BUILDING STEM IDENTITY IN NATIVE AMERICAN STUDENTS: CULTURALLY RESPONSIVE EVALUATION

Melinda Davis,
Karla Eitel

University of Idaho

PROJECT GOALS

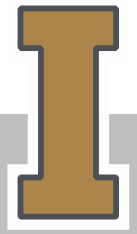
Increase science identity *in Native American students when they engage in technology-based projects that directly relate to their community/cultural by providing experiences with culturally relevant, technology-based learning*

- Expose Native American students to STEM careers important to their way of life.

- Prepare these students for higher education in STEM fields by improving their critical thinking, communication, leadership, and technical skills, and enable them to contribute to their communities in a culturally relevant way,

- Expand students' understanding of the ways that their cultural identity informs and shapes their identity in STEM, and

- Expand the way that STEM professionals understand the importance of supporting cultural identities within STEM contexts.



IMMERSIVE SUMMER CAMP

- Residential summer camp at MOSS
- Used drones and remote sensing to create maps and conduct research
- Investigations on native land with cultural and historical significance
- Tribal Department of Natural Resources and Department of Fisheries conducted classes in the field
- Tribal Elders participated with stories, perspective, and advice
- Native language lessons included

EVALUATION TOOLS

- Pivothead Recordings In The Field- “shared lived experience between observers and observed
- Alternative Research Presentations – “considers culture of projects as well as of participants”
- Evaluation Rubric with Tribal Cultural Standards Incorporated- “importance of bridging understanding between cultures”
- Photovoice, Journals, and Card Sort Activities- “recognizes both language and culture nuance may require interpretation”
- Student Survey And Teacher And Staff Focus Groups- “inclusion of multiple stakeholder perspectives”

Hood, 2001; Frierson, Hood, and Hughes, 2002; Hood, 2009)

CULTURAL STANDARDS

- Students have a sense of values of the Nez Perce people
- Introduce themselves and the family they come from
- They thank the Elder
- Use of Nez Perce language within presentation
- Use of origin of natural resources products that they're using and how it associated with land area
- Create visual representations – artwork
- Tribal geographic
- Use of legends
- Recognition of lessons learned and respect for lessons learned
- Visual representation
- Mastery to the point that they can be a teacher

STUDENT RESEARCH PROJECTS

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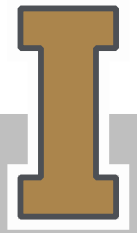


Culturally Relevant Evaluation

By Shalae Clemens and Brandon Senties

What We Measured and Why We Decided to Measure Student's Interests

- Purpose
  - Determine STEM interests, attitudes, competencies, and needs in order to plan the most effective STEM outreach events and clubs for students.
  - Help students become more interested in STEAM
- Why?
  - It is important for us to measure students' interest because it provides a baseline.
  - To see why that goal was/was not reached, and things we could change to improve it

Students Who Took the Survey

- Connolly Middle School
  - Title I Middle School
- Alhambra High School
  - Excited about STEAM
  - Intrigued by the different activities offered at the fair where the survey took place
  - Intrigued by the variety of demonstrations included.

Creating the Questions

- Criteria
  - Help us find out what STEM categories interested our students in order to be able to plan STEM events to their liking.
  - Help us see which STEM skills students needed help with, so that we could help them improve upon those areas.
  - Let us see genuine things we wanted to know
  - Easy for everyone to respond to.
  - Easy to understand
  - Reliable in a way where the questions alone would be able to represent the success of the event as a whole.

What We Did In the Survey

- What We Asked
  - The basics (i.e. their gender, grade, if they were in a music, sport, and also if they knew what STEM stood for)
  - Favorite part of STEM
  - How they felt STEM was incorporated into their education
  - Greatest STEM strength/weakness
  - Attitude towards STEM
  - Made them choose between a couple of choices, narrowing down our responses by a big number.
- Comprehension
  - We made sure to use wording that everyone would be able to understand
  - Made the survey as short as possible
  - All students were able to understand the questions.

People Who Gave Us Some Insight

- Parents and Teachers
  - The father of one of our CSOs, Mr. Gel, gave us some insight on our survey. He is a mechanical engineer at Arizona State University.
  - Some of the teachers collaborating with us in the STEAM fair: Mr.McCluskey, AP chemistry teacher at Alhambra; Mrs. Wright, AP biology and AP psychology teacher at Alhambra; Mr. Mann, founder of the AMPED class (algebra based curriculum which students learn through engineering and science).

