Evaluating Geologic Mapping Tools for the Undergraduate Curriculum

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Photo from http://www.ehow.com/how_7858709_make-rock-hammer.html

Have we left the Stone Age yet?

Geologist's hammer at left…

Title: First Look: Tablets in the Science Classroom
Date: Friday, May 24
Time: 10:15 - 11:30 am
Format: Panels
Location: Kunsela A112

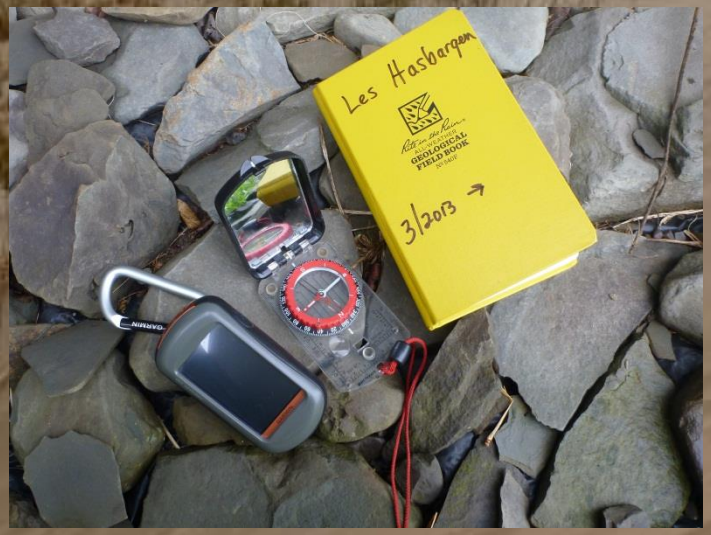
Our Plan

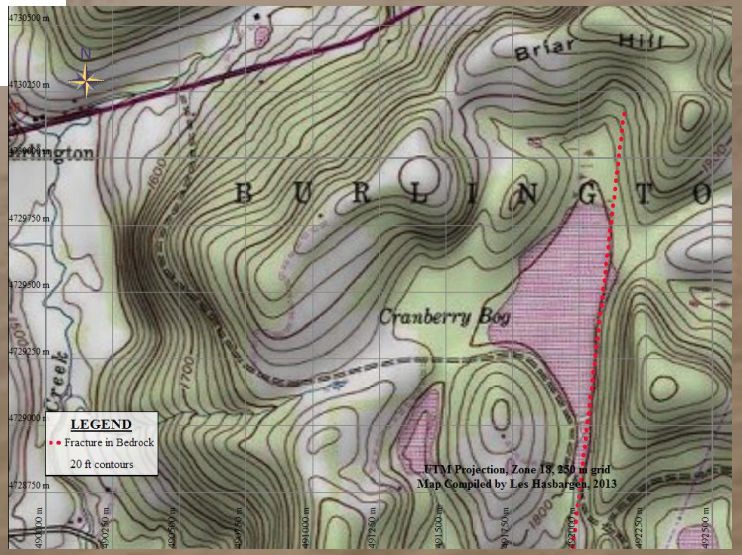
“This project will determine the most student-accessible, cost-effective yet reliable digital field mapping system by conducting…field-mapping evaluation, comparing available tablet computers and Geographic Information Systems (GIS) in side-by-side field tests, with the broad goal of training students to produce new 1:24000-scale geologic maps of New York State (NYS).”

Goals

- **Teach students to use tablets as data collection devices**
- **Compare student learning in the field with tablets and without**
- **Compare maps created with digital technology and without**
- **Determine costs, rank reliability, and ease of use of the iPad and Android system**

