

Education and Human Resources Advisory Committee Meeting

Thursday, November 30, 2017 *and* Friday, December 1, 2017

National Science Foundation, Rooms W2210/2220

2415 Eisenhower Avenue • Alexandria, VA 22314

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2415 Eisenhower Avenue • Alexandria, VA 22314

Thursday, November 30th, 2017

8:30AM – 9:00AM

Welcoming Remarks

Dr. Francisco C. Rodriguez, *Chancellor, Los Angeles Community College District; Chair, EHR AC*

Dr. Jim Lewis, *Acting Assistant Director, EHR*

9:00AM – 10:30AM

Launching a STEM Education Initiative

9:00AM – 9:30AM

Education in 10 Years: Reflections by EHR Staff

Dr. Dean Evasius, *Division Director, EHR/DGE*

Dr. Evan Heit, *Division Director, EHR/DRL*

Dr. Jermelina Tupas, *Division Director, EHR/HRD*

Dr. Robin Wright, *Division Director, EHR/DUE*

9:30AM – 10:30AM

AC Discussion

10:30AM – 10:45AM

Morning Break

10:45AM – 11:45AM

EHR's New Hispanic Serving Institutions Program

Updates from HSI Program Co-leads

Dr. Andrea Johnson, *Program Director, HRD*

Dr. Talitha Washington, *Program Director, DUE*

11:45AM – 12:15PM

Purchase Lunch (NSF Cafeteria is located around the corner on 2nd floor.)

12:15PM – 1:15PM

Working Lunch

During lunch, AC members and EHR staff will take part in small group discussions of today's topics: *Launching a STEM Education Initiative*, *Public-Private Partnerships*, and *EHR's Broadening Participation Portfolio*.

1:15PM – 2:00PM

EHR's New Hispanic Serving Institutions Program

AC Discussion

2:00PM – 3:00PM	Public-Private Partnerships
2:00PM – 2:30PM	<p><i>Report from first meeting of the new EHR AC Subcommittee for Public-Private Partnerships</i></p> <p>Dr. Liz Boylan, Program Director, Alfred P. Sloan Foundation; Chair, EHR AC Subcommittee on Public-Private Partnerships</p> <p><i>Industry Partnerships in NSF's Computer & Information Science & Engineering (CISE) Directorate</i></p> <p>Dr. Erwin Gianchandani, Deputy Assistant Director, CISE</p> <p><i>Lessons from Office of International Science and Engineering (OISE) Experience with International Partnerships to Support Partnerships for International Research and Education (PIRE) Program</i></p> <p>Anne Emig, Program Manager, OD/OISE</p>
2:30PM – 3:00PM	AC Discussion
3:00PM – 3:15PM	Afternoon Break
3:15PM – 4:00PM	Committee Business
4:00PM – 5:00PM	<p>NSF Director, Dr. France Córdoba</p> <p>NSF Chief Operating Officer, Dr. Joan Ferrini-Mundy</p>
5:00PM – 6:00PM	Tour new NSF HQ (optional)
6:00PM	<p>No-host dinner (<i>across the street from NSF</i>)</p> <p>Delia's Mediterranean Grill & Brick Oven Pizza</p> <p>209 Swamp Fox Road • Alexandria, VA 22314</p>

Friday, December 1, 2017

8:15AM – 8:45AM	<p>Recap discussion from Day 1</p> <p>Dr. Francisco C. Rodriguez, Chancellor, Los Angeles Community College District; Chair, EHR AC</p>
8:45AM – 9:15AM	<p>Telling the EHR Story</p> <p>Dr. Jim Lewis, Acting Assistant Director, EHR</p>

- 9:15AM – 10:00AM **Update: OER Subcommittee**
 Open Educational Resources (OER) - Attitudes, Awareness, and Adoption in K-12 and Higher Education
 Dr. Jeff Seaman, Co-Director, Babson Survey Research Group
- 10:00AM – 10:15AM **Morning Break**
- 10:15AM – 10:45AM **Update: EHR Research Roadmap**
 Dr. Evan Heit, Division Director, EHR/DRL
 Discussant: Dr. Roy Pea, Professor, Stanford Graduate School of Education;
 EHR AC Member
- 10:45AM – 11:45AM **Breakout session: Subcommittee work**
- The *Open Education Resources* and *Public-Private Partnerships* subcommittees will meet at this time. In addition, AC members interested in serving on the new *Launching a STEM Initiative* or *EHR's Broadening Participation Portfolio* subcommittees will use this time to discuss next steps.
- 11:45AM – 12:15PM *Purchase Lunch (NSF Cafeteria is located around the corner on 2nd floor.)*
- 12:15PM – 1:15PM **Working Lunch**
 EHR Program Highlights (ADVANCE, DRK-12, IUSE, NRT)
 Dr. Jessie DeAro, Program Director, HRD
 Dr. Rob Ochsendorf, Program Director, DRL
 Dr. Myles Boylan, Program Director, DUE
 Dr. Laura Regassa, Program Director, DGE
- 1:15PM – 2:00PM **Recommendations to EHR, Meeting Wrap-up**
 Dr. Francisco C. Rodriguez, Chancellor, Los Angeles Community College District; Chair, EHR AC
- 2:00PM **Meeting adjourns**

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November 2017

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STEM Education Initiative, Select References

(EHR Senior Staff recommendations, November 2017)

Nature of Science

- National Academies. (2017). *Building America's Skilled Technical Workforce*. <https://www.nap.edu/catalog/23472/building-americas-skilled-technical-workforce>
- AAU. (2017). *Progress Toward Achieving Systemic Change: A Five-Year Status Report on the AAU Undergraduate STEM Education Initiative*. <https://www.aau.edu/sites/default/files/AAU-Files/STEM-Education-Initiative/STEM-Status-Report.pdf>
- NRC. (2017). *Undergraduate Research Experiences for STEM Students: Successes, Challenges, and Opportunities*. <https://www.nap.edu/catalog/24622/undergraduate-research-experiences-for-stem-students-successes-challenges-and-opportunities>

Demographics

- Enhancing Diversity in Science
<https://www.socialworkers.org/LinkClick.aspx?fileticket=cU0DbIMsYZY%3D&portalid=0>
- “Women, Minorities and Persons with Disabilities in S&E” report.
<https://www.nsf.gov/statistics/2017/nsf17310/digest/about-this-report/>
- Starting at the Crossroads: Intersectional Approaches to Institutionally Supporting Underrepresented Minority Women STEM Faculty
<http://www.dl.begellhouse.com/journals/00551c876cc2f027,31a33a3e53bad464,66838ee3473d04c8.html>

Workplace and Careers

- Council of Graduate Schools and Educational Testing Service. (2010). *The Path Forward: The Future of Graduate Education in the United States*. <http://www.fgereport.org/>
- National Science Foundation. (2016). *NSF Strategic Framework for Investments in Graduate Education FY 2016- FY 2020 (NSF 16-074)*. <http://www.nsf.gov/pubs/2016/nsf16074/nsf16074.pdf>
- National Science Foundation. (2016). *Dear Colleague Letter: Improving Graduate Student Preparedness for Entering the Workforce, Opportunities for Supplemental Support*. <http://www.nsf.gov/pubs/2016/nsf16067/nsf16067.jsp>

Educational Institutions Across All Sectors

- GAO-18-49. (2017). CONTINGENT WORKFORCE: Size, Characteristics, Compensation, and Work Experiences of Adjunct and Other Non-Tenure-Track Faculty. <http://www.gao.gov/products/GAO-18-49>
- PCAST. (2010). *Prepare and Inspire: K-12 Science, Technology, Engineering, and Math (STEM) Education for America's Future*. <https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/pcast-stem-ed-final.pdf>
- National Research Council. The National Academies Press. (2015). *Identifying and Supporting Productive STEM Programs in Out-of-School Settings*. Washington, D. C.
http://www.nap.edu/openbook.php?record_id=21740

National Science Foundation
Directorate for Education and Human Resources
NEW Hispanic-Serving Institutions Program

Updates are posted here: <https://nsf.gov/ehr/HSIProgramPlan.jsp>

Resources

NSF 17-092, Dear Colleague Letter: Improving Undergraduate STEM Education in Hispanic-Serving Institutions (HSIs)

<https://nsf.gov/pubs/2017/nsf17092/nsf17092.jsp>

EHR AC Subcommittee: *Building Capacity at Hispanic Serving Institutions*

Briefing Book:

<https://www.nsf.gov/ehr/Materials/HSIMeetingBriefingBook.pdf>

Subcommittee Report:

<https://www.nsf.gov/ehr/Materials/HSISubcommitteeReport.pdf>

**The Strategic Role of Public-Private Partnerships in the EHR Mission and Portfolio:
A Charge for the EHR Advisory Committee Subcommittee on Public-Private Partnerships**

Background: EHR participates and has participated in public-private partnerships for many years. Private entities that NSF has collaborated with include philanthropic organizations, industry, and others. These partnerships take many forms, corresponding to the specific goals of the program and/or partnerships. These partnership efforts can often be considered strategic in that the programs or individual partnerships help EHR achieve its mission and goals. Currently, EHR is one of the NSF directorates that is considering the role of public-private partnerships with respect to its mission and portfolio. EHR would like input and guidance with respect to the “right” mix of public-private partnerships. To this end, EHR is convening a subcommittee of the EHR Advisory Committee to advise the directorate.

Charge to the Subcommittee: The subcommittee is charged with developing one or more documents that address the following:

- Define a landscape of possibilities for EHR public-private partnerships, and identify different types of stakeholders, issues, and potential benefits for NSF/EHR, and potential partners.
- Advise EHR regarding how to develop a strong portfolio of public-private partnerships.
- Develop guidelines for strategic decision-making with respect to EHR entering into public-private partnerships.

The subcommittee may address issues such as:

- *State of the field (landscape):* Identify issues related to public-private partnerships that EHR should be aware of, or explore, as part of developing a strategic approach to partnerships.
- *Foci:* Provide recommendations with respect to focal areas that are most important or most promising for EHR public-private partnerships. The scope (including boundaries) of topics is currently very open. We welcome advice with respect to domains where the potential may best lie: workforce development, diversity, science of learning, etc.
- *Considerations:* Identify conditions under which a public-private partnership is a great idea, a good idea, and/or inadvisable for EHR.
- *Resources:* Advise with respect to the resources (human capacity and other resources) that EHR would likely need to be successful in various types of public-private partnerships.
- *Measures of success:* Recommend measures of success that EHR should consider when evaluating 1) a potential public-private partnership, and 2) ways in which a partnership is successful or not.

We ask that the subcommittee provide an update on their work at the Spring 2018 EHR AC meeting and submit a final report at the Fall 2018 EHR AC meeting.

Subcommittee membership: Dr. Liz Boylan, Program Director, Alfred P. Sloan Foundation, has agreed to chair the subcommittee. Other EHR AC members will include:

Dr. John T. Bruer, President Emeritus, James S. McDonnell Foundation
Mr. Muhammed Chaudhry, President and CEO, Silicon Valley Education Foundation
Dr. Debra Joy Pérez, Chief Measurement Evaluation and Learning Officer, Gordon and Betty Moore Foundation
Dr. Francisco C. Rodriguez, Chancellor, Los Angeles Community College District
Dr. Lilian Wu, Program Executive, Global University Programs, IBM Corporation

Additional AC members and external experts may be appointed to the subcommittee if particular additional expertise is needed.

TCUP/1994 Research Symposium



Agenda

Wednesday, May 24, 2017

8:30 am – 9:30 am

Opening remarks, **Room 375**

Jermelina Tupas, Acting Division Director, Human Resource Development, NSF

Jim Lewis, Acting Assistant Director, Education and Human Resources, NSF

Muquarrab Qureshi, Deputy Director, Institute of Youth, Family and Community, National Institute of Food and Agriculture, USDA

Oscar Murillo, Activity Manager, MUREP Institutional Research Opportunity, Minority University Research and Education Project, NASA

Torry Johnson, Activity Manager, MUREP for American Indian Alaska Native STEM Engagement, Minority University Research and Education Project, NASA

9:30 am – 10:35 am

Research Presentations, Session 1

Moderator:

Colleen Fitzgerald, Program Director, Documenting Endangered Languages, NSF

Oral presentations:

Jason Tinant, Oglala Lakota College

Devin Dragswolf, United Tribes Technical College

Dan Kinsey, A'aniiih Nakoda College

10:30 am – 10:50 am

Break

10:50 am – 11:50 am

Research Presentation, Session 2

Moderator:

Tim Grosser, National Program Leader, 1994 Tribal Programs, National Institute of Food and Agriculture, USDA

Oral presentations:

Misty Peacock, Northwest Indian College

Shawn Garnette, Oglala Lakota College

Lisa Bosman, College of Menominee Nation

11:50 am – 1:15 pm	<p>Participants' Lunch, Room 375</p> <p>Introduction of Keynote Speaker: <i>Brandon Jones</i>, Program Director, Directorate for Geosciences, NSF</p> <p>Keynote speaker: <i>Ryan Emanuel</i> (Lumbee), Associate Professor, Center for Geospatial Analytics, Department of Forestry and Environmental Resources, North Carolina State University</p>
1:15 pm – 2:45 pm	<p>Poster session 1</p> <p>Moderator: <i>Chantel Fuqua</i>, AAAS Fellow, NSF</p>
2:45 pm – 3:00 pm	Cookie Break
3:00 pm – 4:30 pm	<p>Poster session 2</p> <p>Moderator: <i>Chantel Fuqua</i>, AAAS Fellow, NSF</p>
4:30 pm	<p>Closing Remarks, Room 375</p> <p><i>Sonny Ramaswamy</i>, Director, National Institute of Food and Agriculture, USDA (invited)</p>

Thursday, May 25, 2017

7:00 am – 7:15 am	Depart from National Science Foundation (Atrium) to Goddard Space Flight Center, 8800 Greenbelt Road, Greenbelt, MD 20771
9:00 am – 11:30 am	Poster Session, Goddard Space Flight Center
11:30 am -12:30 pm	Lunch at Goddard Space Flight Center
12:30 pm – 1:30 pm	Depart from NASA, travel to NSF
1:30 pm – 2:30 pm	Debrief, Room Stafford II-555

SELECTIONS: What We Teach: K-12 School District Curriculum Adoption Process, 2017

I. Elaine Allen, Ph.D.

Professor of Biostatistics & Epidemiology, UCSF
Co-Director, Babson Survey Research Group

Jeff Seaman, Ph.D.