The Results

- Connolly Middle School
  - Overwhelming percentage of people said that they like STEM (91.5%).
  - Technology was the most popular favorite branch of STEM.
  - Only about 52% of our students know what STEM stands for.
  - Greatest strength in STEM was creativity
  - Greatest weakness was communication.
- Alhambra High School
  - Conclusion: some things could have been done better.
  - Shared data with all of the staff in our campus and our collaborators.

What We’re Most Proud Of

- CSO Shalae
  - Sharing our results through a presentation at the 2017-2018 Arizona Educational Research Organization Conference.
- CSO Brandon
  - All of the positive comments we got

Improvements

- CSO Shalae
  - Sending home the permission slip for the survey earlier
- CSO Brandon
  - Making sure that everyone who attended the fair answered our survey

Similarities and Differences to Other Surveys

- Similarities
  - Digital
  - Asks simple questions to achieve a goal
  - A lot of common questions that can be seen in other surveys
- Differences
  - Mostly multiple choice questions
  - Created and orchestrated by students
  - Not in the classic pen and paper form, but on google forms
  - Not a lot of people give candy when students fill out surveys (which we did).

Two Roads Consulting

Evaluation and Research

Cultural Competence in Evaluation: Lessons Learned

Rachel Becker-Klein

May 14, 2018

Evaluation cannot be culture free.

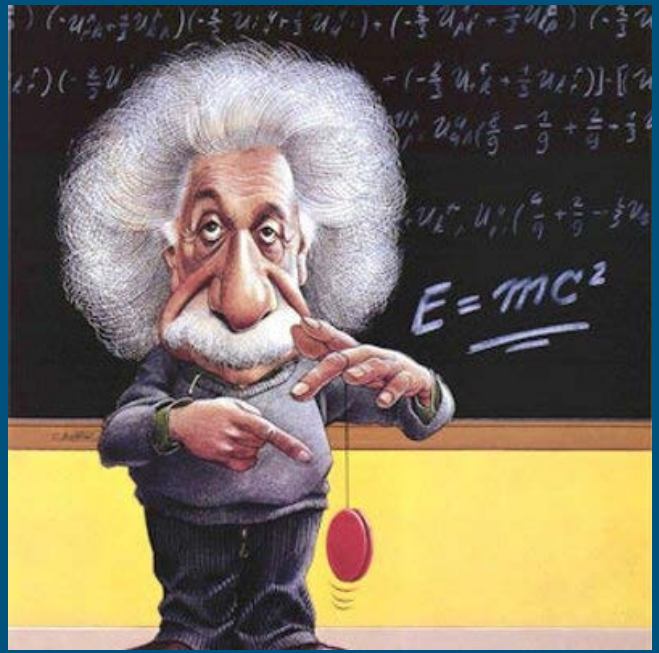
Cultural competence is a process...

Why cultural competence in evaluation?

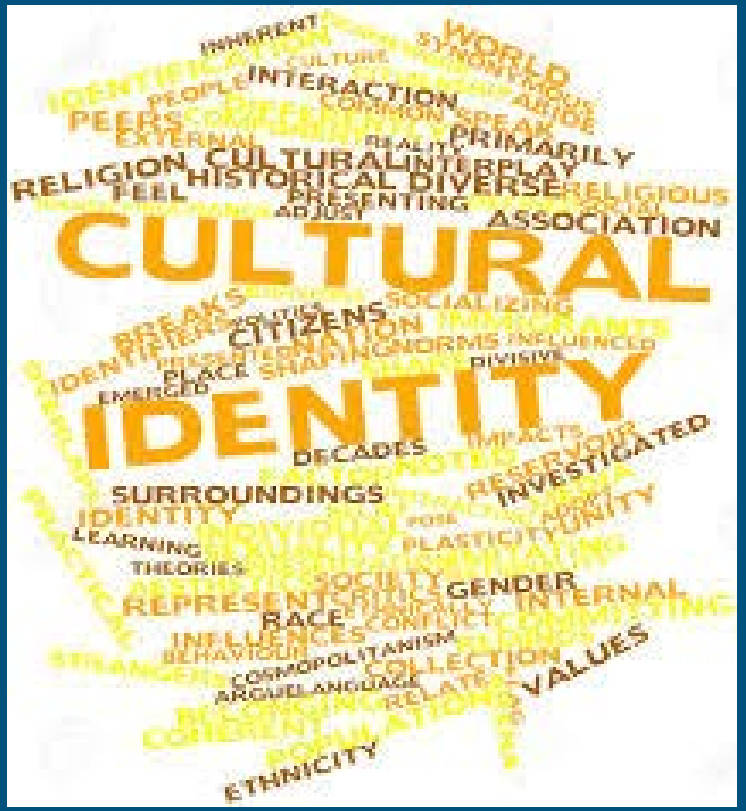
1. Produce honest work

1. Supports validity

1. Based on theories



Acknowledge complexity of cultural identity



Recognize the dynamics of power

Power OVER...

