read. Identifying letters, words, or an author's style are recognition tasks.

Strategic Networks
The "how" of learning

Planning and performing tasks. How we organize and express our ideas. Writing an essay or solving a math problem are strategic tasks.

Affective Networks
The "why" of learning



How learners get engaged and stay motivated. How they are challenged, excited, or interested. These are affective dimensions.

Present information and content in different ways

More ways to provide **Multiple Means of Representation**

Differentiate the ways that students can express what they know

More ways to provide **Multiple Means of Action and Expression**

Stimulate interest and motivation for learning

More ways to provide **Multiple Means of Engagement**

http://www.cast.org/udl/index.html

As discussed earlier,

- blindness
- low vision
- hearing impairments
- mobility impairments
- learning disabilities
- health impairments
- psychiatric/mental health impairments

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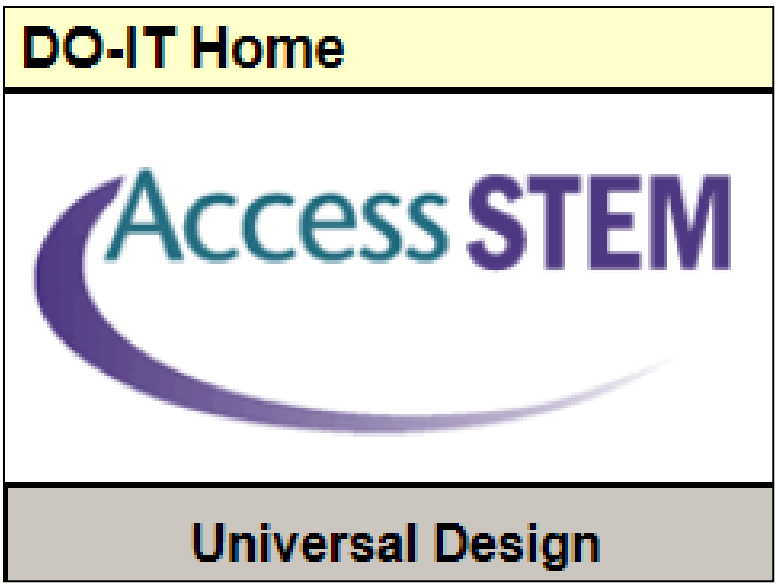
https://www.washington.edu/doit/Stem/ud.html

+ addressing the other diversities inherent to our students:



https://www.washington.edu/doit/Stem/

Let’s jiggle our minds.

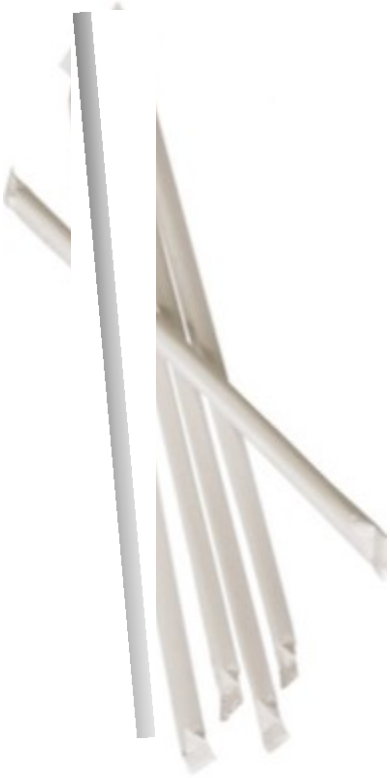
(It is after lunch, after all.)

Taking a moment to consider a problem:

You are provided six straight objects all of the same type in terms of length and size (such as toothpicks, coffee stirrers or plastic straws in individual wrappers).

or

or



You are offered a selection as a method of Universal Design. Allow students to select objects they can more easily manipulate (since there may be physical abilities to address; let your student self-select so as not to call attention to mobility issues without a student's self advocacy, for instance).

With the six items,

arrange the objects to make four equilateral triangles.

However,

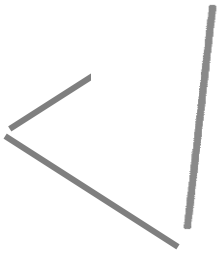
you must use the full original length of each object.

So…no overlap, bending or breaking. (Note: students will still do this as they are working through the process…let them initially, but then gently remind them if they seem to want to do it for their final submission.)

