

**NASA MISSION DATA ANALYSIS RESEARCH AS A TOOL TO DEVELOP ENGLISH LANGUAGE PROFICIENCY IN COLOMBIAN UNDERGRADUATE ENGINEERING STUDENTS.** M. A. Riner<sup>1\*</sup>, P. S. Riner<sup>2</sup> and A. F. Arboleda Gaeth<sup>1</sup> <sup>1</sup>Fundación Universitaria de Popayán, Claustro San José, Calle 5 No. 8-58, Popayán, Cauca, Colombia, <sup>2</sup>Department of Foundations & Secondary Education, College of Education & Human Services, University of North Florida, Building 57, Room 2321, Jacksonville, FL 32224, USA. \*mariner@unividaup.edu.co

**Introduction:** We present preliminary status of a case study of undergraduate research by Colombian engineering students as a mechanism for improving English proficiency among English Language Learners (ELLs).

Fundación Universitaria de Popayán (FUP) is a private university of 7300 students in Popayán, Cauca, Colombia. After major restructuring in 2006 FUP has risen to the second ranked university in the Department of Cauca, after the nationally ranked public University of Cauca [1]. FUP caters to students of scarce resources – mainly from strata 1-3. (Colombia classifies socioeconomic situations in six “strata” where 1 is the poorest and often rural and 6 is upper class.) FUP supports students with financial need with scholarships for academic excellence and part-time work opportunities within the university. FUP has placed an emphasis on student research, providing financial and academic incentives.

**Goals:** The National Accreditation Council (CNA) is strengthening mandatory requirements for all institutions of higher education with an emphasis on research activities and foreign language learning in order to foment internationalization of the curricula. In advance of these accreditation changes FUP Ingeniería de Sistemas (Systems Engineering) Program aims to provide additional opportunities for undergraduate research experiences and to increase emphasis on foreign language proficiency. For engineering students, English is an obvious choice for a second language. While FUP has a school of languages with courses in English and French, it can be difficult for engineering student to fit language courses into their demanding curriculum and there is a need for technical English specific to engineering. Therefore the Systems Engineering Program has endeavored to include English language training within the engineering coursework.

**Approach:** This project began in Fall 2016 with the definition of two research projects to be led by Dr. Riner. Both projects analyze NASA planetary mission data to study the composition and/or degree of space weathering (alteration by contact with the space environment) of the Moon and Mercury. Projects were constructed to capitalize on the programming skills of students in the Systems Engineering Program. (In Colombia Systems Engineering more closely aligns with

common U.S. curricula in computer science.) Students are expected to have complete two semesters of physics and mathematics through linear algebra. Up to ten students will begin undergraduate research on these projects in Fall 2017.

Concurrently two courses in remote sensing of planetary bodies will be offered as electives, open to all FUP students, regardless of study area. These courses will focus primarily on teaching remote sensing concepts with approximately a quarter of instruction devoted to basic concepts in planetary science. The planetary science covered will differ for each course to be relevant to one of the two research projects. Enrollment in one of these courses is required for participation in either research project. The language of instruction will be English. These will be the first content (not language) courses offered in English at FUP.

**Student Research:** The benefits of undergraduate research has been widely documented. [2] Specifically, NASA mission data analysis research can provide distinct benefits, such as utilizing existing university infrastructure and resources. [3] Projects can be designed to avoid expensive analytical techniques or highly specialized hardware. Furthermore planetary science projects can frequently have simple (often repetitive tasks) such that an undergraduate can begin contributing to the project with minimum initial training. As the student progresses, knowledge specific to the project can be acquired and greater roles can be taken on by the student. Finally, the excitement of working with planetary mission data cannot be overstated. With proper encouragement, even simple, repetitive tasks can be used as a basis to “explore” another planetary body.

All NASA planetary mission data are archived in the Planetary Data System (PDS), sponsored by NASA’s Science Mission Directorate. All data in the PDS are peer reviewed, well-documented and publicly available. All PDS data may be exported outside the United States under “Technology and software Publicly Available” (TSPA) classification [4].

While PDS standards for storing and documenting data ensure researchers can analyze the data using a variety of computer platforms and software, a variety of free software packages are available to analyze PDS

data in addition to software packages that may be common in undergraduate institutions. The USGS has designed an invaluable resource for analysis of planetary mission data called Integrated System for Imagers and Spectrometers (ISIS). ISIS is a free image processing and cartographer software package developed by the USGS for NASA. [5] In short, international researchers can use ISIS to leverage millions of dollars invested in software development by NASA to conduct research on NASA mission data freely available from the PDS.

Colombia does not have its own space program and most Colombians have little or no direct contact with NASA programs or research. Students at FUP have shown strong interest and curiosity about NASA research. Since motivation has been identified as a key to ELL success [6], hands-on research with NASA mission data was identified as potentially more exciting and more motivational to engineering students than traditional coursework.

**English Proficiency:** English proficiency varies widely among Colombian students. While English is taught in secondary schools it is often challenging to find qualified teachers, particularly in public schools. The Ministry of Education has initiated ambitious programs to improve bilingual education but most of these programs are too recent to impact most FUP students [7]. Programa Nacional de Bilingüismo predicts that in 2018 only 8% of graduating secondary school students in Colombia will have an intermediate or better knowledge of a foreign language [8].

Research on ELLs typically centers on (a) students in English speaking countries whose primary language is not English (here English is referred to as L2) or (b) students in non-English speaking countries learning English (as a foreign language). [6] Since we intend to teach English through content courses (not courses in English) and research the techniques in the literature for L2 students are more applicable even though a lack of language immersion and English in social contexts aligns our students as foreign language learners. Additionally much, but not all, of the research on ELLs studying English as an L2 concentrates on primary and secondary schools. Therefore we believe our situation is rarely represented in the literature and the results of our case study may be of interest to the wider education and science community.

**Need Word:** Student performance will be evaluated in several ways. First, all students in both courses (and therefore all students involved in research) will be given an English proficiency exam at the beginning and end of the semester. Furthermore the success of the student researchers will be assessed by: continuation of research in subsequent semesters, success in individual

research tasks, oral and written summaries of research progress, and presentation or publication of research results.

Additionally we will present an empirical comparison of ELL pedagogic techniques and strategies. Specifically we are interested in how techniques developed for secondary school students can be adapted to university students and how strategies developed for content-based L2 students can be adapted to Colombian students with limited contact with English outside this course and research project. Finally we are interested in comparing English learning strategies and outcomes in the classroom to those in a research environment.

**References:**[1] [http://www.webometrics.info/es/Latin\\_America\\_es/Colombia](http://www.webometrics.info/es/Latin_America_es/Colombia) [2] Crowe, M. and Brakke, D. (2008) *Council on Ugrad. Res.*, 28(4), 43-50. [3] Antonenko, I. (2004) *LPS XXXV*, 2156. [4] NASA PDS <https://pds.nasa.gov/> [5] USGS ISIS Overview <https://isis.astrogeology.usgs.gov/documents/Overview/Overview.html> [6] Schwarzer, D. et al. (2003) *Language Arts*, 80, 453-460. Colombia. [7] Ministerio de Educación. Press Release. (2015) <http://www.mineducacion.gov.co/cvn/1665/w3-article-348120.html>. [8] “En 2018 solo el 8% de los bachilleres serían bilingües” (2015) *Portafolio*, <http://www.portafolio.co/economia/finanzas/2018-bachilleres-serian-bilinguees-37112>.