Language Preservation: the Language of Science as a Bridge to the Native American Community

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Language Arts: important to the Native American Community

- Native Languages are losing speakers
  - Most Native speakers are now elderly
  - Only 30 percent of Native Americans as a whole speak their own tribal language in the home.
    - Almost 70 percent of Navajos speak their tribal language in the home, and
      - 25 per cent do not know English very well.
  - For the Cherokee and the Chippewa, less than 10 percent speak the native language in the home.
  - For the Navajo, the number of first graders who solely speak English is almost four times higher than it was in 1970.
- Native language ability, an important cultural touchstone
  - Retention of a cultural identity includes knowing how to express cultural ideas in one's own language
  - Attrition from STEM fields is a prominent problem in the tribal settings, and self-esteem is such a recognized part of success in STEM fields, it is clear that steps taken to work within a cultural framework to build knowledge of STEM concepts in a Native Language, have the potential for a positive impact downstream.

The Rosetta Mission

- An ESA (European Space Agency) ‘cornerstone’ mission
- First to rendezvous with, land upon, and ‘escort’ a comet around the sun
- Objectives include: complete inventory of composition, characterize how jets erupt from the surface, characterize how the coma develops and the interaction of volatiles and dust as the coma evolves.
- As outlined by the European Space Agency, Rosetta is expected to provide the keys to the primordial solar system the way the original Rosetta Stone provided a key to ancient language

US Rosetta Outreach

- Outreach efforts will include a component to reach out to Native American communities through a known avenue of concern – language preservation
- First steps toward several different tribal communities have been taken. Each community has a different set of concerns.
  - Navaho
  - Hawaiian
  - Ojibwe
  - Salish
- Steps toward several more are under consideration:
  - Cherokee
  - Shawnee & Deleware
  - Cree
  - Quiche (or K'iche': Mayan language (Guatamala))
- Our European colleagues are intrigued for the possibilities for disappearing European languages – such as Bernese.

Navajo

- Largest population of Native speakers
- Existing liasons with NASA
- Robust tribal college
- As a first cut: define (new) Navajo words for the existing 'NASA' words to the left.

List of "NASA words' translated to Navajo:

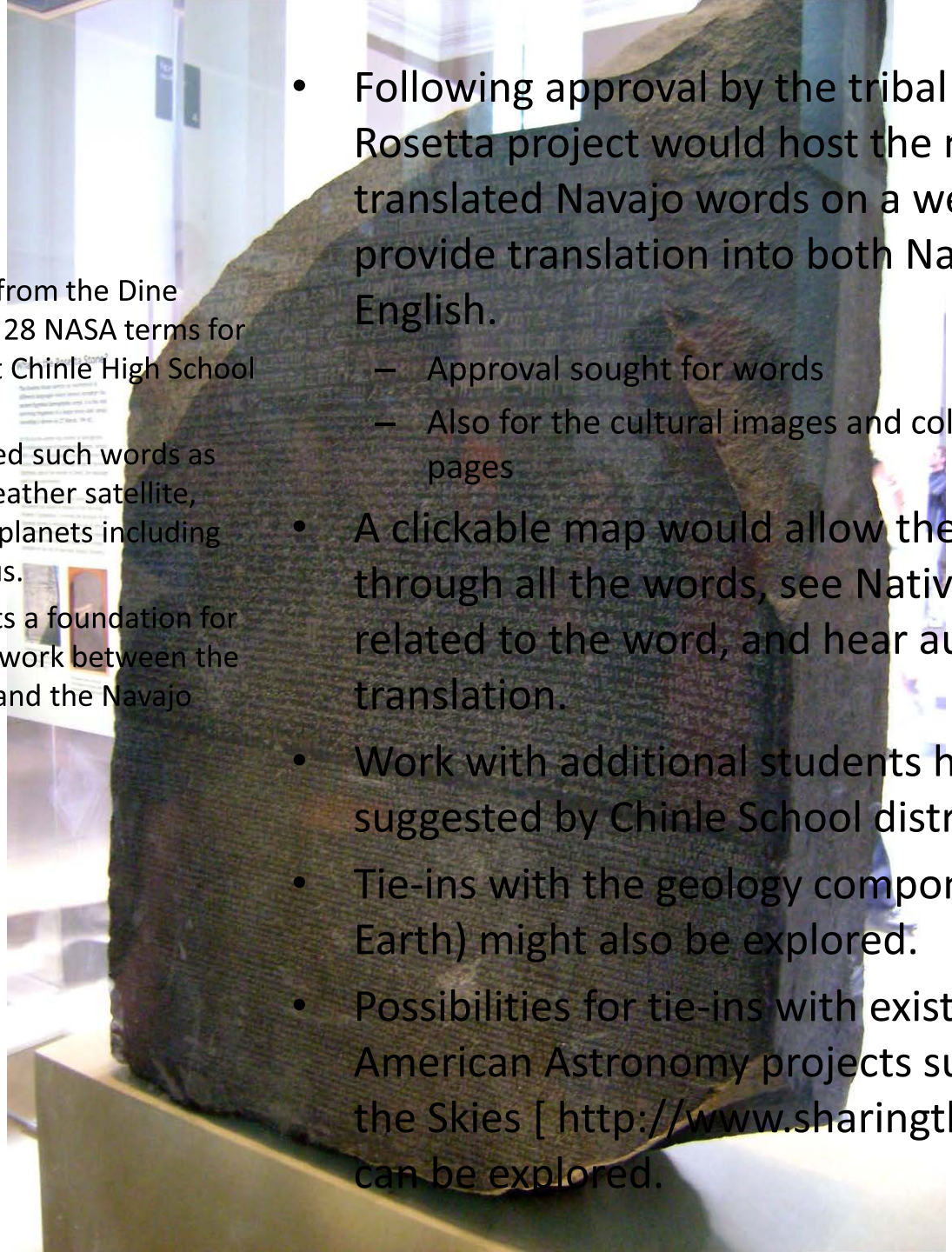
1. Outer space
2. Galaxy
3. Comet
4. Star
5. Meteor
6. The solar system
7. Sun
8. Earth
9. Moon
10. Solar Eclipse
11. Lunar eclipse
12. The planets
13. Mercury
14. Venus
15. Mars
16. Jupiter
17. Saturn
18. Rings
19. Uranus
20. Neptune
21. Asteroid
22. Orbit
23. Telescope
24. Spacecraft
25. Space station
26. Communication satellite
27. Weather satellite