Co-Director, Babson Survey Research Group

September 2017

Key Findings

Some of the key findings from this study of 584 K-12 school districts, collected in the spring of 2017, representing 48 states and the District of Columbia:

- 77% of districts made at least one full-course curriculum adoption decision in the past three years.
- Larger districts (over 2,500 students) are the most likely to engage in adoption decisions (84%).
- Two-thirds of all districts make decisions in more than one subject area, with one-third selecting in two subject areas and one-third selecting in three or more.
- Most districts make an adoption decision for Mathematics (59%), followed by English Language Arts (44%), Science (29%), and History and Social Studies (19%).
- Almost all districts include teachers, district-level administrators, and principals in the decision-making process.
- Teachers have decision-making power in 94% of districts, followed by district-level administrators (75%), and principals (73%).
- Outside experts and parents are included in the adoption process in about half of all districts, but rarely have decision-making power (outside experts 21% and parents 18%).
- Districts cite five or more factors as being "very important" or "critical" in their adoption decision. The top three are comprehensive content, working with existing technology, and cost.
- Cost is far more important among districts with high rates of children in poverty (52% say it is "critical") than those with low rates of child poverty (26% say it is "critical").
- Districts adopt material from more than a dozen sources, but the top three publishers (McGraw-Hill, Pearson Education, and Houghton Mifflin Harcourt) command the market.
- The overwhelming reason districts cite as the reason to engage in an adoption decision is a need to select new material to meet changing standards.
- A majority of districts are replacing curricula resources that have been in use for 6 to 10 years.
- The entire adoption process takes less than a year, with most running 4 to 9 months.
- A majority of districts begin the process by considering 3 to 5 curricula alternatives, and narrow that number to 2 or 3 for final evaluation.
- District decision makers are reasonably aware of copyright and public domain licensing, but are far less aware of the Creative Commons alternative.

- Awareness of open educational resources (OER) is low, with only one-third of districts aware of the term and its licensing.
- Awareness and adoption of specific OER materials is higher than awareness of the term itself; two-thirds of all districts are aware of at least one open full-course curriculum alternative and over a third have actively considered at least one.
- Open licensed full-course curricula materials have been adopted by 16% of all districts.
- Districts with a high proportion of students in poverty have adopted open licensed full-course curricula materials at twice the rate of districts with low rates of child poverty (22% as compared to 10%).

Adoption Process

The "build it and they will come" approach to K-12 school district curriculum adoption, where an alternative is so compelling that districts rush to adopt it, will NOT work. School districts rarely engage in an adoption process because they have found a compelling curricula alternative. Almost all decisions are driven by a belief that the current materials are out dated or no longer meet current standards, not by the characteristics of potential alternatives.

There is no single decision maker. Adoption decisions are collaborative, with multiple players having decision-making power (almost always including teachers and district administrators, but often joined by others) and a second tier of those who can advise, but do not have decision-making power (typically from groups such as outside experts and parents).

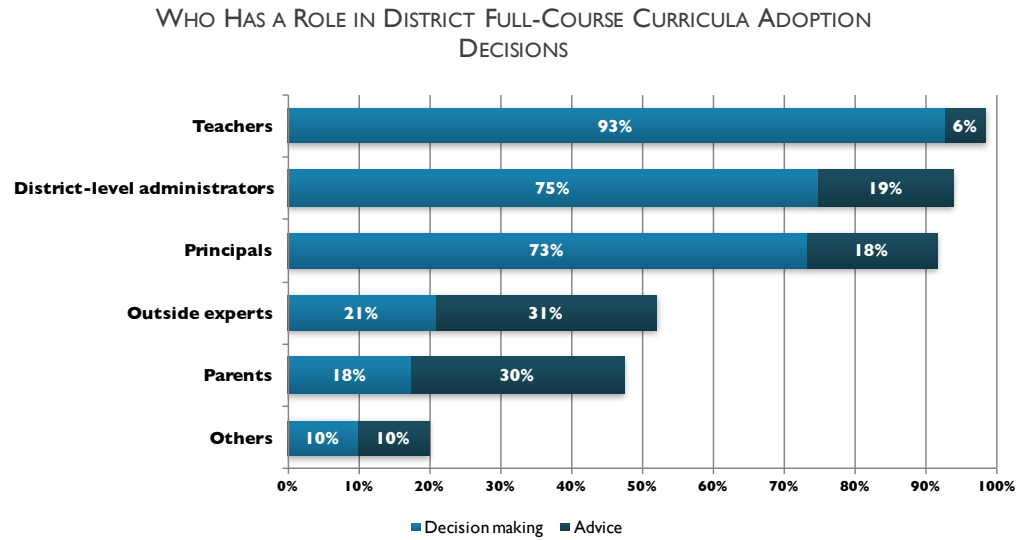
For all the players involved, decisions are made reasonably quickly, taking less than a year from start to finish. There is little evidence, given this decision speed, of any extensive "try it before you buy it" piloting of materials on a test basis before adoption.

While the pool of potential curricula publishers is very wide, the "big three" publishers (McGraw-Hill, Pearson Education, and Houghton Mifflin Harcourt) command the lion's share of all adoption decisions. While no other publishers come close to the scope of adoption of these three, that does not mean that others are not being adopted - they are, albeit at much lower rates than the big three.

As might be expected by a process involving this many decision makers, there is no one single factor that is cited as driving the decision - most districts cite five or more factors as being "very important" or "critical" to their decision. For all the variety of factors playing a role, there are three that are most common: comprehensive content, working with current technology, and cost.

Decision Makers

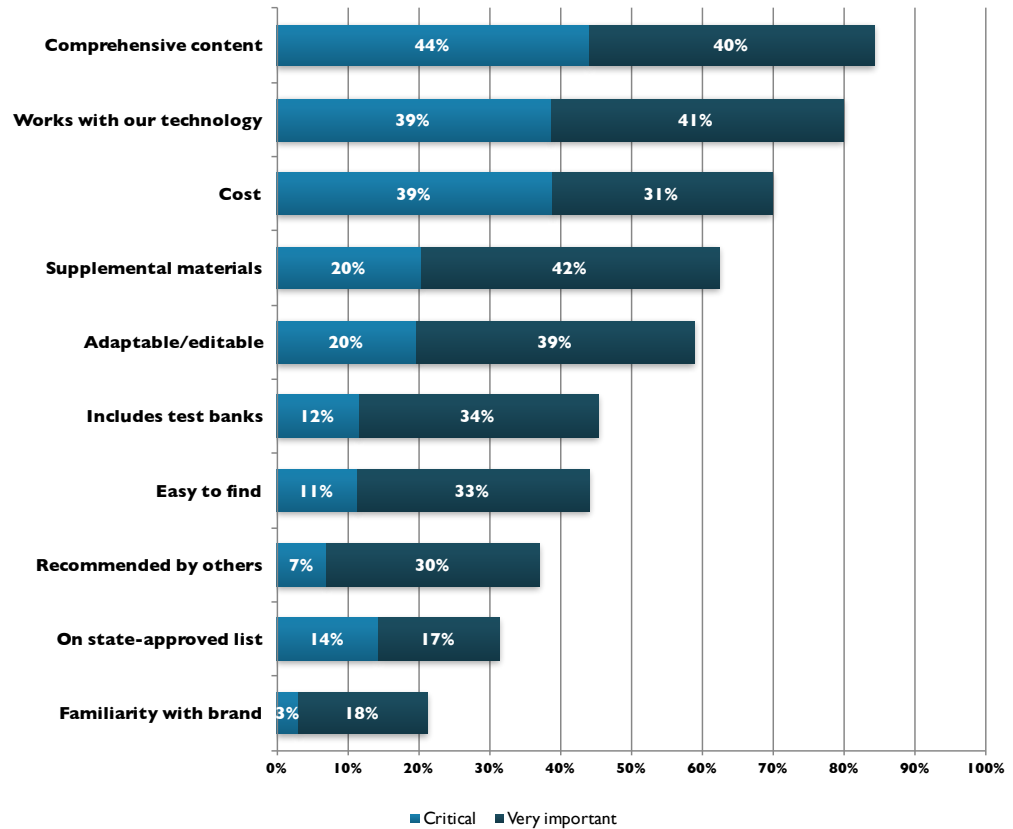
Adopting a full-course curriculum is a group activity. Teachers almost always play a role, typically joined by administrators and principals. Parents and outside experts are included by about half of the districts.



Factors Driving Selection

There is no single factor that drives a district selection process, with most districts citing five or more factors as "very important" or "critical" to their decision. Comprehensive content, working with current technology, and cost are cited most often.

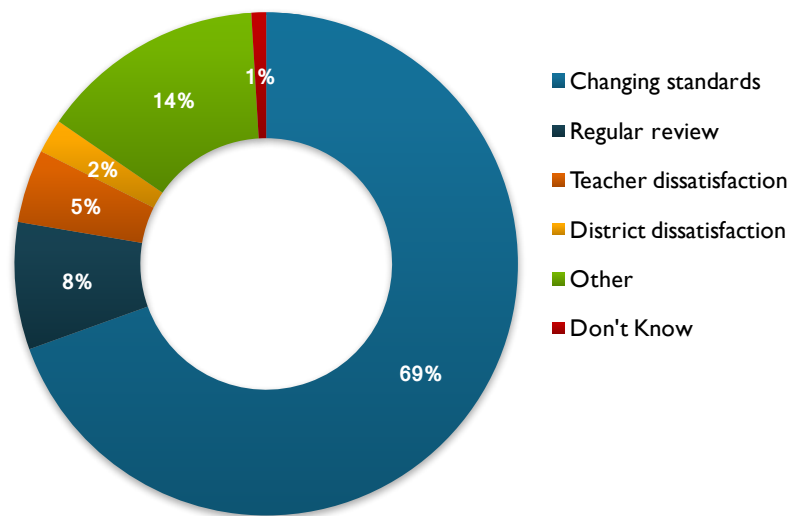
IMPORTANCE OF FACTORS IN DISTRICT FULL-COURSE CURRICULA ADOPTION DECISIONS



Decision Process

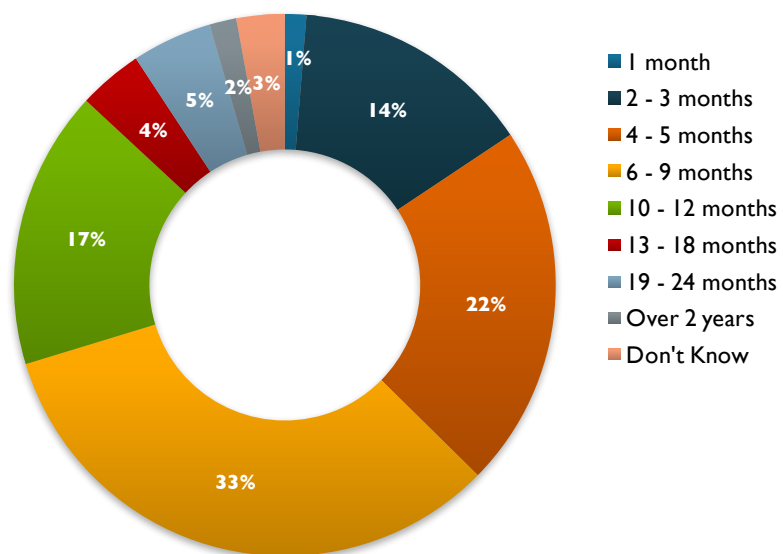
The vast majority of district adoption decisions are driven by an external factor: changing standards. Districts typically consider 3 to 5 alternatives initially, narrowing that number to 2 or 3 for a final decision. Most decision processes take the better part of a year to complete, with only 10% taking longer than that. The curricula materials being replaced are usually 6 to 10 years old.

WHAT WAS THE PRIMARY REASON FOR REPLACING THE PREVIOUS CURRICULA MATERIAL?



The curriculum decision process takes a number of months from beginning to end, but rarely exceeds a year in length.