Typical Geologic Mapping Tools





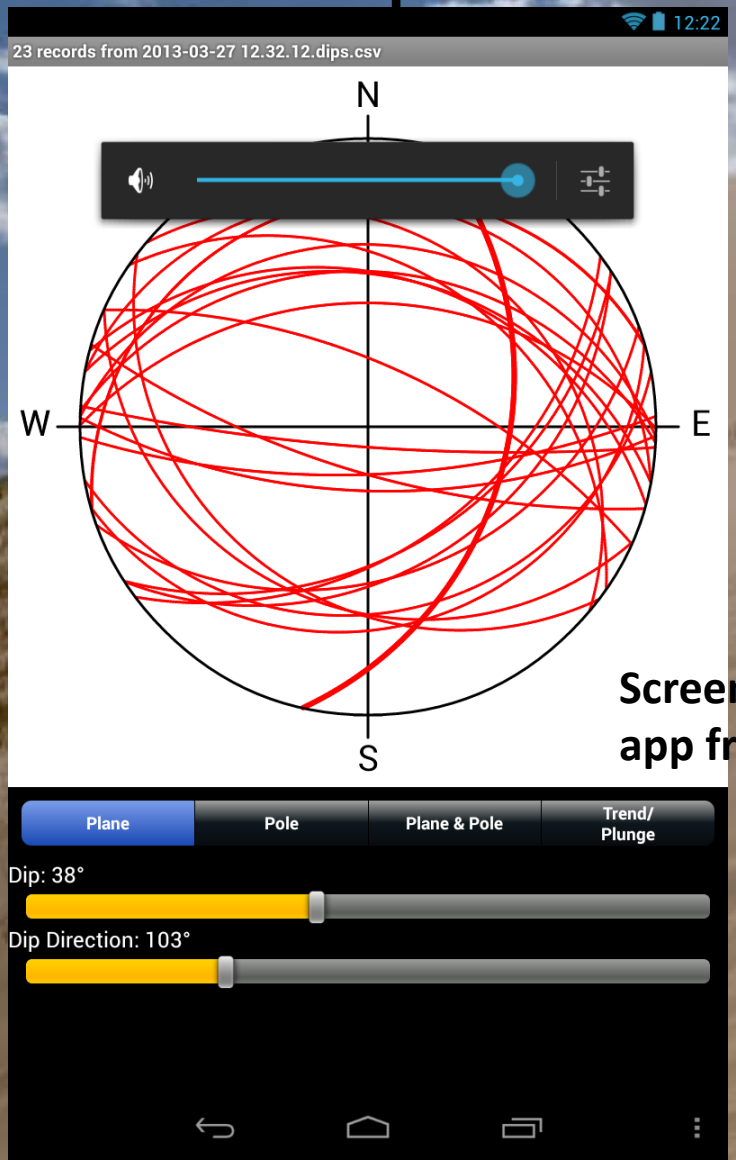
Mapping with Tablets

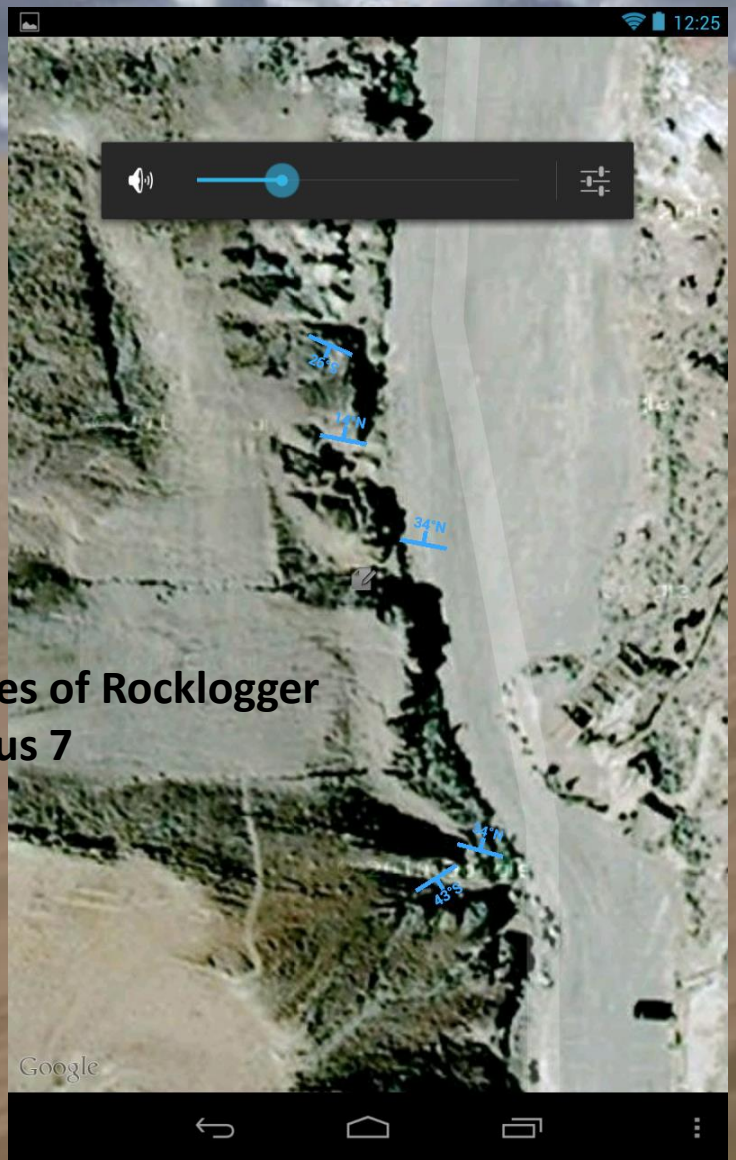
Students at work with tablets in Calico, CA