Navajo

In 2009, a student from the Dine Nation interpreted 28 NASA terms for his senior project at Chinle High School in Chinle, AZ.

These terms included such words as space telescope, weather satellite, space suit, and the planets including Neptune and Uranus.

This work represents a foundation for possible continued work between the US Rosetta Project and the Navajo Nation.



- Following approval by the tribal elders, the U.S. Rosetta project would host the newly translated Navajo words on a web-site, and provide translation into both Navajo and English.
  - Approval sought for words
  - Also for the cultural images and colors used on the pages
- A clickable map would allow the user to move through all the words, see Native artwork related to the word, and hear audio translation.
- Work with additional students has been suggested by Chinle School district.
- Tie-ins with the geology component (Mother Earth) might also be explored.
- Possibilities for tie-ins with existing Native American Astronomy projects such as Sharing the Skies [http://www.sharingtheskies.com/] can be explored.

Lessons Learned (Navajo)

- It is <u>essential</u> to establish the appropriate authority of respected Native Language users who can "approve" the new terms.
- Emphasis on web-based interaction with the community was premature
  - The remote communities where the children speak Navajo do not have computers, nor wireless! Internet is not part of their lives
  - Computer technology (and IT) must be sought for the community
  - Personal contact with some of these communities should be planned.
- It might be important to create a process by which we can agree on any definitions that have a rigorous technical explanation in English.
  - Example: in the back-translation of the Navajo word for 'moon' from Navajo to English, was the phrase, it travels across the sky (implying something different from that of a derived, apparent motion, due to the rotation of the earth) … An objection was raised that this terminology is not strictly correct, and might give misleading physics.
- Once we obtained approval for the initial words, to find a way to use those words in context …

Hawaiian

A Hawaiian ‘immersion’ school is and example of this Native communities’ robust language commitment.

We approached a Native Hawaiian educator about using the same approach as we started with the Navajo.

Among the challenges, for a web-interaction, is the appropriate spelling (using the 'okina and macrons). Consideration will need to be given to how to get these marks to show up correctly on users' screens. it is basically impossible to really understand the language without them. For example, the way "hoku" was written above technically means "the night of the full moon" NOT "star" because it doesn't include the macrons over the "o" and the "u"

- Hawaiian language was exclusively oral before Captain Cook arrived in the Hawaiian Islands in 1778. Shortly thereafter,missionaries developed a written Hawaiian language consisting of a 12 letter Roman alphabet (a, e, i, o, u, k, h, l, m, n, p, w) plus the 'okina (a backwards apostrophe indicating a glottal stop), which is considered a letter. Macrons are also used over vowels to indicate long vowel sounds. Existing Hawaiian oral words were written based on phonetics. Some of the words intended for this study were part of pre-contact Hawaiian language, such as "mahina" (moon), "la" (sun), and "hoku" (star).
- New concepts were and still are generally assigned words based on either a phonetic translation of the source word that was modified to accommodate Hawaiian linguistics (i.e. Jupiter = Iupika), or a combination of existing words intended to convey the meaning behind the concept (i.e. hoku ukali = satellite = following or attendant star).
- There is no governing body that approves new Hawaiian words.

Lessons Learned (Hawaiian)

It is essential to establish the appropriate authority of respected Native Language users who can "approve" the new terms.

- With the Hawaiian community, there is no governing body as such to approve new words.
  - New words come into the language 'catch as catch can'
- Implies the project may have to assemble a team of language and science experts who can serve as a Board

Summary

•Steps were taken along a path to using Language as a bridge to address STEM concerns in Native American communities.

- First steps included building a 'cool' web interface with which to host 'NASA' words translated into Navajo – with the approval of the tribal elders at Dine College.
- The web-pages are under development, with the first release envisioned for sometime in the coming year.

•**Lessons Learned:** A project of this magnitude requires considerable input from appropriate qualified people from both the scientific community and the Indigenous community.

• These types of projects, destined to enter the public domain, will be open to intense scrutiny and one of the first questions will concern validation and verification by community, as opposed to individual. It is most appropriate, since these are culture property rights, that the validation comes from a recognized body of the tribal Nation.

•A recognized authority, who is well versed in both Native American ways of knowing and western astronomy, as well as being completely bi-lingual (carrying the deep cultural knowledge) should be considered for consultation and involvement.