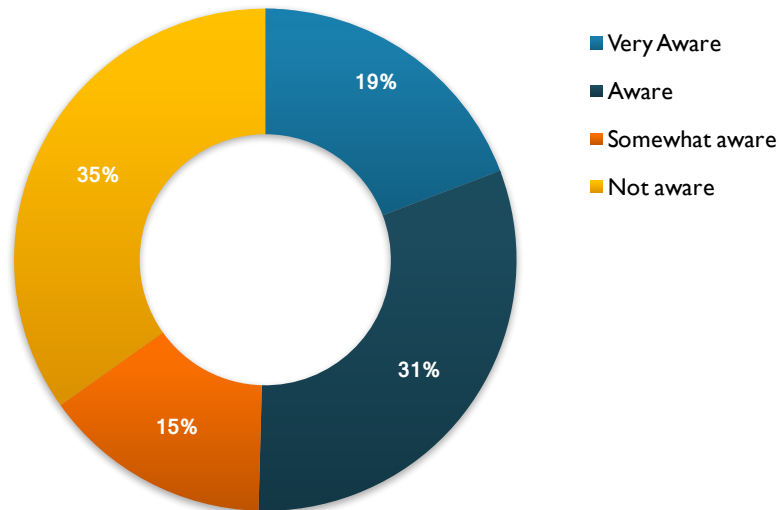
LENGTH OF CURRICULUM REVIEW PROCESS



Awareness of Licensing and Open Educational Resources

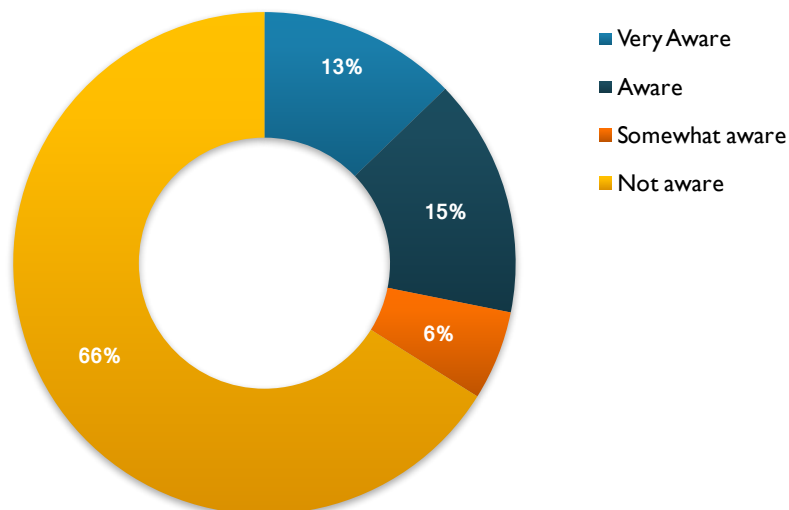
Awareness of copyright and the public domain is much higher among districts than is awareness of Creative Commons licensing. Nearly three-quarters of respondents claim some level of awareness of OER, but this drops to only one-third when awareness of licensing is included. Only 40% of districts have any level of awareness of the federal #GoOpen campaign.

AWARENESS OF OPEN EDUCATIONAL RESOURCES



The level of OER awareness drops when awareness of licensing is included, implying that respondents may be claiming to be aware of OER, but they have only a limited understanding of the concepts.

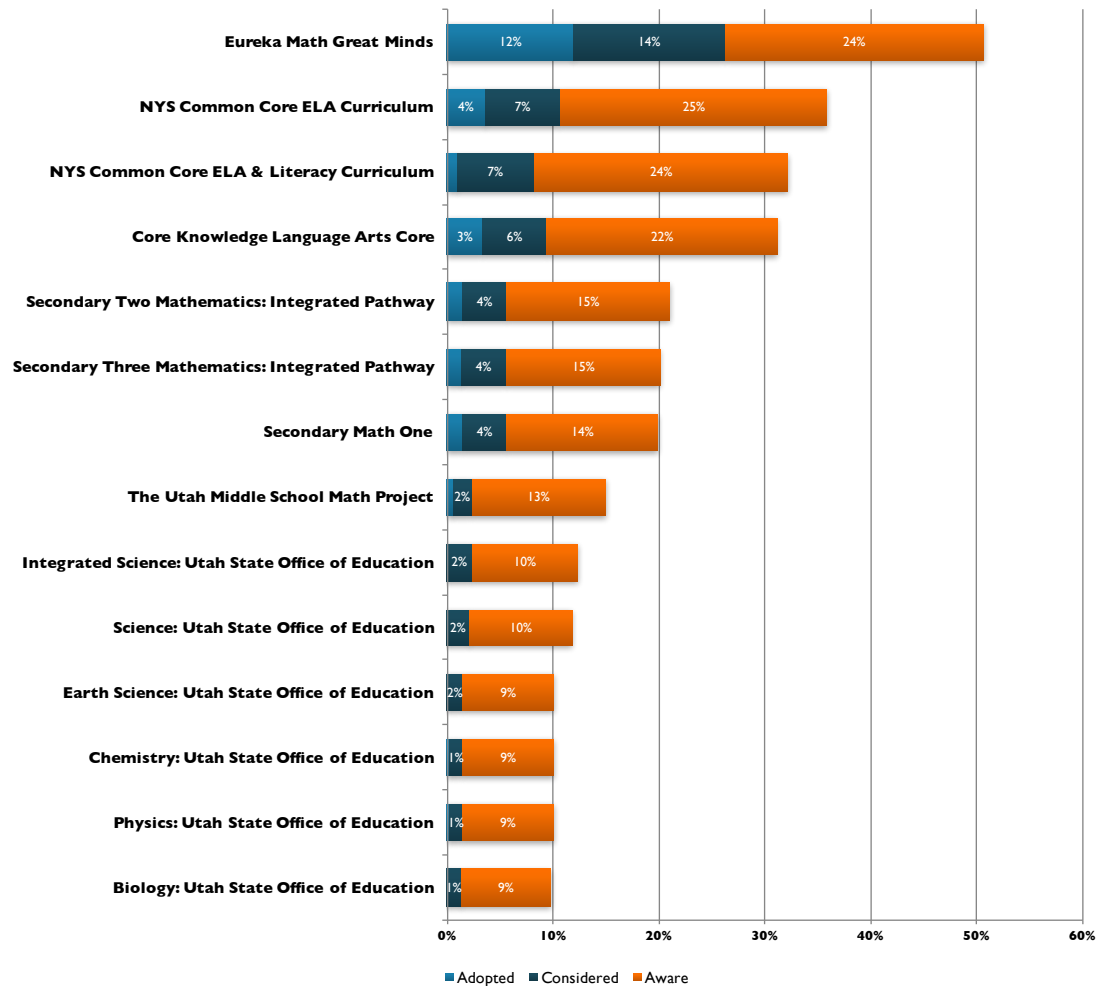
AWARENESS OF OER AND CREATIVE COMMONS



Open Educational Resource Material Adoptions

K-12 school districts have a greater degree of awareness of OER materials than of OER concepts and definitions. Two-thirds of all districts are aware of at least one OER full-course curriculum, with 37% having actively considered at least one for adoption. A full 16% of districts have adopted at least one full-course OER curriculum.

AWARENESS AND ADOPTION OF OER FULL-COURSE CURRICULA



SELECTIONS: Opening the Textbook: Educational Resources in U.S. Higher Education, 2017

I. Elaine Allen, Ph.D.

Professor of Biostatistics & Epidemiology, UCSF
Co-Director, Babson Survey Research Group

Jeff Seaman, Ph.D.

Co-Director, Babson Survey Research Group

2017

SUMMARY

Most higher education faculty are unaware of open educational resources (OER) – but they are interested and some are willing to give it a try. Survey results, using responses of over 2,700 U.S. faculty, show that OER is not a driving force in the selection of materials – with the most significant barrier being the effort required to find and evaluate such materials. Use of open resources is low overall, but somewhat higher for large enrollment introductory-level courses.

Selecting Teaching Resources

Almost all (90%) of teaching faculty selected new or revised educational materials for at least one course over the previous two years.

The most common factor cited by faculty when selecting educational resources was the cost to the students. After cost, the next most common was the comprehensiveness of the resource, followed by how easy it was to find.

Required textbooks

Virtually all courses (98%) require a textbook or other non-textbook material as part of their suite of required resources.

Required textbooks are more likely to be in printed form (69%) than digital. Faculty require digital textbooks in conjunction with a printed textbook more often than using only digital textbooks.

Licensing

Faculty continue to have a much greater level of awareness of the type of licensing often used for OER (Creative Commons) than they do of OER itself, and it is clear that they do not always associate this licensing with OER.

Open Educational Resources

Faculty awareness of OER has increased in the last year, but remains low.

Barriers to OER Adoption

The barriers to adopting OER most often cited by faculty are that “there are not enough resources for my subject” (49%), it is “too hard to find what I need” (48%) and “there is no comprehensive catalog of resources” (45%).

Future

The number of faculty claiming that they would use OER in the future (6.9%) is of the same order of magnitude of those already using open resources (5.3%). A larger group (31.3%) reports that they will consider future OER use.

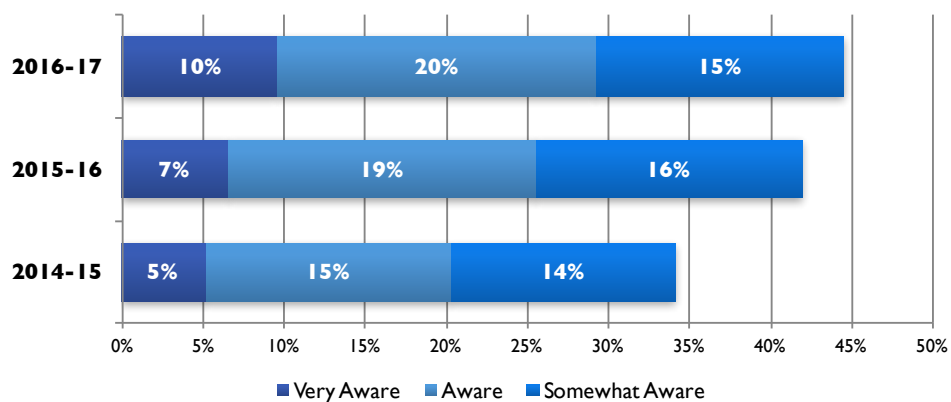
Cost to the Student

Nearly ninety percent of all faculty say that cost to the student is either “Important” or “Very important” in their selection of required course materials.

Awareness of Open Educational Resources

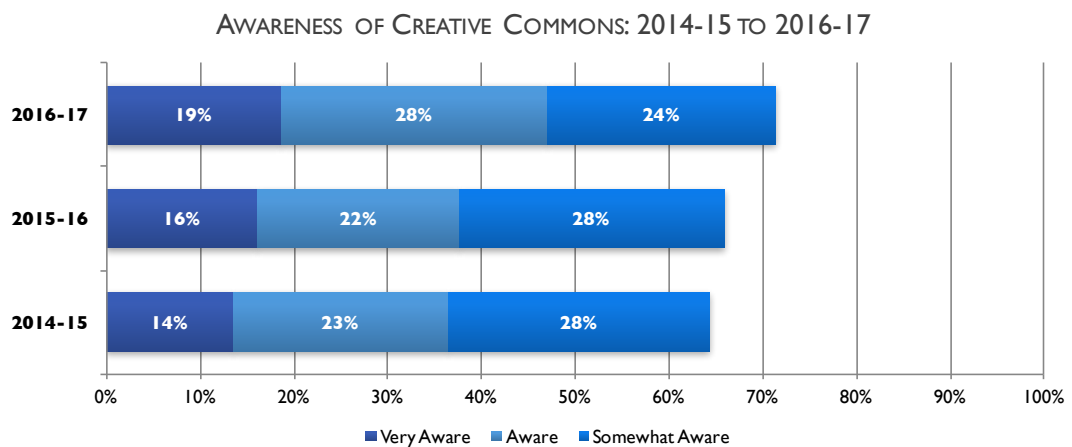
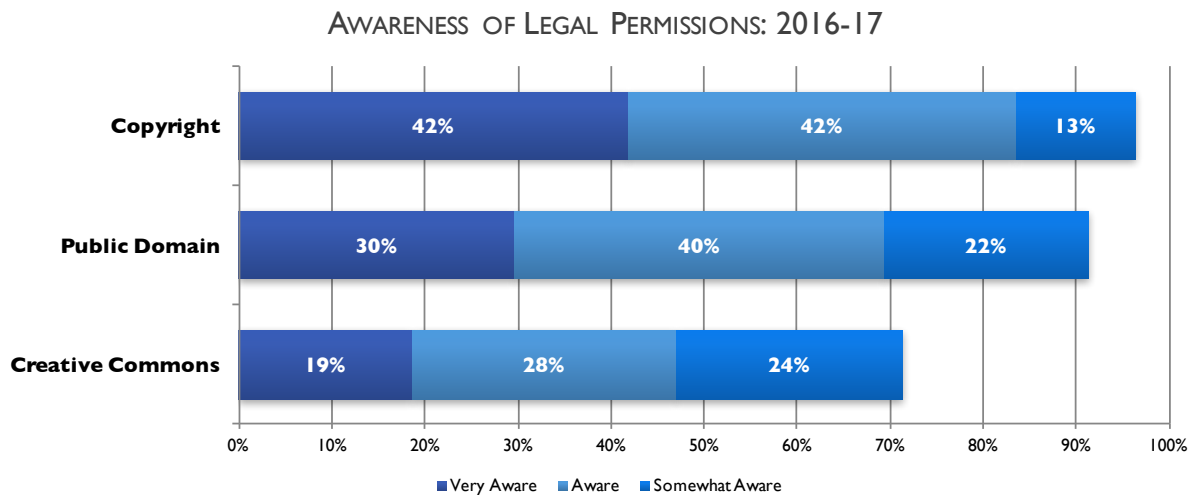
Many faculty members have only a vague understanding of the details of what constitutes open educational resources. Some confuse “open” with “free,” and assume all free resources are OER, while others confuse “open resources” with “open source,” and assume OER refers only to open source software. The 2016-17 results reinforce the trend of increased awareness of OER observed over the past two surveys.