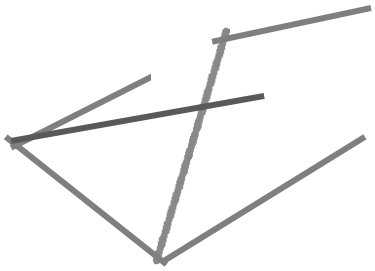
(Give participants time to process and “do.”)

Solution Steps:

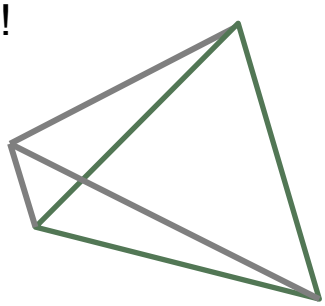
Lay a foundation equilateral triangle down on the 2-dimensional tabletop.



Then position the remaining three objects such that they each connect to an apex of the foundation triangle, but that each of the remaining three “sticks” rise off the table to a point.



The result is that there are now three equilateral triangles projecting upward into the third dimension from the foundation triangle. 3 + 1 = 4 equilateral triangles from the six equal length linear objects. *Viola*!



Why did we take the time to do this today?

First, to demonstrate simple activities you can use within your teaching that provides more “hands on” interaction for your learners.

What was done / learned here?

I demonstrated an application of Universal Design to you.

By providing different yet essentially the same materials for problem-solving:

- ▷ Same in the terms of all linear objects.
- ▶ Different in terms of size and ease of holding the object (note: straws in paper covers provide easier “grip” when trying hold several at different angles).

Secondly, I actually use this to break-up the pace when working with intro students as we begin the minerals topic.

Why? It’s a tetrahedron!

I use this when working with them about chemistry and bonding… then getting to the topic of silica tetrahedra in silicate structures. (Note: It helps to bring grapes and/or mini-marshmallows to help hold the sticks together…and to let students eat a quick snack. ;))

Getting back to the diversity of students:

(Psst…I used http://www.wordle.net/ to generate the word clouds.)

There is a broad range of disabilities that we may need to accommodate during any given semester (and often without advance notification):

- blindness
- low vision
- hearing impairments
- mobility impairments
- Autism Spectrum
- learning disabilities
- health impairments
- psychiatric/mental health impairments

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https://www.washington.edu/doit/Stem/ud.html

Let's consider a few during our session today.

Consider the use of video in our curriculum…

Let's consider using what's online:

Many people use streaming video from the internet.
For instance, many items are available through YouTube.

YouTube has a beta version of auto-captioning. But it is beta. Do not rely upon that feature to provide the needed clear and accurate audio accommodation for hearing impaired/deaf students.

In terms of Universal Design, accurate captioning not only assists students with disabilities, but is very important for English Language Learners, as well.

This is an example of an excellent brief video I use with my students at the very start of the semester:

http://www.youtube.com/watch?v=jxbIJH4fTYo

Let's watch…but set the volume to "mute."

After viewing without audio for several minutes…
what's up with this?
Cigar waters?

"Care for it's atmosphere…"

Then compare to what can be done to facilitate access:

https://bbvideo.ualr.edu/watch/VPkU

Both accurate closed captioning and high contrast captioning have been added.

In this instance, I was teaching an online section that had several students with documented ADA accommodations for hearing impairment and/or deafness. However, I now use this correctly captioned video and other related Earth Science Literacy “Big Ideas” that were captioned for my sections.

▷**Why Earth Science?**
https://bbvideo.ualr.edu/watch/VPkU

▷**Earth Science Literacy Initiative**

Big Idea 1. Scientists use repeatable observations & testable ideas to understand/explain our planet.
https://bbvideo.ualr.edu/watch/z1rN

Big Idea 2. Earth is 4.6 billion years old.
https://bbvideo.ualr.edu/watch/pGChjLc

Big Idea 3. Earth is a complex system of interacting rock, water, air, and life.
https://bbvideo.ualr.edu/watch/nim8b

Big Idea 4. Earth is continuously changing.
https://bbvideo.ualr.edu/watch/9PGK

Big Idea 5. Earth is the water planet.
https://bbvideo.ualr.edu/watch/b2h7WXd

Big Idea 6. Life evolves on a dynamic Earth and continuously modifies Earth.
https://bbvideo.ualr.edu/watch/vUiAlWE

Big Idea 7. Humans depend on Earth for resources.
https://bbvideo.ualr.edu/watch/TeN7TUPN

Big Idea 8. Natural hazards pose risks to humans.
https://bbvideo.ualr.edu/watch/lNi6

Big Idea 9. Humans significantly alter the Earth.
https://bbvideo.ualr.edu/watch/tcNKgUc6

I am now much better prepared to meet the needs of my new students semester by semester through Universal Design.