Power TO...

Power FROM...

Match methods and theories to culture

Continue self-assessments

Steps Towards Culturally Competent Evaluations

Consider Diversity of Population

Race

Age

Gender

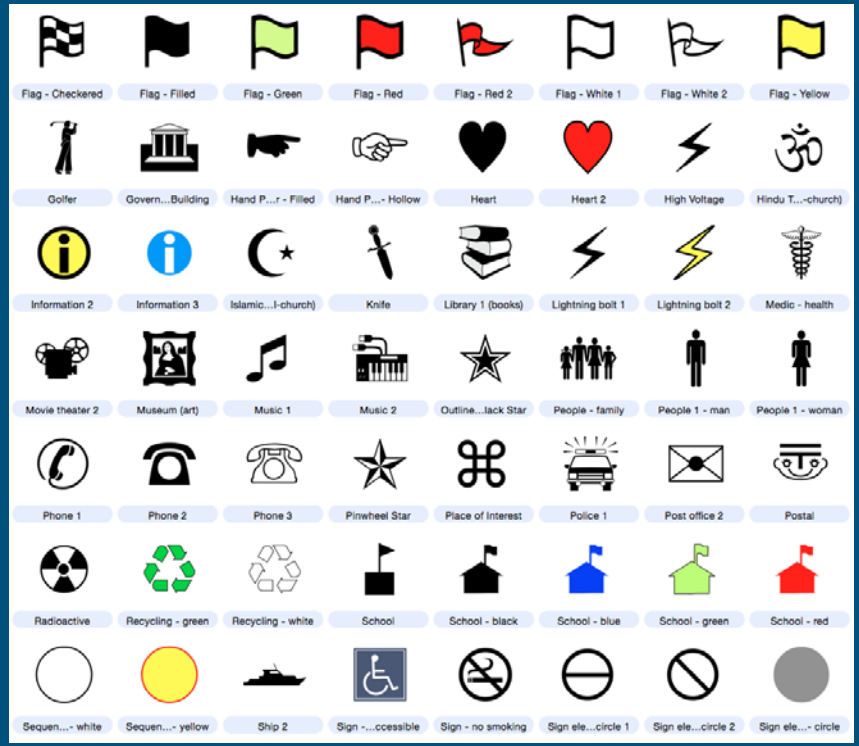
Income

Education

Ethnicity

Location

Consider the Cultural Context



CULTURALLY RESPONSIVE EVALUATION (CRE)

Tandra Tyler-Wood, Ph.D.
University of North Texas

Prior Experiences Led to my Definition of CRE

Special Education and School Psychologist training created a focus on equitable individual evaluation---does such a phenomenon exist?

Leaving the school setting, I began to focus on the effectiveness of various interventions. I moved to group evaluation, still with major questions about the equity of assessment