AWARENESS OF OPEN EDUCATIONAL RESOURCES: 2014-15
TO 2016-17



Awareness of Licensing of Open Educational Resources

Open licensing and the ability to reuse and remix content is central to the concept of open educational resources¹. Most faculty continue to report a high degree of awareness of copyright status of their classroom content. The level of awareness of Creative Commons licensing, on the other hand, is somewhat lower, but has increased over time.



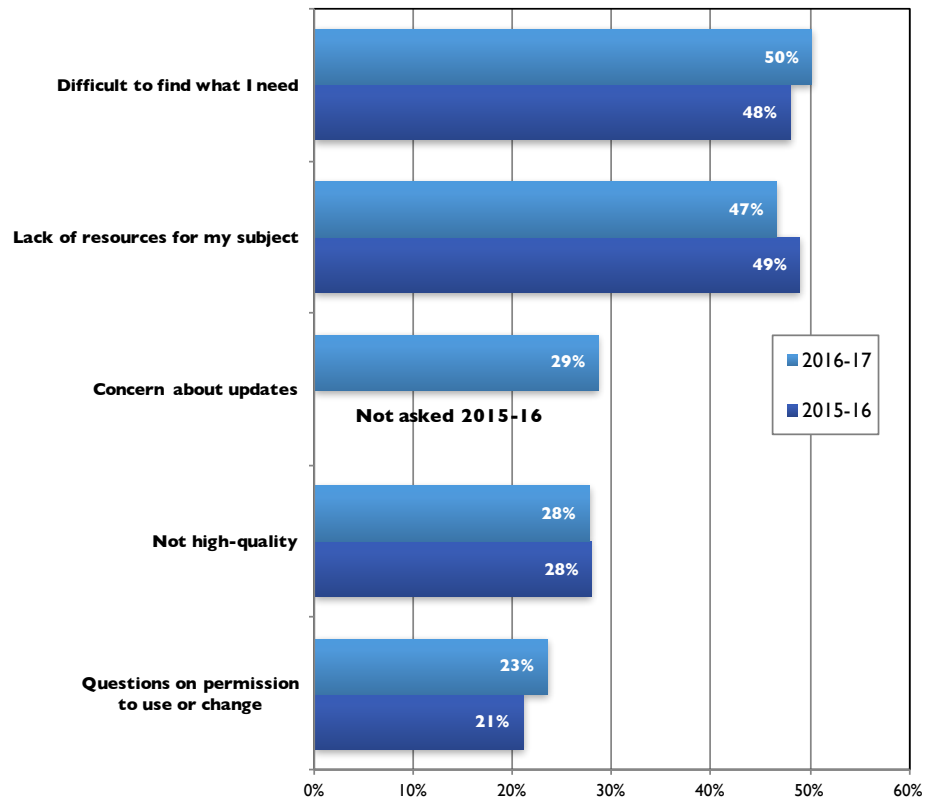
Potential Barriers

The most serious issues facing wider adoption of open educational resources continues to be the effort needed to find and evaluate suitable material. Nearly one-half of all faculty report that “there are not enough resources for my subject” (47%) and it is “too hard to find what I need” (50%). These rates are far in excess of those for any other potential barrier.

¹ David Wiley, The Access Compromise and the 5th R, Iterating Toward Openness, <http://opencontent.org/blog/archives/3221>

Many faculty members also voice concerns about the long-term viability of open educational resources, and worry about who will keep the materials current. Concerns about quality are reflected in both the fourth-mentioned item (28%), "not high quality," and "not current or up-to-date" (16%). There has been little change among faculty perceptions of these barriers. Comparing the 2016-17 results for the top-mentioned barriers to those reported last year shows only the smallest changes.

BARRIERS TO ADOPTION OF OER - 2016-17 AND 2015-16



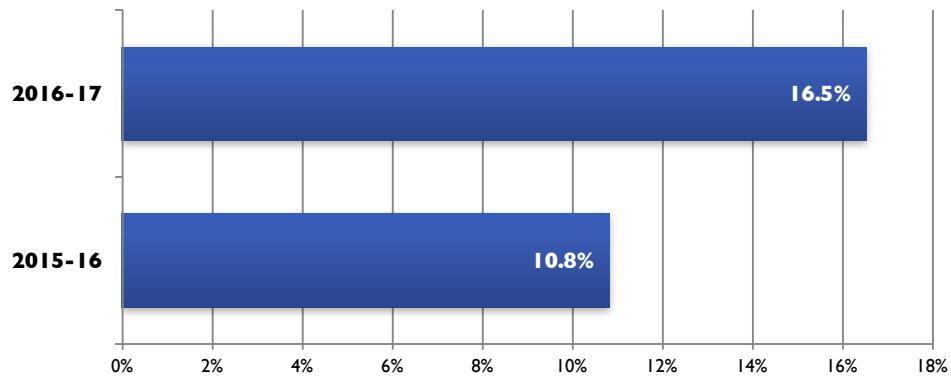
The Process of Textbook Adoption for Introductory Courses

The decisions of faculty who teach large enrollment introductory level courses affect far more students than those teaching smaller enrollment courses. OER publishers are well aware of this and have concentrated their offerings to serve these large enrollment courses. Introductory level courses are often taught in multiple sections (66%) and are typically required for at least some students (79%).

Faculty teaching these courses rank the importance of the various factors in their decision in exactly the same order as the general faculty, with only a few small differences in reported levels.

The rate of adoption of OpenStax (OER) textbooks among faculty teaching large enrollment courses is now at 16.5% - a rate which rivals that of most commercial textbooks. This is a substantial increase over the rate observed in 2015-16.

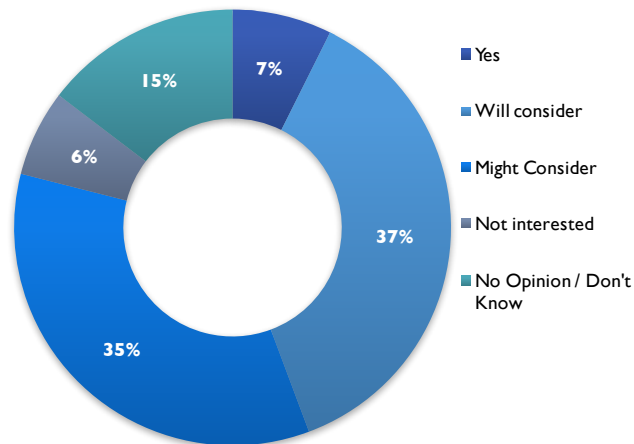
ADOPTED AN OPENSTAX TEXTBOOK FOR INTRODUCTORY
LEVEL COURSE: 2015-16 AND 2016-17



Future Use

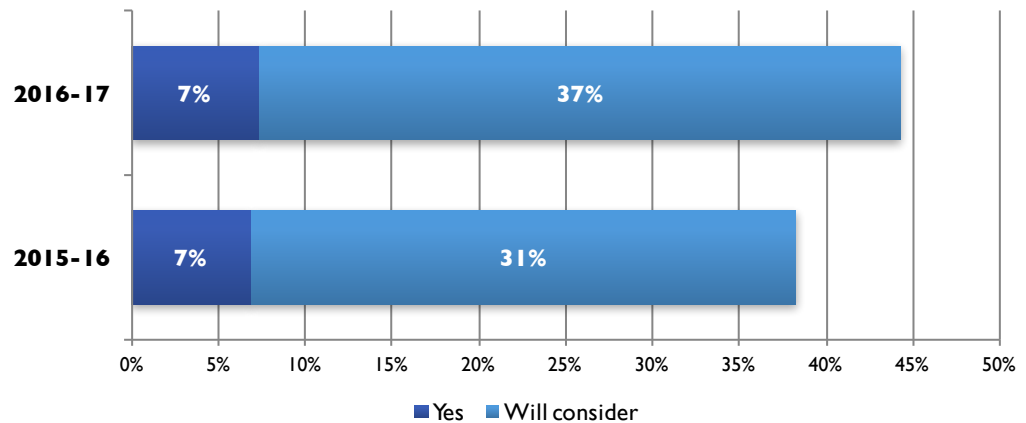
Faculty members who are not current users of open educational resources were asked if they expected to be using OER in the next three years. Only 6% reported that they were not interested, while an additional 15% had not yet decided and were unable to offer an opinion.

WILL YOU USE OPEN EDUCATIONAL
RESOURCES IN THE NEXT THREE YEARS?



There has been no change in the proportion of faculty who report that they will use open education resources in the next three years, remaining at the same 7% in 2016-17 as it was in 2015-16. There has been an increase in the number who report that they "Will consider" open education resources, growing from 31% in 2015-16 to 37% this year.

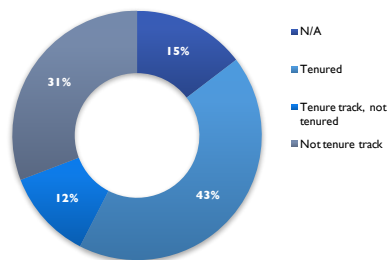
WILL YOU USE OPEN EDUCATIONAL RESOURCES IN THE NEXT THREE YEARS: 2015-16 AND 2016-17



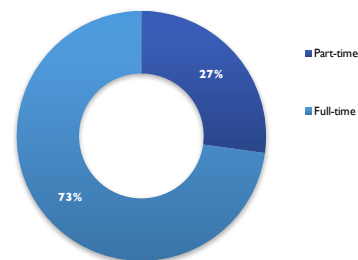
METHODOLOGY

A national faculty sample is used in this analysis, designed to be representative of the overall range of faculty teaching in U.S. higher education. A multiple-stage selection process was used for creating a stratified sample of all teaching faculty.

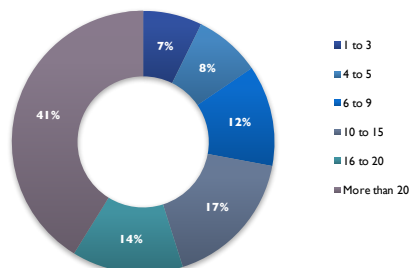
TENURE STATUS OF RESPONDENTS:
2016-17



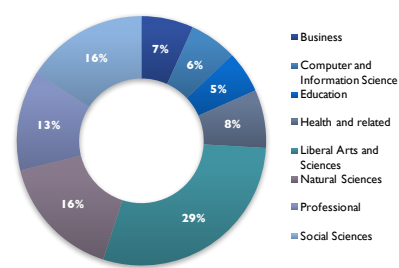
TEACHING STATUS OF RESPONDENTS:
2016-17



YEARS TEACHING OF RESPONDENTS: 2016-17



DISCIPLINE OF RESPONDENTS: 2016-17



To: EHR Advisory Committee
From: William. J. (Jim) Lewis, Acting Assistant Director of EHR
Date: November 21, 2017

I am writing to share with you the recommendations of the EHR Research Roadmap Working Group. This document had the input of more than 40 EHR staff, and was devised over a series of more than 10 meetings this past spring. The recommendations were presented at the October 23 EHR All-hands staff meeting, and discussed at the November 14 EHR Senior Staff meeting. This is a very substantial and thoughtful document, and I am pleased to accept it, and provide it to the Advisory Committee for discussion.

The working group was charged with developing a plan to enhance the scope, quality, and impact of EHR's research portfolio around identified and emerging program priorities. The working group in turn made 18 specific recommendations in areas such as promoting scientific transparency, building internal and external expertise, engaging stakeholders, and evaluating progress.

In reviewing these recommendations, I am struck that several are well connected to EHR efforts currently under way. For example, in terms of promoting scientific transparency, we have recently updated the EHR guidance on data management. The new IUSE solicitation also promotes transparency, by encouraging replication studies as well as sharing of educational materials. In terms of building internal expertise, we have initiated an EHR brown bag series held Wednesdays at lunchtime. In terms of building external expertise, the Life STEM initiative recently funded in-depth workshops for enhancing capacity in the field. The ECR program team has drafted a Dear Colleague Letter to encourage developments in research methodology. Of course, there is still more to be done.

I would welcome comments from the Advisory Committee on any aspect of this document. With that said, I would prioritize efforts to build research expertise in the field, given the nature of NSF's outward-looking emphasis. Hence, I would particularly welcome advice on this important topic.

Going forward, for each of the five main topics in this document, I intend to assign a champion within EHR, to ensure that efforts are moving forward.

Thanks to the Advisory Committee, in advance, for your wise advice.

Introduction

EHR's research portfolio is now at a strong position where projects come from the best ideas in the field and awards are made through NSF's gold standard merit review process. The projects are responding to STEM education priorities and contributing to the body of literature on these topics. To further strengthen these efforts, a research roadmap working group was formed and charged (see Appendix 1) with developing a plan to enhance the scope, quality, and impact of EHR's research portfolio around identified and emerging program priorities.

The research roadmap working group recommends four categories of issues that should be addressed. Three of these (promote scientific transparency, build research expertise, and engage stakeholders, broadly) arise from the changing nature of scientific research itself. The final area (evaluate) arises from ongoing efforts to build EHR's evaluation capacity and from the imperative to employ evidence in decisions to disburse Federal funds.