Now please consider this Computer Science recruitment streaming video for Veterans produced by the University of Washington with National Science Foundation backing:

http://www.youtube.com/watch?v=vunQEDq-b-c&feature=youtu.be

Note: In addition to captioning, there is **audio description** provided (see https://www.washington.edu/doit/Stem/articles?1079).

What about color blindness?

Here are word clouds with the same information, but different color of text and/or background. Consider how those in your class with color-blindness perceive what you are presenting. Not only in terms of instructional presentation and activities, but also in terms of maps. Find a quick primer about color blindness at http://www.eyehealthweb.com/color-blindness/ (there are examples of maps with the different types of color blindness).

Color Oracle is a free color blindness simulator for Window, Mac and Linux: http://colororacle.org/index.html

Think-Pair-Share

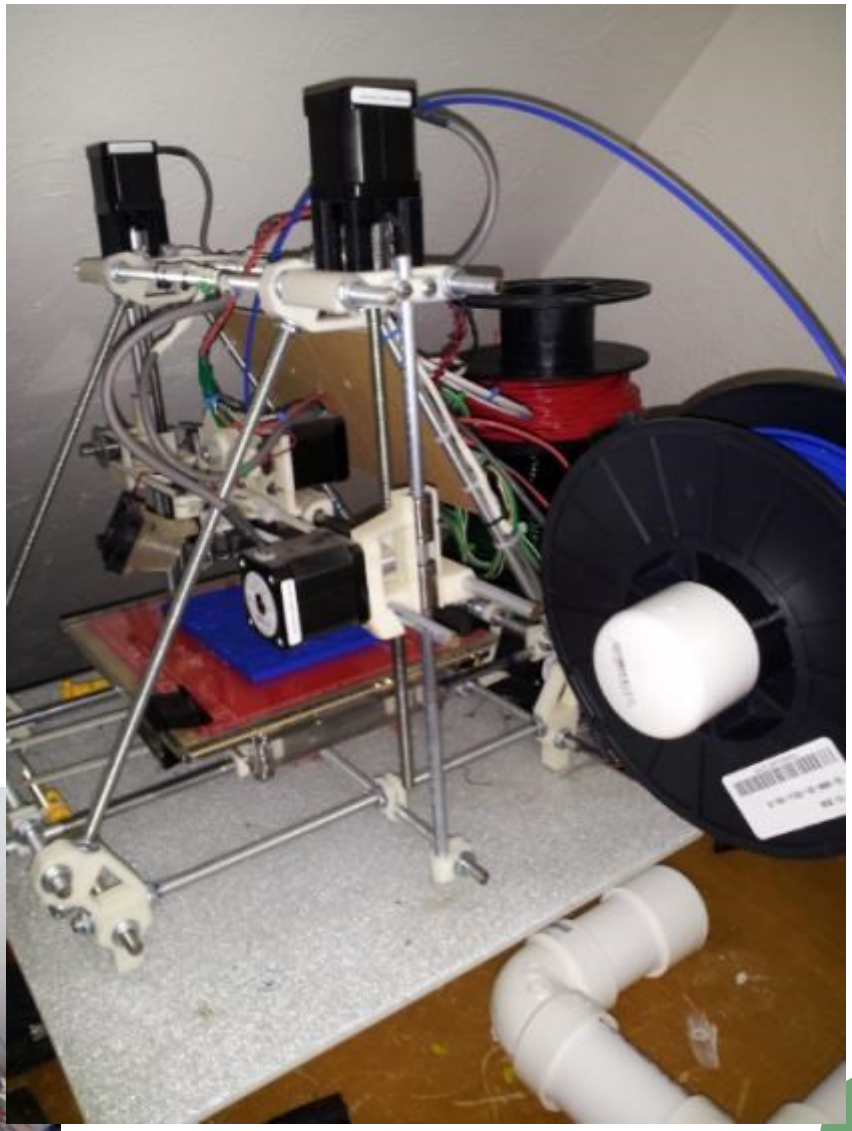
- How can including UD help you make a more accessible learning experience for students…but also make it more of a "learner-centered" experience?