Documenting field sites

- Sketches are usually line drawings in field books
- Tablets provide the advantage of sketching on the photo and making annotations

Tablets provide real time graphical presentation of data





Screen captures of Rocklogger app from Nexus 7

Sketching in a moment

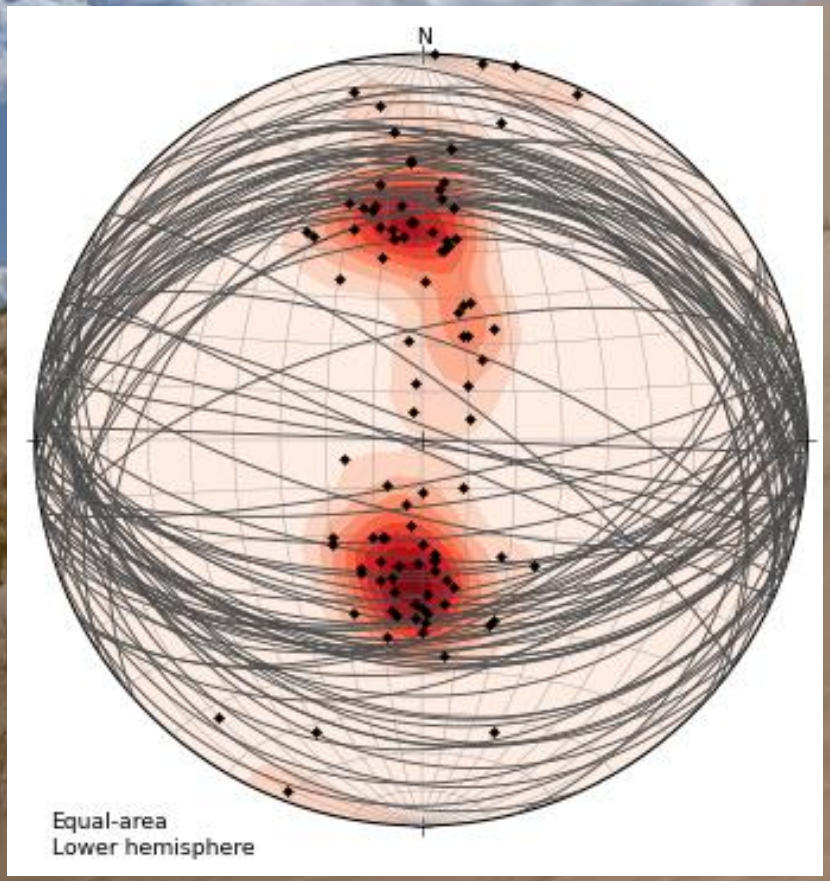
- This student was not a geology major, but immediately caught on to tracing key features on photos