This working group has considered the question of just what *is* the EHR research portfolio. At the level of programs, this question should be answered as inclusively as possible. For example, ECR is clearly a research program. But a fellowship program, focusing on graduate education and training, is also a supporter of research. All EHR programs should potentially be considered as research programs, directly supporting research, contributing to research capacity (at the individual or institutional level), or perhaps as a source of research data. The details may vary from program to program, and in some cases may apply to only some program strands. With that said, there is great value in other aims of EHR programs such as resource development, individual or institutional support, and informing policy or practice, in their own right.

In considering the scope of the EHR research portfolio, portfolio analysis will be important, to study how things stand now, to assess changes, and possibly to point to future research directions. Note that EHR currently puts a great deal more resources into reviewing proposals, pre-award, than it does for reviewing projects, post-award. This working group did not perform a portfolio analysis. However, some of the recommendations in the following sections are relevant to this point.

The next sections provide high-level strategic recommendations and more detailed operational activities. Together they make up a measurable plan of actions that will over five years enhance EHR's research portfolio as it addresses future challenges in STEM and STEM education research. As EHR moves toward implementing some or all of these recommendations, additional consideration will be needed of potential costs and benefits.

Promote scientific transparency

The nature of research itself is changing as science is becoming more open, democratic, collaborative, and even crowd-sourced. Scientists as well as the general public increasingly take scientific transparency to be the norm. Promoting scientific transparency has the potential to

benefit researchers, government bodies and other funders, educators and learners, and the general public. These trends raise interesting challenges and opportunities for EHR. The concept of what it means to replicate education research--in the field--it not yet fully developed. Yet the nature of education research itself--involving student-, instructor- and school-level data--raises new privacy issues. There is also an opportunity to encourage the sharing and dissemination of educational materials funded by EHR.

- *Highlight the role of data management plans in the proposal review process.

- *Ensure that award abstracts provide information on research methods, theoretical framework, and approach to evaluation.

- *Fund research on scientific transparency itself in relation to the EHR portfolio and community (e.g., on replication, infrastructure needs, or privacy concerns).

- *Encourage/incentivize/require sharing of research plans, data, and materials, by investigators.

Build research expertise, internally

The expertise of EHR's staff is a great strength. EHR implicitly has a distributed expertise model, where there is a diversity of staff expertise, e.g., some program officers have expertise in a STEM content area, others in education research itself, and yet others in topics such as broadening participation or particular learning environments. EHR itself is a learning organization, thus EHR should prioritize learning opportunities for every staff member. These learning opportunities include research methods (quantitative, qualitative, multiple methods). Additionally, EHR should recognize that an important part of its own internal work is knowledge management, to leverage our distributed expertise and to make EHR more resilient.

- *Explicitly adopt a distributed expertise model for hiring, staffing, program management, and professional development, including a means for documenting staff expertise.

- *Every EHR staff member is encouraged to have an IDP, IR/D, or equivalent (including collaborative work), and should have the time to carry out these activities.

- *Build EHR's internal infrastructure for knowledge sharing and curation. Activities could range from brown bag events and more in-depth learning opportunities to depositories of our funded research, and should cut across divisions and directorates.

Build research expertise, externally

Ultimately, NSF's success rests on what happens in the field. NSF is where both discoveries and discoverers begin. EHR should consider the nature of its outreach activities, seeking those that have greater impact than webinars. In terms of EHR's funding portfolio, EHR should increase funding of activities and awards that build research expertise in identified areas of need and opportunity. Some of these activities will synergize with efforts to build internal research expertise.

- *Have deeper and more sustained outreach activities, beyond solicitations and webinars, to include PIs and potential PIs.

- *Fund more professional development opportunities for PIs and potential PIs (e.g., summer schools, award supplements for professional development).

- *Fund twice as many CAREER awards, while maintaining a competitive program.
- *Fund other field-building awards, targeted at graduate students, post-docs, or mid-career faculty, and fund projects that develop research and evaluation methodology itself.

Engage stakeholders, broadly

In an effort to inform funding priorities, EHR should engage stakeholders, both internal and external. Internally, EHR should look to expertise from senior staff, program officers, as well as science assistants and fellows. Externally, EHR should actively examine guidance from the National Science Board, the NSF Director, Congress, OSTP, other NSF directorates, other government agencies, reports from the National Academies, other research funders (both for-profit and non-profit), input from professional associations, policymakers and practitioners to augment existing advice mechanisms (e.g., Advisory Committee, COVs).

- * Conduct retreats to determine if the motivation for existing programs and investments is well grounded in advice from appropriate stakeholders, and inclusively engage staff in any necessary realignment of investments.
- *As warranted, undertake Requests for Information (RFI) to solicit ideas from the field or other stakeholders.
- *In consideration of portfolio analyses, programs should fund more synthesis proposals and forward-looking workshops.
- *Re-engage and re-target National Academies investments (e.g., diversify perspectives and contemplate decadal or similar surveys for STEM education researchers).

Evaluate

EHR has a longstanding commitment to monitoring its research initiatives, having established the Evaluation and Monitoring Group (EMG); funded third-party program evaluations; and appointed staff members to design, manage, provide technical oversight on, conduct, and report results of numerous monitoring and assessment activities. Traditionally these activities have been undertaken at the program level for ongoing program management, continuous quality improvement, and accountability purposes. Thus, EHR's monitoring and evaluation infrastructure is arguably more fragmented and less well-integrated than desirable. To facilitate broader, more nimble, thematic assessments of efforts to enhance the scope, quality, and impact of the research elements of all the Directorate's programs, EHR should:

- * Identify opportunities to integrate (where appropriate, streamlining or enhancing) data and tool development for monitoring and evaluative purposes, working collaboratively across programs and with NSF's Evaluation and Assessment Capability.
- * Charge the EMG with developing a framework for evaluating EHR research programs, capturing common content as well as differences.
- * Monitor the progress, provide data to inform continuous quality improvement, and evaluate the success of all the above research roadmap activities—individually and collectively—in enhancing the scope, quality, and impact of EHR's research portfolio.

Conclusion

Over a short period (about two months), the research roadmap working group held more than ten meetings and made substantial progress in terms of making concrete recommendations that will enhance EHR's research portfolio as it faces emerging challenges. It is hoped that these efforts will lay the groundwork for future activities, including discussions about implementation as well as further research planning. For example, EHR should pursue the following issues.

*Consider the alignment across EHR programs, e.g., how can an education program provide data for a research program, how can education and research efforts across various STEM topics be coordinated?

*More generally, create a set of guiding principles for EHR's research investments.

*Connect the recommendations in this document more explicitly to realistic workflow and staffing plans, so that these recommendations will be sustainable.

Appendix 1: Charge to Working Group

The research roadmap working group is charged with developing a plan to enhance the scope, quality, and impact of EHR's research portfolio around identified and emerging program priorities. The plan may entail the *alignment, focus, and prioritization within and across EHR programs*, with particular attention to methodology, theoretical grounding, and strategies for promoting scientific transparency and assessing the results of EHR's research investments.

The working group will consider and recommend potential changes (phased in over a 5-year period) around three main themes:

- I. Developing Expertise (internally and externally)
 - Staffing and staff professional development
 - Building capacity in the field, seeking expert reviewers, and optimizing the panel review process
- II. Engaging the Field
 - Creating language for solicitations (and management plans), program announcements, DCLs and similar mechanisms
 - Seeking guidance to inform directions and priorities, and to foster innovation
- III. Conducting Evaluations (Program level or thematic)

This charge was given from Dr. William. J. (Jim) Lewis, acting Assistant Director of EHR, to the research roadmap working group. Some of the categories of recommendations (building internal and external expertise, engaging the field, and evaluate) map directly onto this charge. The item in the charge on solicitation language led to recommendations cutting across categories. There is also a set of recommendations directly aimed at scientific transparency. Although the issue of EHR's priorities was discussed extensively, this document does not recommend EHR priorities so much as recommend means for setting future priorities.

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(EHR Senior Staff recommendations, November 2017)

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Informal Science and K-12 STEM Education

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9. Navigating Uncharted Waters: First-Generation Native Hawaiian College Students in STEM
https://www.researchgate.net/publication/316976821_Navigating_Uncharted_Waters_First-Generation_Native_Hawaiian_College_Students_in_STEM
10. NEST 2014: Views from the Trainees—Talking About What Matters in Efforts to Diversify the STEM Workforce
<http://www.lifescied.org/content/13/4/587.full>
11. Culturally Diverse Undergraduate Researchers' Academic Outcomes and Perceptions of Their Research Mentoring Relationships
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TCUP/1994 Research Symposium

May 24-25, 2017



Abstract Book

1994 Land Grant Institutions Programs

National Institute of Food and Agriculture

Tribal Colleges and Universities Program

National Science Foundation

Minority University Research and Education Project

National Aeronautics and Space Administration

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Introduction to Engineering: A Multidisciplinary Active Learning Approach Writing Engineering Children's Books

Lisa Bosman, Ryan Winn, Kelli Chelberg - College of Menominee Nation

History suggests that most incoming freshmen engineering students arrive on campus with both a lack of knowledge about the varying engineering disciplines and challenges with their levels of college readiness. As a result, dropout rates are higher than most other disciplines. We propose this is likely due to lack of engagement in applying engineering to a real-world setting and limited prior knowledge about what engineers do. Recent main stream media also supports the notion that the field of engineering is not good at “telling their story,” which tends to turn away women and minorities. Many people have a narrow understanding of engineering and what engineers do, and richer storytelling is a great start to get more people, including females and underrepresented students interested in engineering (Seepersad, 2016). Books and movies, such as “Hidden Figures” are doing just that; showing that opening the doors for women and minorities is a prerequisite to success (Booker, 2017). The purpose of this research is to respond to the following question: “How does incorporating the development of engineering children’s books into an Intro to Engineering course increase learning outcomes and build interest in engineering?” Book creation in an engineering course may seem unconventional to many, however, the efforts produced students with both sound communication skills and a fundamental understanding of engineering that has laid the foundation for their academic careers. Our recent manuscript highlights the overall process, what went well, and areas for improvement. This special Introduction to Engineering course has been offered three times at a minority-serving college in northern Wisconsin. The course requires engineering students to work in teams to create a children’s book featuring a specific engineering field, with the support of an instructional team consisting of faculty within engineering, education, and the humanities. Students are required to create a fictional book series that introduces young readers to the engineering fields using a variety of fictional characters to capture underrepresented demographics (e.g. females, minorities, and people with disabilities). The students were required to research engineering disciplines and brainstorm about potential conflicts that their characters could overcome. They drafted, shared, edited, and revised their texts first in small groups and later with the full classroom. The students then plotted their artwork with a student illustrator and used a free online publishing tool (CreateSpace through Amazon) to design and upload the books for publication. The books are collectively called the “Future Engineers in Training Series,” and including a variety of engineering disciplines. Initial exploratory analysis resulted in qualitative student support for the project. Several students noted that the process allowed them to go above and beyond to not only learn about different engineering disciplines, but gain a better understanding of how to explain those disciplines to non-technical people. Most students

agreed that the opportunity to pass knowledge onto the next generation was a great motivational factor for completing the project.

Preliminary Results from Bioassessments Used to Monitor Mine Impacted Streams Flowing on the Fort Belknap Indian Reservation

Dan Kinsey – Aaniiih Nakoda College

Several streams flowing in the Little Rocky Mountains have headwaters that originate in the now defunct Zortman-Landusky cyanide heap-leach gold mines. The streams originate in the mined area and flow on to the Fort Belknap Indian Reservation. These streams flow into Little People's Creek which provides fishing and recreation sites for local residents. According to the Montana Department of Environmental Quality TMDL 2012 data, these creeks are impacted by metals of concern that include; aluminum arsenic, cadmium, iron, nickel, zinc, and selenium. These metals of concern are toxic to aquatic life and can have adverse effects on an organism's survival, activity, growth, metabolism, and reproduction. The purpose of this study was to conduct a bioassessment of mine-impacted streams, King Creek and South Big Horn Creek flowing on to the Fort Belknap Indian Reservation as compared to the North Fork of Little People's Creek, a non-impacted stream in the same area. The bioassessment is focused on benthic macroinvertebrates and periphyton as indicators of biotic integrity. Current data was collected during the summer and fall of 2016, the first year of an ongoing 2 year project. This data was also compared to data gathered in 1996 to see if there was a difference in the biotic indices after 20 years. Kicknet samples were collected for the macroinvertebrates and the periphyton was collected by scraping the diatoms off of rocks selected from the streambeds. The macroinvertebrates and diatom samples for each stream were collected at the same site. The macroinvertebrates were identified to the family level and the diatoms identified to species with the assistance of Rithron Associates, Inc of Missoula, MT. The metrics used for data analysis included the following; Family Richness, Family Biotic Index (FBI), Biological Monitoring Working Party (BMWP), Average Score Per Taxon (ASPT), Shannon-Weiner, and % EPT. A two-way analysis of variance (ANOVA) was performed to compare data sets in order to test the effects of mine impacts over time. Our current macroinvertebrate indices from King Creek show that even after reclamation that was conducted approximately 20 years ago, the FBI and the ASPT indicate that fairly substantial pollution is likely. The South Bighorn Creek macroinvertebrate FBI and ASPT also show substantial pollution is likely. For a stream not impacted by the mining activity, the North Fork of Little Peoples Creek, the macroinvertebrate FBI and ASPT indicates very good water quality.