- How can this be an integral part of *your* course design and implementation?

For Example: Tactiles

Tactiles are becoming more “budget accessible” with increasing availability / decreasing cost with 3D printers.

Jeffrey L. Williams built a printer at home (from scratch for a few hundred dollars), then made some initial teaching manipulatives for my students:

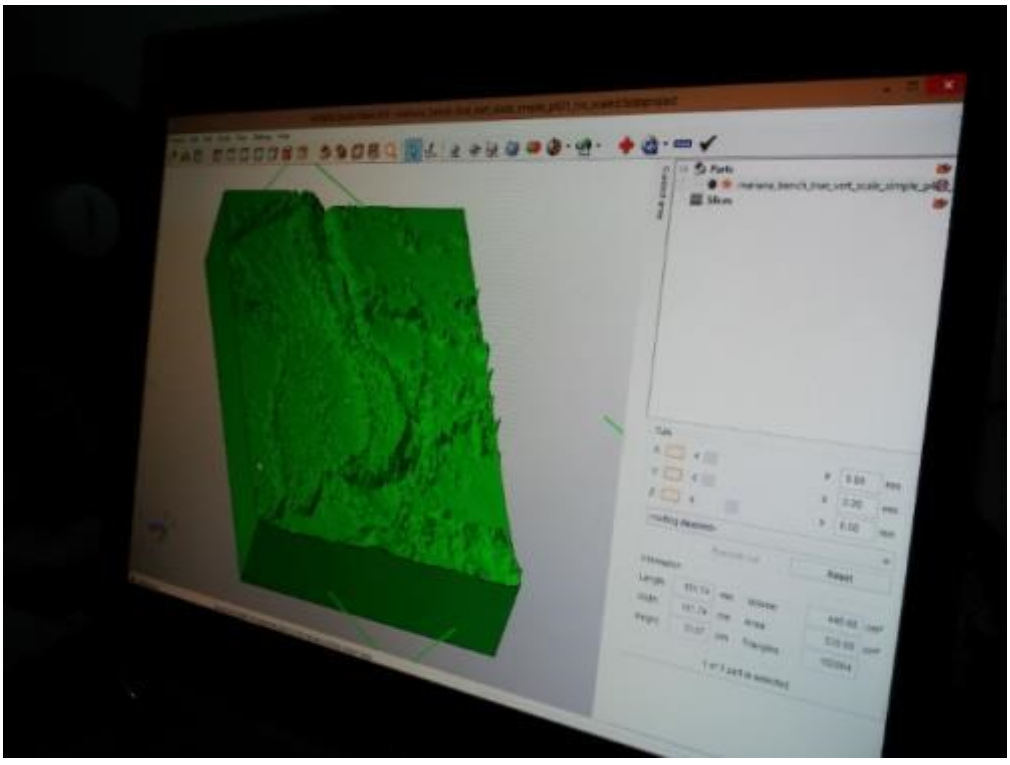


Using freely available data from sites such as:

British Oceanographic Data Center
https://www.bodc.ac.uk/data/online_delivery/gebco/

U.S. National Oceanic and Atmospheric Administration
http://www.ngdc.noaa.gov/mgg/bathymetry/

Google Earth
http://www.google.com/earth/index.html



National Geographic / Mariana Trench
http://channel.nationalgeographic.com/videos/the-challenger-deep/

Session No. 142 Paper No. 142-4 as Poster
T117. Developing and Sustaining Thriving Geoscience Programs and Departments: Strategies and Examples from Two-Year and Four-Year Colleges and Universities (Posters)
Monday, 28 October 2013: 9:00 AM-6:30 PM
Colorado Convention Center Hall D
https://gsa.confex.com/gsa/2013AM/webprogram/Paper232739.html

Geological Society of America *Abstracts with Programs.* Vol. 45, No. 7, p.239

UNIVERSAL DESIGN IN GEOSCIENCE EDUCATION: PROMOTING STUDENT SUCCESS WITH ACCESSIBILITY USING LOCAL 3D PRINTING FOR LEARNER-CENTERED INSTRUCTION