Comparing analog and digital tools

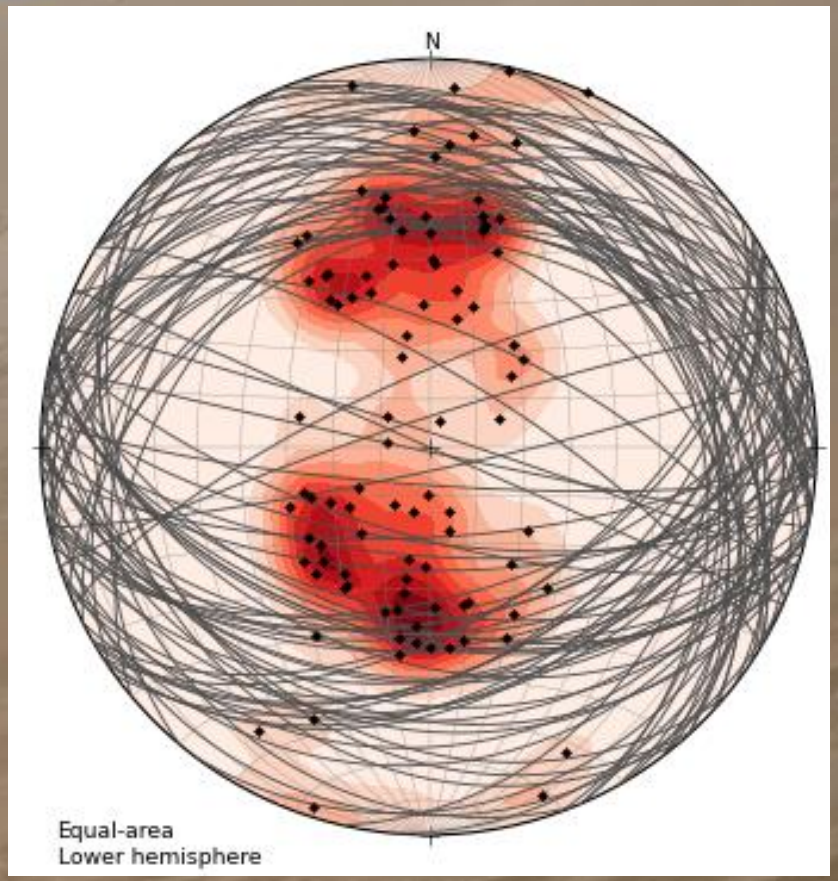
- To measure rock orientation requires direction and dip angle
- Tablets use accelerometers which wander…Nonetheless, the tablets did pretty well

Students compared tablets to old school compass measurements

Brunton Compass Measured Data



Tablet Measured Data



iPad Costs and Apps we tried…

		Total	**1107.94**
	cost	# items	subtotal
iPad	529	1	529
Apple Care+ for iPad (2 yr coverage)	99	1	99
OtterBox iPad Defender	25	1	25
Apps			
NotesPlus	7.99	1	7.99
Theodolite	3.99	1	3.99
GeolCompass	2.99	1	2.99
GeoID	4.99	1	4.99
Magnetmeter	0	1	0
Coordinates	0	1	0
GeoFieldBook	**0**	**1**	**0**
GPSKitHD	14.99	1	14.99
iCMTGIS	94.99		0
GISPro	**299.99**	**1**	**299.99**
Stereonet	0.99		0
3G Service for 4 months	**30**	**4**	**120**

Costs for Nexus 7 and Apps we tried…

Android Tablet (Nexus 7)	**Total (tablet + apps) =**		**282.79**
	cost	# items	subtotal
Nexus 7 tablet 16 GB	249	1	249
Protective case, Poetic	20	1	20
Total Apps Cost =	13.79		
Apps	Cost/ea		
Rocklogger	**9.3**	**1**	**9.3**
SmartTools	2.5	1	2.5
Google Drive	0	1	0
3D Compass and Magnetometer	0	1	0
PicsArt (draw on photos)	0	1	0
ES File Explorer	0	1	0
Paint Joy	0	1	0
Evernote	0	1	0
GPS Status	0	1	0
Markers	0	1	0
Papyrus	0	1	0
GPS Essentials	0	1	0
OruxMaps	**0**	**1**	**0**
Gnotes	0	1	0
Skitch	**0**	**1**	**0**

Reliability, Costs, Ease of Use

- To present, none of the tablets have failed (total of 70+ tablet-days).
- Both tablet types successfully collected field data, including geolocation, imagery, rock description and rock orientation.
- Android is far cheaper than Apple.
- Apple software worked better, but only when within cellular service areas.
- Students like the size of the Nexus 7 better, and would like to see the iPad mini at work in the field.