The Virulence of Atrazine when Exposed to the *Batrachochytrium dendrobatidis* Chytrid Fungus

Devin Dragswolf, Julie Stock-Porter, and Stefan Jaronski – United Tribes Technical College

Global populations of amphibians have been on the decline in recent years generating a cause for concern. Exposure to chemical pesticides and pathogenic diseases are two of the major causes of these declining populations. Atrazine is one of the world's most widely used pesticides available; which has been linked to amphibian declines. Evidence has also surfaced that the devastating *Batrachochytrium dendrobatidis* (Bd) pathogenic chytrid fungus has also negatively impacted amphibian populations. The purpose of this study was to determine if different levels of Atrazine had effects on the virulence and growth of this fungus. Cultures were grown in TGH liquid medium (1.4% trytone, 4% gel hydrolysate, 0.5% lactose) and diluted with dimethyl sulfoxide (DMSO). Then, nine varying concentrations of Atrazine were used (250, 125, 62.5, 31.1, 15.6, 7.8, 3.9, 2, and 1 ppm). Four 96-well plates were used to grow the Bd and Atrazine/DMSO solution was applied. Cultures were scanned through a BioTek plate reader and adjusted to read at an optical density of 490 nanometers. Atrazine did not have a detrimental effect on the growth of Bd, however, there may be a correlation between higher atrazine concentrations and increased Bd growth.

The Salish Sea Research Center at Northwest Indian College

Melissa Peacock, Andres Quesada, Rachel Arnold, and Marco Hatch – Northwest Indian College

Tribal communities are closely connected with their natural surroundings and take a long-term perspective on ecological changes, stewardship, and management of resources. This is crucial to maintain ecosystem health and resiliency when confronted by anthropogenic impacts and climate change. The Salish Sea Research Center (SSRC), part of Northwest Indian College, is located on the Lummi Reservation and is staffed by Native American scientists to serve the students and the surrounding communities by connecting marine science with the cultures of the Pacific Northwest. Northwest Indian College's SSRC provides technology and tools for Indigenous students to ask and answer research questions that are important to their communities, using a combination of traditional and non-traditional methods. In the Pacific Northwest, the Salish Sea is highly impacted by humans through agriculture, urbanization, and climate change, yet also holds tremendous commercial and cultural value for thousands of people who rely on its resources. We acknowledge that the Coast Salish people have been fishing these waters since time immemorial, and ask what lessons can be learned from the people who have promoted sustainability of the land, the Sea, and the resources. Examples of the research being conducted by staff, faculty, and students at the SSRC include multiple projects to explore mariculture practices. Highlighted projects include an investigation of the Longfin Smelt, or "Hooligans" as they are known by the Indigenous peoples of the Salish Sea. This project used the newly supplied genetics lab to identify local populations and worked closely with Lummi Natural Resources to build an effective stock management program for this important subsistence harvest fish. The SSRC is also supporting efforts to examine the relationship between food availability, clam diet, and traditional harvest practices of manila clams on Lummi tide flats. Our newest project is to design a long-term Harmful Algal Bloom monitoring program, focused on data sovereignty and management of seafood that are impacted by harmful algae. Joining all of these projects together is our grounding in Coast Salish culture and using place-based focused research to fortify the ecological and cultural resilience of the Salish Sea.

Differential Assimilative Capacity to Land Use Intensity for Hydrogeomorphically Dissimilar Streams on the Pine Ridge Reservation, southwestern South Dakota

Charles Jason Tinant - Oglala Lakota College

Stream biological community composition arises from dynamic interactions among the biological elements of the ecosystem and between these elements and the physical environment. Spatiotemporal hydrogeomorphic variability among watersheds results in differential biological community responses to natural variation in the physical environment, and to changes in land use intensity. The capacity of a stream to assimilate pollutants can be estimated from macroinvertebrate community responses to water quality parameters once hydrogeomorphic groups have been identified. As part of the Environmental Protection Agency (EPA) 106-and 319-programs, macroinvertebrate and water quality samples are collected for about 30% of the approximately forty water quality sampling stations for the Pine Ridge reservation in southwestern South Dakota. An initial time-series analysis for these data collected between 1993-2015 indicates that ecosystem functional declines are correlated with lower annual precipitation, but are not well correlated with increasing nutrient concentrations for stream segments with event-dominated and mixed-flow hydrologic regimes. The correlation between ecosystem functional decline and lower annual precipitation is less evident for streams with base flow-dominated regimes. The “flushing flow” hypothesis is one theory our laboratory proposes to explain differences in macroinvertebrate community response along a hydrogeomorphic gradient, in which the frequency of stream scour by high flow events influences stream ecosystem structure and function by regulating algal standing stocks, net ecosystem respiration and near-hypoxic event likelihood. Hydrogeomorphic group identification is a first step in evaluating the “flushing flow” hypothesis. The results of this study focused on hydrogeomorphic group identification for the Pine Ridge reservation by principal component analysis (PCA), quadratic discriminant analysis (QDA) to identify misclassified observations, and the explanation of multiple regression of precipitation and nutrient concentrations using hydrogeomorphic group membership as an explanatory variable.

Potential Sources of Background Radiation on the Pine Ridge Reservation in Southwest South Dakota

J. Shawn Garnette, Charles Jason Tinant, James Sanovia, and Hannan E. LaGarry - Oglala Lakota College

Ionizing radiation was measured during the 2015-2016 field seasons at 206 locations across the Pine Ridge Reservation (PRR) using a Geiger-Muller counter held at one meter above ground level. Three measurements of three minutes each were taken and results were averaged. Radiation intensities were plotted as points using Global Information Systems (GIS) software. Radiation intensity for the study region was interpolated through Gaussian process regression (kriging) and nonparametric descriptive statistics of the sample data were compiled. Potential sources of elevated background radiation were identified near the White Clay Fault in the Slim Buttes Area of the PRR. The results of the sampling indicated a median background radiation intensity for the PRR of 23.0 microrems per hour (uRem/hr) with an interquartile range of 6.4 uRem/hr. Radiation intensity near the White Clay fault averaged 34.0 uRem/hr, the 95th-percentile of measured radiation intensities across the PRR. We interpreted the annual background radiation dose for the study area of 200 to 300 mRem/yr to be an aggregate measurement of ionizing radiation from cosmic sources, along with naturally-occurring uranium and breakdown products, including thorium and radon. Future work will focus on the White Clay fault region and off reservation sites near Edgemont, SD and Crawford, NE to also include areas around current and abandoned Uranium mines. Further data analysis includes increasing sampling spatial density, also the monitoring and abatement of radon in homes to evaluate multiple hypotheses in explaining sources of relatively elevated radiation intensity near the White Clay fault.

Poster Abstracts

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Autonomous and Robotic Radiation Implementation Research to Detect Radiation Contamination Levels

Kirsch Davis - Navajo Technical University

The use of autonomous and robotic systems (drones, hexapod, and rovers), will be implemented to do research on radiation contamination levels on the Navajo Reservation in New Mexico. Accordingly, uranium (U) mining occurred on the Navajo Reservation for over 40 years (1944 to 1986), where over 30 million tons were extracted on Navajo Territory. To clarify, uranium is a metal element found in different parts of the universe, having the characteristics of nuclear energy that emits radiation. However, due to the slow process of radioactive decay, radiation contamination is harmful to the environment, and the general population, causing harmful life threatening illnesses. In addition, radioactive decay can last for several years up to billions of years. Consequently, radiation contamination has left over 500 abandoned mines and homes, along with drinking water with elevated levels of radiation on the Navajo Reservation. In addition, radiation contamination has resulted in increases within the population of lung cancer, bone cancer, and impaired kidney function from exposure in radionuclides in drinking water. The use of different types of drones and ground vehicles is programmed to have autonomous missions that will be implemented to collect data for research studies and purposes on radiation contamination levels. Autonomous tasks performed by the systems will collect data using different types of payloads and sensors (imaging sensors electro optical/infrared (EO/IR), radiation detectors, Faro Scanner, cameras, methane sensors). In continuation, aerial views, imagery, and ground scanning will produce and create a 3D topographic maps for the rugged and inaccessible terrain. Similarly, geographical interface system (GIS) using an LiDar detector will create a detailed map of contaminated areas. For cause and reason, data collected will help inform regulation agencies like the Environmental Protection Agency (EPA). In conclusion, the collection of this radiation contamination data will help in the advancement of cleaning up radiation on the Navajo Nation, and will be beneficial for future generations of people living on the Navajo Reservation.

Pollinators on the Fort Berthold Indian Reservation

Alexis Archambault, Tanya Sand-Driver - Nueta Hidatsa Sahnish College

For Native Americans, the Juneberry plant has played a significant role due to its nutritional value, medicinal purposes, and cultural importance. This culturally significant plant had virtually disappeared by 80% within the surrounding natural environment. To further understand the native pollinator role in the vitality of the Juneberry plant population, five sampling sites on the Fort Berthold Indian Reservation were used to collect multiple species of bees. Various species of bees were collected at the sites using blue and yellow vanes, along with blue, yellow, and white bowls. The data collection assisted in better understanding the role of local native pollinators and established baseline data. Results of this study have shown at least five species of Bumbus (bees) are the major pollinators on the Fort Berthold Indian Reservation.

Management of Sustained Harvesting of Local Huckleberry Plants on the Flathead Indian Reservation

Alfred Balletto - Salish Kootenai College

The Confederated Salish, Kootenai, and Pend d'Oreille (CSKT) have a cultural and preservation interest in the research of local huckleberry plants that grow on the Flathead Indian Reservation to ensure future management of sustained harvesting. This research was conducted to document in site baseline soil moisture characteristics with complimentary huckleberry productivity and data being collected by ongoing collaborative research (USGS, CSKT, SKC). The low commercial agriculture suitability of the wild huckleberry plant (*Vaccinium sp*) which tend to grow at higher elevations has led to little applied research. Global and local climate change, particularly on high elevation ecosystems, has been observed to influence phenological changes in similar species and may directly or indirectly control earlier berry ripening. Twenty-four soil moisture data points were collected using two independent techniques at nine huckleberry sites. Individual sites varied by aspect, slope, and elevation. Soil moisture ranged between 0.5% and 53.2% at the site with an average of 16.5% and between the pre and post ripe stages there was an overall reduction in soil moisture of 6.9%. Though timing of berry development may be linked to environmental conditions like soil moisture, more data will be required to make any definitive or statistical determinations. Data collection was limited by timing and duration of study but this preliminary data suggested that soil moisture percentage may be a determining factor in date of berry ripening. Elevation and plant tolerances need further study due to variations in environmental stresses from snowpack, snow melt off, precipitation, plant community, canopy cover and insolation driven evapotranspiration. The continuation of this project will provide more knowledge of plant and environmental interactions, further helping direct the management of this culturally relevant food source for future generations and assist in the assurance of the plant species survival.

NASA-Swarmathon: Virtual Robotic Simulation Competition

Conrad Begay – Navajo Technical University

What would be the most efficient algorithm to locate, retrieve, and drop off resources from and to a certain location? The NASA Swarmathon is a research competition that incorporates autonomous physical robots in searching for resources in distant places. The laboratory team has been working to build the physical robot (swarmie) that was given by the UNM computer science department, configuring the wireless Local Area Network, and ensuring that the Intel Next Unit of Computer (NUC) and Pololu module work together. The laboratory team also utilized the ROS platform during the building of the robot, which was downloaded through a server based repository. After downloading and installation of the ROS platform, the process of downloading and installation of full plugins was acquired. These plugins are the base software for the webcam, GPS, ultra-sonic sensor, grabber's motors, and Inertial Measurement Unit (IMU). Once the installation and configuration was complete, the setup of a github repository was acquired to use a get-pull command on the ROS software framework from the github account of the BCLab-UNM repository. When the ROS software framework incorporates the virtual environment simulation of the competition arena, the control of the virtual robot's functions. This simulator relates to physical robot's competition where the webcam can identify a four-dimensional cube and all hardware components functionalities can be operational. The ROS software framework retains different directories that withhold scripts of code that manipulate and control the simulated environment, plugins, acceleration, rotation, recognition algorithm and virtual model of the robots. The laboratory data collected during the building of the robot provided a better understanding of the different scripts and how they relate to one script called mobility.cpp. Within the mobility.cpp script there is a main block of code called Mobility State Machine. The structure has loops, declarations and variables that are defined throughout the framework of the ROS software. During this physical competition, our laboratory worked to program an efficient search algorithm to use in locating, retrieving, and dropping off 256 resources at certain location in set amount of time. Rules of the competition also state that a high school research outreach should be conducted. The hands-on and interactive activities conducted during the high school research outreach inspired students in learn more about STEM careers and robotics.

Eco-distribution and Diversity of Edible and Medicinal Mushrooms of Standing Rock Sioux Reservation in North & South Dakota

Thomas Deville, Francis Onduso - Sitting Bull College

Mushrooms still grow wild and are hunted for food and medicine. They also provide ingredients for pharmaceuticals, enzymes for detergents, are used in biocontrol, and are anti-oxidant, anti-cancer, prebiotic, immunomodulating, anti-inflammatory, anti-microbial, and anti-diabetic (Patel, S. & Goyal, A. 2012). They are leavening and fermentation agents, and, as natural decomposers, are environmental cleaners. Environmental change threatens the existence of wild mushrooms, their habitats and their genome. The objectives of this study were to survey and document edible and medicinal mushrooms species and their habitats in the reservation. This information is important for planning habitat conservation practices and giving direction for further research before losing vital local knowledge. We hypothesized that uphill forest, riverine forest, floodplain and grassland habitats have no significant differences in fungi species richness and diversity. Transect lines 10m wide by 100m long were established in various habitats. The survey was done during summer in July and August 2016. The null hypothesis was rejected since the ANOVA F-test and Simpson's Diversity Index revealed that there are statistically significant differences in mushroom richness ($\alpha = 0.05$; $P < 0.0001^*$) and diversity across the habitats (in descending order: riverine forest, uphill forest, floodplain and grassland). These differences may be caused by both natural and human influences unique to each of the habitat studied. Future studies will focus on genotyping these mushrooms to investigate genetic linkages within and between the edible and medicinal mushrooms. Specific cultural values surrounding the use of mushrooms for food and medicine will also be considered.