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Many programs seek success strategies for working with students representing overlapping kinds of diversity, such as learning preference, first generation college-bound, Persons with Disabilities, English Language Learners, and military active duty/veteran status. Universal Design (UD) techniques are deliberately applied in geoscience and physical science learner-centered lessons to address this diversity in order to reduce barriers for the majority of students. UD for education uses three overarching principles covering multiple means of representation, action and expression, and engagement. We combine three-dimensional (3D) printing with UD implementation in the two year college setting. This type of printing shows promise as becoming a transformative media for manufacturing, hobbyists and education. Geoscience education is especially primed for applications using 3D printing, particularly since local inexpensive printing affords easier incorporation of different modalities (e.g. vision or touch) into our curriculum and budgets.

The most obtainable 3D tabletop method is additive manufacturing, where extruded material builds up a three-dimensional object one layer at a time. By using relatively simple tools such as Open Source or kit-built printers, inexpensive plastic filament and laptop computers, faculty and students can create models to illustrate landforms and mathematical constructs. Ready-made Open Source, General Public License (GPL) or Creative Commons licensed printable models are available online, yet many opportunities exist for geoscience-related collections to be developed and shared. We are using GPL and inexpensive commercial software with publically available data to construct models for in-house 3D printing. We have created high fidelity models for use in introductory physical science courses as part of our Universal Design efforts. For example, we use bathymetric data to print variably scaled models of the Mariana Trench and digital elevation data to model the San Andreas Fault as part of a tectonic plate boundary collection. We anticipate greater demand for shared file collections for use with courses (online as well as hybrid or fully face2face) due to the number of 3D printers projected as typical tools in educational, home-use and printing service chain settings.

Become involved in:

http://www.theiagd.org/

IAGD
International Association for Geoscience Diversity

The **IAGD** mission is to improve access to the geosciences for persons with disabilities and promote communities of research, instruction and student support.

The **IAGD** Vision

- Celebrate the diverse abilities of all geoscientists while fostering student engagement in geoscience career pathways
- Provide faculty professional development in instructional access and inclusion
- Unify and promote efforts of collaboration in research and instructional best practices
- Develop a community of resources for faculty and student support
- Advance knowledge of access and accommodation within the geosciences through scientific research

Become an IAGD member

The IAGD offers:

- a place to network
- shared resources
- a student community
- collaboration in research
- and.... it's free to join!

www.The**IAGD**.org

http://www.facebook.com/TheIAGD

info@theiagd.org

http://www.theiagd.org/

http://www.theiagd.org/iagd-members/iagd-member-locations/

(This slide in edit mode can be used to illustrate the addition of Alt Tags.)

How did we do?

☑ major needs of learners that also serve Students with Disabilities

☑ strategies that work well

☑ discussion with the participants (ya'll) about how best to serve our population in geoscience courses

Please see my essay for this workshop for additional comments and resources cited.

"Never doubt that a small group of committed people can change the world. Indeed, it is the only thing that ever has."

Margaret Mead

How I Made this Presentation More Accessible

▷ **Font:** the best fonts for low vision are those without serifs and a wider, fixed width. For the general fonts provided with most word-processing software, that means Helvitica, Arial and Verdana. There is a new font made for low vision that is available through http://www.aph.org/products/aphont/ called APHont™, The download is free. However, I did not use it here because it needed to be embedded into the PowerPoint or must be available by the end user on their computer to maintain format. I do plan to try using it for future work, however.

▷ **How to Make PowerPoint files more Accessible** (Especially if a person is using assistive technology such as a screen reader to access the information.)

Please see **http://tinyurl.com/PPT-Accessible**

- ❑ Add alternative text to images and objects
- ❑ Specify column header information in tables
- ❑ Ensure that all slides have unique titles
- ❑ Use hyperlink text that is meaningful
- ❑ Use simple table structure
- ❑ Avoid using blank cells for formatting
- ❑ Include closed captions for any audio or video
- ❑ Ensure that the reading order of each slide is logical
- ❑ Increase visibility for colorblind viewers
- ❑ (Note: why I do not use a color or pattern-saturated background)

▷ Also learn more at:
http://webaim.org/techniques/powerpoint/