What we attained…

- Time available to map was limited, SOOOO…
  - Students learned old school methods first
  - Students learned about tablet limitations
    - iPads: no cell signal = no data
    - Instrument drift made strike-dip data unreliable
    - Nexus 7 had a lousy camera, and user-facing
    - Data transfer was annoying for iPads
- Student surveys of the tablets

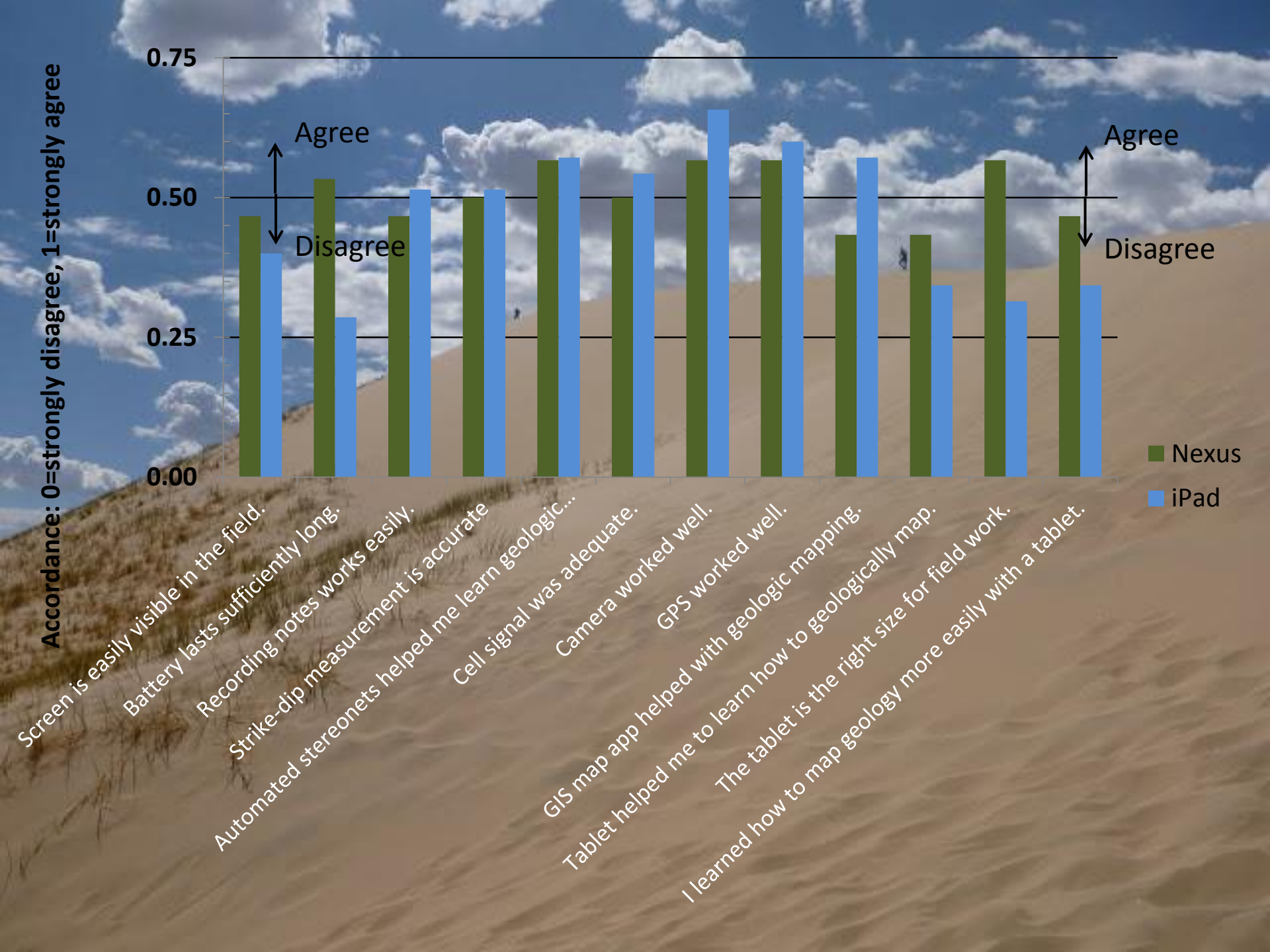
Tests with Fall 2012 Geol 275

7: How would you rank the Google Nexus tablet as an aid in geologic mapping? Only answer this if you used the Nexus. (hide)

Response	%
The tablet is useless.	0
The tablet worked in some situations, but was difficult to use.	0
The tablet worked overall, but had some limitations.	20
The tablet worked adequately well, and facilitate geologic data collection over paper map and pace-compass methods.	20
The tablet worked very well, greatly facilitated geologic mapping, and reduced the amount of time and effort to create a geologic map and report.	6.7

8: How would you rank the iPad tablet as an aid in geologic mapping? Only answer this if you have used the iPad. (hide)

Response	%
The tablet is useless.	0
The tablet worked in some situations, but was difficult to use.	6.7
The tablet worked overall, but had some limitations.	13.3
The tablet worked adequately well, and facilitate geologic data collection over paper map and pace-compass methods.	20
The tablet worked very well, greatly facilitated geologic mapping, and reduced the amount of time and effort to create a geologic map and report.	6.7


Accordance: 0=strongly disagree, 1=strongly agree
0.75
0.50
0.25
0.00
Agree
Disagree
Agree
Disagree
Nexus
iPad
Screen is easily visible in the field.
Battery lasts sufficiently long.
Recording notes works easily.
Strike-dip measurement is accurate
Automated stereonets helped me learn geologic...
Cell signal was adequate.
Camera worked well.
GPS worked well.
GIS map app helped with geologic mapping.
Tablet helped me to learn how to geologically map.
The tablet is the right size for field work.
I learned how to map geology more easily with a tablet.

Instructor's comments: iPads

- Glare off the screen was bad, and very nearly invisible when viewed through polarized sun glasses.