Sugar Content as a Driver of Resource Partitioning Between Foraging Bears and Tribal Harvest of Huckleberries

Celina Gray - Salish Kootenai College

There are 35 species of huckleberries (*Vaccinium*), but little is known about wild huckleberry plants and their surrounding ecological processes. Huckleberries provide cultural resources that include traditional foods and customs, social elements, and economic products. During 2016, Salish Kootenai College interns partnered with U.S. Geological Survey and Confederate Salish and Kootenai Tribes (CSKT) to research ecological characteristics of huckleberries on the Flathead Indian Reservation in Montana. Phenology data for ten plants at ten different sites were recorded. Cover type, brix% (a measure of sugar content), and bear sign were documented. Remote plant and wildlife cameras were installed at each study site, and line transects were conducted to measure berry productivity and bear sign in and around each huckleberry plot. When berries reached peak ripeness, brix% was calculated using a field refractometer. Data were analyzed to determine statistically significant relationships between bears and brix% of berries. Bear sign was most prevalent at the more remote locations with higher brix% and plentiful berries. Huckleberries facilitate important ecological relationships for Native Americans within the Flathead Indian Reservation (and the extended Pacific Northwest). Semi-structured community interviews are planned for 2017 to learn more about the ecological relationships of tribal harvest and foraging bears from the tribal perspective.

Design and Fabrication of the Sea-SIC Unmanned Surface Vehicle for the purpose of Ocean Color Data Collection

Jaynine Parico - Kapi'olani Community College

Weather, time, and environmental circumstances often limit people who collect marine data by diving underwater or operating equipment on boats. Additionally, such operations can be dangerous. Sending a robotic system such as a USV (unmanned surface vehicle) can be a safer and potentially easier alternative to collect data from Hawaii's local waters. The current research objective is to design and fabricate a remotely operated, unmanned surface vehicle in order to collect ocean color data for oceanography studies. Collecting information on ocean color can give scientists a better understanding of ocean waters and the impact of phytoplankton in the area. Phytoplankton is micro algae that thrive in the upper part of the ocean as they need sunlight to live. They are a vital part of the aquatic ecosystem and are first in line of the food chain. Not only are they important for the ocean, they serve a great purpose on the surface as well. Through photosynthesis, the phytoplankton provides almost half of the oxygen we breath. Monitoring ocean color can also identify problematic algae blooms caused by spikes of phytoplankton populations. A prototype-USV named the Sea-SIC (SWATH Information Collector) armed with a miniature spectrometer will be used to conduct ocean color frequencies to fulfill these needs. The design used to build the prototype is heavily based off the SWATH model (Small Waterplane Area Twin Hull). The SWATH design provides stability for imaging equipment, as the hulls are completely submerged underwater - minimizing absorption of wave energy and maximizing ship stability. A good example of the success of the SWATH design for data collection is the RV Kilo Moana (University of Hawaii oceanographic research ship). Once the primary objective is met, the USV prototype will undergo design modifications and additional sensor considerations.

Genetic Health of Bison on the Pine Ridge Reservation

Tada Vargas, Alessandra Higa - Oglala Lakota College
Forrest Cain, Shane Sarver - Black Hills State University

North American bison populations exhibit a range of genetic purity depending on the history and management of individual herds. Determining the purity of a population is vital because ultimately, the level of introgression will impact the individuals' behavior and reproductive viability. This study assessed the introgression of cattle genes present in the Oglala Sioux Tribe's bison herd. Maternal introgression, inherited through mitochondrial DNA, was determined by screening 900 individuals using a polymerase chain reaction (PCR) based assay. A subset of 336 individuals were screened for paternal introgression, inherited through nuclear DNA, using a panel of 18 microsatellite nuclear DNA markers. The nuclear based assay product was genotyped to detect the presence of introgression. No evidence of cattle mtDNA was detected. Nuclear DNA analysis indicate introgression in 47 of 336 (14%) subset groups. Furthermore, genetic diversity was evaluated through data collected by genotyping. Results showed high diversity in two diagnostic markers. However, four loci evaluated displayed little to no genetic variation for all individuals. This study emphasized the significance of genetic analysis of interspecies introgression for wildlife population management and species conservation. Future work will evaluate genetic diversity through linkage disequilibrium, relatedness, and Hardy Weinberg using GenePop.

Math Immersion Model: Calculus ready in one semester!

Maria Bautista and Kira Yamashita – Kapi'olani Community College

Mathematics can often present a barrier for prospective STEM majors. Incoming Kapi'olani Community College students are frequently placed in pre-college level math courses, which may delay their enrollment in calculus and STEM courses by up to two years. Responding to the challenges of calculus readiness facing community college students pursuing STEM degrees, the Math Immersion Model (MIM) program aims to successfully bring students to calculus level in just one semester. Through MIM, students are immersed in an accelerated program comprising college algebra, pre-calculus, trigonometry, and a STEM research experience course in which they are given the opportunity to apply their acquired mathematical skills and/or participate in a scientific-based semester-long STEM project. Student learning and achievement are supported daily through Peer-Led-Unit-Sessions (PLUS) led by peer mentors recruited from and trained through the program. Significant outcomes data collected show the successes and challenges of students participating in this program through two semesters of implementation.

Abundance of Native Bees Surrounding Huckleberry Patches on the Flathead Indian Reservation

Laura Hernández - Salish Kootenai College

Observational data collection of native bees and other potential pollinators was taken during several phenological stages of Mountain huckleberry (*Vaccinium* spp.) as an indicator of abundance of native bees in the vicinity of huckleberry plants. It is thought that native bumblebees play a vital role in pollinating huckleberry flowers (Dolan 2016). This research study took place shortly after flowering and during the later phenological stages of huckleberry plants. Research methods included transects to determine bee abundance and observations of potential pollinators visiting flowering plants in the vicinity of huckleberry plants. Research was conducted during the summer months of June and July in montane and subalpine forests of Northwestern Montana. Bumblebees live throughout the year and thus are dependent on the nectar of multiple species of flowering plants during their active season (Moisset and Buchmann 2011). This knowledge sparked the interest for learning more about native pollinator abundance during these summer months, and which other species of flowering plants pollinators in the vicinity of huckleberries may use as a nectar food source after the huckleberry flowers are developing into fruits. The overall goal of this research study was to be a part of filling in some of the existing gaps in baseline knowledge on native bees on the Flathead Indian Reservation. This study included several hypotheses related to native bees abundance:

- 1) Native bee abundance is greater at lower elevation sites due to warmer temperatures and earlier flowering of plants compared to higher elevation.
- 2) Bee abundance will be lower when wind speeds are higher because wind influences insects' ability to fly.
- 3) South and west facing will have a higher abundance of bees than north and east facing aspects because sunlight and temperatures will be warmer on south and west facing slopes.

Native potential pollinator abundance and bumblebee abundance showed a negative relationship between elevation and wind speed. No relationship was found between the remaining variables (temperature, slope, aspect) and potential pollinator abundance or bumblebee abundance.

Changes in the Nushagak Estuary: Society, Climate, and Arctic Biotic

Todd Radenbaugh - University of Alaska Fairbanks

The Nushagak Estuary is a large water body covering over 110 thousand km² in southwest Alaska close to northeastern Bristol Bay. The Nushagak Estuary also receives the waters from four rivers important in the regional salmon lifecycle. Significant changes in this estuary have coincided with increasing inputs from society and numbers of extreme climatic events, such as more severe storms and warm spells in winter. Given the large breadth of change in culture, ecology, and climate in the Nushagak, we need to closely examine the ecological functions and the full range of services this estuary provides (e.g. fisheries, nutrient cycling, diversifying wildlife habitats, safe harbors, and distributing and cleaning fish waste). The fauna of the Nushagak estuary is composed mostly of Arctic euryhaline species such as *Saduria* Isopods, gammarid amphipods, rainbow smelt, and beluga whales. The temperature tolerances of most these species is below 15°C, but the estuary has been warming and recent summer temperatures have been measured above 20°C, which have been shown to be lethal to Arctic species. Other important ecological data gaps for the estuary include the influences of summer fish processing waste on food webs, seasonal population changes in biota, and primary productivity vs. marine derived nourishment. We need a more robust understanding of how the Nushagak and other Bristol Bay estuaries function in a warming Bering Sea so that scientists and policy makers can better address regional concerns. We must also be prepared that scientists may discover hard truths due to measured change.

Complete Sustainability: Turning Waste Cooking Oil into Biodiesel and Soap

Portia Yee - Kapi'olani Community College

Biodiesel is a sustainable energy fuel processed with oils from plant or animal sources. The use of biodiesel as an energy source reduces our dependability on fossil fuels which emit carbon dioxide and sulfur dioxide into the environment upon combustion. As more consumers transition to the use of biodiesel, fewer emissions are released, reducing the damage to our ecosystem. Converting to a more sustainable energy source such as biodiesel will reduce waste and utilize a safer production process. The Kapi'olani Community College Culinary Department has been working on producing a large quantity of biodiesel using waste canola oil from the cafeteria and the BioPro™ 190 Processor. The biodiesel product was tested in the laboratory to determine if the quality met ASTM standards. Continuing with sustainable practices, the laboratory converted the byproduct of this process, glycerin, into liquid soap.

Solar Medicine Cooler

Erika Begody - Navajo Technical University

On the Navajo Reservation, many Navajo people live with medical conditions which require medication treatment. Some of the medications prescribed are required to be refrigerated. On the reservation, many people are isolated, meaning they live far from hospitals and stores. Many homes on the reservation do not have electricity. The solar medicine cooler purpose is to help individuals store their medication in a controlled refrigerated environment. The goal is to improve the quality of life by lessening complication from not taking medications as prescribed. The solar medicine cooler could also eliminate hospitalization from complications which can decrease health care cost. The solar medicine cooler will be portable and energy efficient. This project will eventually be available globally to help individuals in many parts of the world. The solar medicine cooler could potentially save and improve lives of many people around the world.

Characterizing Common Effective Strategies of the Tribal College Research Mentor

Jeremy Guinn – United Tribes Technical College

Undergraduate research has increasingly become integral to the recruitment and retention of STEM students in tribal colleges (TCUs). Summer research experiences and course-integrated research projects have become common practice. Mentoring undergraduate researchers, especially early-career students, requires mentors who are adept at experimental design, guiding students through the process of collecting, analyzing, and presenting data, and managing multiple competing pressures on time. TCU mentors must also be skilled in navigating campus inhibitors to conducting research and assisting TCU students in navigating challenges. We adapted the Entering Mentoring program, which is typically used for training new research mentors, to provide a foundation for a small-group discussion of best practices used by experienced TCU mentors. Within this group of research mentors, a myriad of strengths were perceived in their students, including students' willingness to devote substantial amounts of their time to their projects. Also noted were significant non-academic life-skills (such as outdoor survival, trouble-shooting, and engine repair) –skills learned growing up on reservations which enhanced the efficiency of field research programs. TCU students possess a unique inquisitiveness about how nature works and a distinct empathy for their communities and protection of natural resources. Common challenges experienced by mentors revolved around students' varying levels of resiliency to "drama" in their lives, maintaining communications with their mentors, and higher level professional relationships. Effective strategies used by this group of TCU mentors included focusing on developing confidence in each student, devoting large amounts of time to engage in research projects on an intimate level, encouraging peer interactions but also independence, and ensuring student ownership of projects and products of the research. Over the course of the 3-year grant cycle, student participants also provided input on their gains during research programs and about their mentors. Students scored their own gains high (i.e. an average of >4.0 on a 5-point Likert scale) in areas such as Thinking and Working Like a Scientist, Confidence in Ability to Do Research and Contribute to Science, and Research Skills. Similarly, they consistently rated their Working Relationship with their Research Mentor as Excellent and that they were Very Satisfied by the Support and Guidance from the Research Mentor. External researchers have found that there is no need to structure research experience programs differently for unique racial/ethnic groups – we agree but with some recommendations for deeper, more meaningful experiencing for both the undergraduate student and the research mentor. Using these initial discussions, we are designing a broader research project to characterize research mentoring and mentors at tribal colleges. Surveys will be distributed to TCUs mentors and/or students. Common practices among TCU research mentors that are

identified will made available to new faculty entering TCUs and innovative practices will be shared with existing TCU mentors.

The Power of Place: How Cross-Curricular Cases are Creating Learning Communities, Revitalizing Indigenous Knowledges, and Increasing STEM Retention

Emma Norman, Northwest Indian College

This presentation reports on the initial research that examines the impact of a pedagogical approach that includes cross-curricular, multi-year cases which are culturally relevant, place-based, and community focused. In this research, we hypothesize that this approach will increase tribal college students' long-term success in the STEM field and will contribute to a revitalization of Indigenous Knowledges. This inquiry was framed by two goals: 1) testing the ability of curricular design to improve student success in the STEM field and contribute to wider goals of revitalization of Indigenous Knowledges; and 2) testing the ability of fostering a community of learners to increase student success in the STEM field and build long-term capacity. The presentation will highlight the steps taken to identify, implement, and adopt the cross-curricular cases to the Native Environmental Science program. In addition, the presentation will report on the initial findings of STEM recruitment, retention, and cultural revitalization.

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Dutch Elm Vectors: Scolytinae (Elm Bark Beetle) Presence in *Ulmus americana* Trees in Urban and Rural Areas of Burleigh County

Amy Jackson, Jeremy Guinn - United Tribes Technical College

Dutch Elm Disease was first discovered in the U.S. in the 1920s and caused severe depletion of *Ulmus americana* trees. There are two types of fungi, *Ophiostoma ulmi* and *O. novo-ulmi*, which affect elm trees in the region. *Ulmus americana* is the state tree of North Dakota, but it is no longer recommended for planting due to the need for frequent treatments against the disease. Dutch elm disease is caused by a virulent fungus carried on backs of bark elm beetles (Scolytinae) that rot trees from within. In North Dakota the three types of elm bark beetle are the *Hylurgopinus rufipes*, *Scolytus multistriatus* and the *Scolytus schevyrewi*. The objective of this study, was to examine the current status of elm bark beetles in Burleigh County, ND to determine if the potential for Dutch elm disease still exists in the area. In addition, we investigated whether routine treatments on urban trees reduced the prevalence of the beetles compared to rural locations. We sampled beetles using bark beetle sticky traps at various paired locations to determine if historical treatment of the trees had an impact on current bark beetle populations. All three species were found commonly in urban areas, while only the European species was found in high numbers in rural zones. All three species were found on all untreated trees, while only European bark beetles were found in substantial numbers on treated trees. This indicated that elm bark beetle treatment was effective on both banded and native species, but not the European species. This preliminary study provided support for the treatment of bark beetles for the preservation of American elm trees, and indicates a need for continued monitoring of European bark beetles which were unaffected by the treatment.

Revitalizing Cultural Knowledge and Honoring Sacred Waters: Documenting the Oral History of Life on the Nooksack River

Althea Wilson – Northwest Indian College

The purpose of this work is to preserve knowledge and to share the story of the Nooksack River from the perspective of the Lummi People, who still fish and hold sacred the land at the mouth of the river. With constant changes to our environment and public policy affecting the tribe, the stories connected to the Nooksack River become invaluable. These stories are reminders of what is important to our people and our culture, as the Lummi People have a rich understanding and oral history of the land in which they live. It is important to the Lummi community, through documentation of the oral history, to reflect how the community thrived and interacted within the natural world. Through these studies, work will begin to document these stories, true to their experiences, and by doing so, add to the collective history of life on the Nooksack River. Project work will include story telling by those who lived in the fishing village as well as completion of a video timeline to paint the true untold story of daily life on the river. This poster will outline the initial findings from this project.

Funds from NSF Project Number: 1461441

The Association between Continual, Year-round Hunting and Bellowing rate of Bison Bulls during the Rut in western South Dakota

Ronald J. Sarnoa - Hofstra University

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Alessandra Higa - Oglala Lakota College

Eddie Childers - Badlands National Park

Trudy Ecoffeye - Natural Resources Conservation Service

The impact of hunting (selective harvest, trophy hunting) on the demography of mammals is well documented. However, despite continual year-round hunting of bison in some populations, little is known about how the behavior of survivors may be altered. Therefore, in this initial study, we used focal-animal observations in adjacent populations of continually hunted and protected Plains bison (*Bison bison*) in western South Dakota, to examine the potential impact of hunting on bellowing rate— an important behavior that serves to intimidate rival bulls and potentially influences mate choice by females. In addition to hunting, we investigated how the number of attendant males, number of adult females, group size, and number of days from the start of rut influenced bellowing rate. Bulls bellowed an order of magnitude more often in the protected area than in hunted areas, whereas neither hunted population significantly differed in bellowing rate. Hunting was significantly and negatively associated with bellowing rate, while all other predictors were found to be positively associated with bellowing rate. Furthermore, the impact of hunting on bellowing rate became more pronounced (i.e., dampened bellowing rate more strongly) as the number of attendant males increased. Changes in bellowing behavior of bulls (and possibly mate choice by cows) can alter breeding opportunities. Therefore, our data suggest the need for studies with broader-scale geographical and temporal replication to determine the extent that continual year-round hunting has on the bellowing rate of bison during the rut. If reduced bellowing is associated with human hunting on a larger scale, then wildlife managers may need to adjust hunting rate and duration, timing (season), and the time lag between hunting events in order to insure that bison are able to express their full repertoire of natural mating behaviors. We thank Oglala Lakota College (OLC), Oglala Sioux Parks and Recreation Association, and Badlands National Park for permissions to conduct this study (Permit #: BADL-2013-SCI-0009) funded by USDA/NIFA/TCRGP Award #2011-38424-30914. OLC staff and students received research support from NSF/TUCP Award #0903686.

Particulate Matter Exposure along Designated Traffic Routes on the Fort Berthold Reservation, North Dakota

Florence Laducer-Garrett, Kerry Hartman - Nueta Hidatsa Sahnish College
Bernhardt Saini-Eidukat, Shafiqur Rahman, and Md. Borhan - North Dakota State University

Increased road traffic related to oil development on the Fort Berthold Reservation in western North Dakota has resulted in increased road dust generated along the many unpaved roads. There is a concern among residents regarding whether fine particulate matter (PM) in this "fugitive dust" results in adverse health effects. The goal of this research was to quantify the amount, particle-size distribution, and mineral composition of dust being generated along highly traveled gravel roads in the Reservation that are impacted by petroleum development. MiniVol™ TAS portable samplers (Air metrics, Springfield, OR, USA) were deployed to collect dust samples. Dust was quantified as particulate concentration in terms of $\mu\text{g}/\text{m}^3$ of air, for particles of size less than $2.5\ \mu\text{m}$ and $10\ \mu\text{m}$ (PM_{2.5} and PM₁₀, respectively). Scanning electron microscopy (SEM), X-ray Diffraction (XRD) and chemical analysis were used to characterize and identify the mineralogical, biological and chemical components of the dust samples.

Identifying Paleo-Gravel Deposits on the Pine Ridge Indian Reservation Using Geospatial Techniques

Lester Richards – Oglala Lakota College

Meandering from West to East on the northern plains on the Pine Ridge Indian Reservation in Southwest South Dakota is a paleo-gravel deposit called the Pliocene-Pleistocene Medicine Root Gravels deposit. Little is known about the remnants of the deposit other than the paleo-channel is approximately eight miles wide and 50 miles in length (400 mi²), and consists of a layer of metamorphic and igneous rock deposits. This large paleo-deposit is of great interest to the Oglala Sioux Tribe as they need new reliable locations of gravel sites for tribal road and building construction. This project used geospatial techniques to see if vector data and remote sensed imagery such as Landsat 8, NAIP, soils and digital elevation models could help identify potential gravel site areas. Initial results showed that elevation, slope and soil play a role in identifying present known gravel deposits. Presently, further studies are underway using supervised and unsupervised classification to better understand NAIP imagery and selected Landsat 8 bands. The remote sensed classification datasets can then be used to help identify other potential paleo-gravel sites. The completed map and datasets of the project area could provide insight to the Oglala Sioux Tribe and its affiliated offices to determine areas fit for gravel excavating for construction.

Amphibious Submarine Drone

Nicholas J. Begaye, Hansen Tapaha - Navajo Technical University

In 2015, there was an environmental disaster that occurred when the Environmental Protection Agency (EPA) accidentally released toxic waste water in the Animas River in Colorado. The toxic waste water made its way into New Mexico and into the San Juan River. High levels of heavy metal, such as copper, lead, arsenic, cadmium, and manganese, were found in the river. This incident has raised some questions as to how much this accident has effected the local water sources. Even though the river might seem clean, how much of the metals and toxins have settled within the riverbed soil? At Navajo Technical University (NTU), six senior undergraduate students are collaboratively working on an underwater remotely operated vehicle (ROV) for their Capstone project. The Capstone group consisted of four Industrial Engineering students and two Electrical Engineering students. The Capstone team incorporated sensors on to the ROV that will test the pH levels along with the installation of a testing probe that will collect soil samples. Using this underwater ROV, the Capstone team will collect samples from the Animas river and conduct analyses to determine the possible toxins left in the water supply.

Bioavailable and Leachable Fraction Concentrations of (As, Cd, Se, Th, and U) from Stratigraphic Units and Vegetation Uptake of Orella Bridge, Sioux County, NE by ICP-MS

Patrisse M. Vasek, Hannan E. LaGarry, Charles Jason Tinant - Oglala Lakota College
Marcello B. B. Guerra - Black Hills State University

Uranium is currently mined at the Crow Buttes mine near Harding, Nebraska. The mining operation is topographically up gradient from the Pine Ridge Reservation in south-central South Dakota. The potential for contamination from mining activities is of serious concern to the Oglala Sioux Tribe and surrounding communities. Uranium ore is extracted in-situ from the lowermost Chamberlain Pass Formation and uppermost Pierre Shale. The Peanut Peak Member of the Chamberlain Pass Formation, and the Yellow Mounds Paleosol outcrop nearby the Pine Ridge Reservation – Nebraska border at the Orella Bridge and near Red Shirt Table, South Dakota. We collected and processed samples of rock, regolith, soils, and commonly occurring plants: *Artemisia ludoviciana* (Silver sage), *Atemesia frigida* (Fringed sage), *Glycyrrhiza lepidota* (American licorice), *Penstemon grandifloras* (Shell-leaved penstemon), *Helianthus maximiliani* (Maximilian sunflower), *Ratibida columnifera* (Yellow coneflower), *Echinacea angustifolia* (Narrow-leaved coneflower), *Hordeum jubatum* (Foxtail barley), *Bromus japonicas* (Japanese brome), *Cirsium arvense* (Canada thistle), *Melilotus* spp. (yellow sweet clover), *Tragopogon dubius* (Goatsbeard), *Psoralea esculenta* (tinpsila), and *Allium canadense* (Wild onion). These samples were collected in summer and fall 2016. Leachable and bioavailable concentrations of As, Cd, Se, Th, and U from rocks, regolith, and soils were determined by Inductively Coupled Plasma Mass Spectrometry (ICP-MS) after samples were processed using EPA Methods 30.50A & 30.50B. In all samples, we found high leachable and bioavailable concentrations of Se and As, leachable concentrations of U and Th with lower bioavailability, and leachable Cd concentrations near the instrument detection limit. The metals concentrations varied within and among rock units, with relatively higher concentrations in regolith and soils. Our findings indicate that: a) weathering increased metals concentrations in area soils, and b) Se and As exhibit greater bioavailability than U and Th. Further studies, ICP-MS analysis of plant samples, is planned for summer 2017 to determine metals variation among plant specimens and whether the EPA Method provides a good proxy for plant uptake. Research was funded in part by grants from the NSF TCUP Woksape, PEEC II, and SD EPSCoR.

An Investigation Study of Juneberry (*Amelanchier alnifolia*) Phenology on the Fort Berthold Indian Reservation

Ashly Hall, Tanya Sand-Driver, Kerry Hartman - Nueta Hidatsa Sahnish College
Paul Johnson - South Dakota State University

For centuries, tribal people of the Northern Great Plains have utilized plants for cultural, medicinal, structural, and nutritional uses. Juneberry (*Amelanchier*) historically played an important part in the diet and culture of the Mandan, Hidatsa, and Arikara Tribal Nations. Juneberries have polyphenol antioxidants and there is recent scientific validation to the historical use of the berries, twigs and roots of the *Amelanchier* genus trees by Native Americans for treatment of a diverse assortment of medical conditions (Conti 2006). Restoration of the Juneberry plant on the Fort Berthold Indian Reservation will lead to rejuvenation of cultural, nutritional, and economic uses of the plant. One important aspect of the restoration will be the understanding of the different variables that impact yield. In this research study, samples were collected from both wild and cultivated Juneberry stands to compare the yields. Results showed significant difference between the wild Juneberry yield and the cultivated Juneberry yield. Future studies will consist of looking into Juneberry phenology and the numerous variables related to fruit yield.

An Investigation Study of t-tubular architecture in HD mouse skeletal muscle: A Model for Huntington Disease

Colton Rommanose – Northwest Indian College

Huntington Disease (HD) is a neurodegenerative disease that affects both neurons and skeletal muscle. Symptoms include chorea, rigidity or, dystonia, and muscle weakness. HD skeletal muscle have demonstrated atrophy, weakness, and altered intracellular calcium signaling. Furthermore, we found a decrease in the specific membrane capacitance of skeletal muscle in HD mice, suggesting overall membrane depletion. A major membrane system in skeletal muscle is the transverse-tubules, or T-tubules, which are invaginations of the sarcolemma and are essential structures that signal contractions in skeletal muscle. When a muscle fiber action potential reaches the T-tubule, the membrane depolarizes and opens voltage-gated calcium channels that trigger the release of calcium from the sarcoplasmic reticulum; resulting in muscle contraction. Few studies have examined skeletal muscles in HD and no studies have examined pathologic changes to the T-tubule membrane system in HD model mice. We hypothesize that the t-tubular architecture in HD mouse skeletal muscle will be significantly reduced. Detubulation would result in a decrease in membrane capacitance, alter calcium signaling and underlie muscle contraction and weakness typically observed in HD.