- Power consumption was very high.
- Strike and dip measurements could be made easily, but instrumental wander required frequent recalibration of the accelerometer. Drift would be hard to detect without the accompanying measurements made with an analogue compass.
- The backpack straps to carry the iPads had to taken off to open and close the Otterbox case. A different protective case should be used instead of the ones we chose.
- The camera would not shoot through the Otterbox case.
- Cellular service was intermittent in the Mojave Desert, which limited the times and places where the iPad could be used in the field. We could not predict a priori where these locations would be.
- We tried both the GIS Pro and GeoFieldBook apps. When cell service was available, the real time location on aerial imagery in GIS Pro was a huge benefit. Some students really liked this app. Most students used GeoFieldBook to collect imagery and strikes and dips. It worked fairly well. Some students really liked the app (in fact, one student who was not a geology major started taking much better notes when she could annotate the pics). Other students found the tablet to be no more helpful than a standard field book.

Instructor’s comments: Nexus 7

- Glare was not as bad as the iPad.
- Power consumption was moderate.
- Strike and dip measurements could be made easily, but instrumental wander required frequent recalibration of the accelerometer. Drift would be hard to detect without the accompanying measurements made with an analogue compass.
- The protective cover for the Nexus was ok, but did not cover the ports.
- The camera in the Nexus is forward facing, and so it was a challenge to properly frame pictures. The image quality was inferior to the iPad.
- The Nexus could be used in any location where GPS satellites were in view. The time to locate was longer than for the handheld Garmin GPS receivers.
- We used Rocklogger for geologic data collection, and Skitch to annotate photos. Rocklogger worked fairly well. Some students really liked the apps. Other students found the tablet to be less helpful than a standard field book, compass, and camera.
- Data transfer worked easily via email, whenever the tablets were in wifi range.