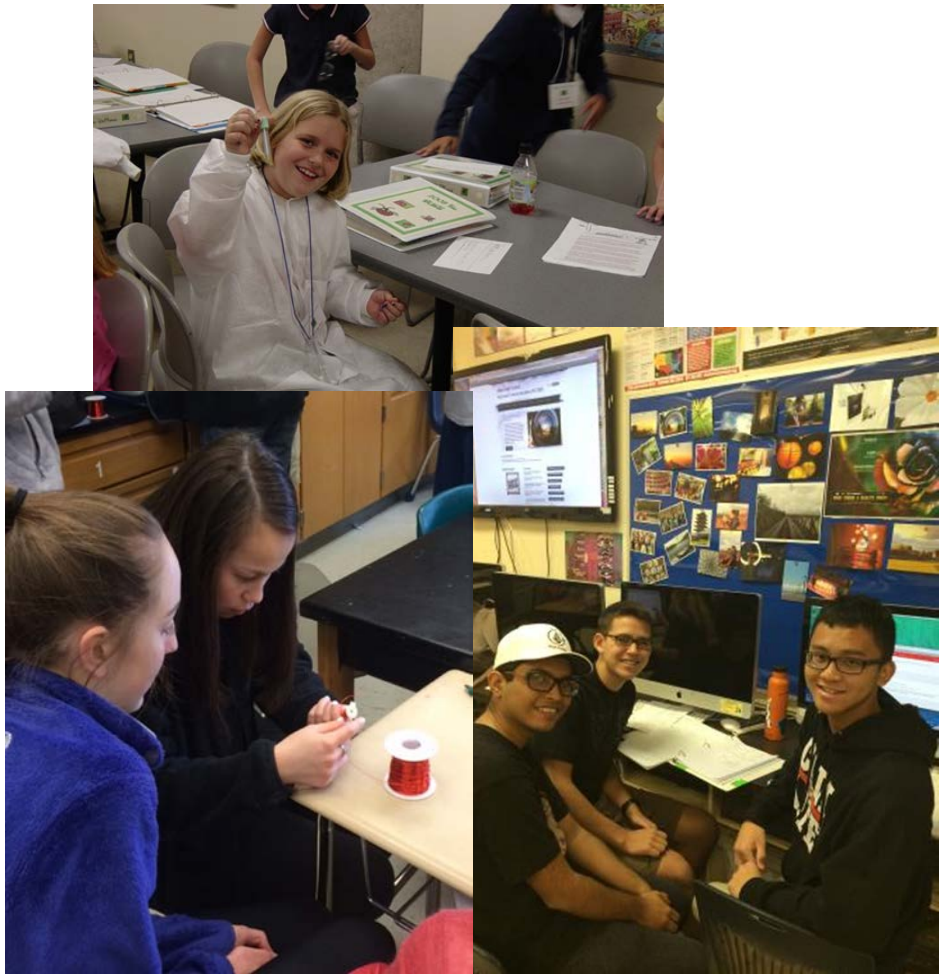
Principles Of Culturally Responsive Evaluation: Critical Components of My Definition

Inclusion- equal opportunity for participation is important

Acknowledgement and Understanding of the cultures involved

Appropriate Measures

- Allow participants to demonstrate knowledge
- Include participants in the normative data
- Uses appropriate symbols and language



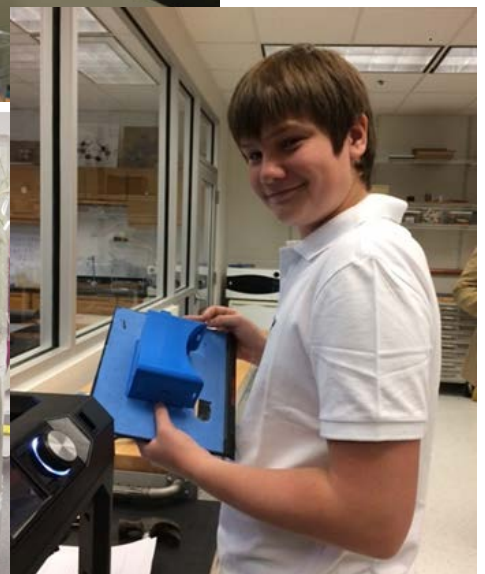
Principles Of Culturally Responsive Evaluation: Critical Components of My Definition (Cont.)

Provides pertinent information back to stakeholders

Relevance to participants

Generalizable

A good use of critical academic learning time



THE BELMONT REPORT AND THE COMMON RULE

The Common Rule, 45 CFR 46, Subpart A (Protection of Human Subjects 2009), lists criteria for IRB approval of a research plan that are directly related to the three Belmont principles. One of those principles is "justice." Justice is defined as the "selection of participants is equitable" and the "opportunities for participation" also are equitable.

The Belmont Report should influence the "who" and the "how" when we study the effectiveness of STEM programs.

Issues With the Belmont Report

Shore(2006) interviewed community-based researchers for their interpretation and critique of the *Belmont Report*.

- Interviewees expressed concerns regarding the *Belmont Report*'s ethical principles and interpretations.
- One size does not fit all.
- Ethical analysis should take into account more appropriate factors, such as cultural, gender, ethnic and geographical considerations.

Lessons Learned Through My Research

It is critical to study and evaluate subgroups of a population:

- BUGS (Bringing Up Girls in Science)-Near peer-mentors and after-school studies in environmental science can increase 3rd and 4th grade girls likelihood of taking STEM coursework at the college level. (Tyler-Wood, Ellison, Lim, & Periathiruvadi, 2011)
- MSOSW (Middle Schoolers Out to Save the World) An environmental awareness program for middle school students can impact girls' dispositions towards STEM when compared to boys (Christensen, Knezek, & Tyler-Wood, 2015)
- Collaborative Grant (Strategies: Collaborative Research: American Innovations in an Age of Discovery: Teaching Science and Engineering through 3D-printed Historical Reconstructions) Curriculum vetted in a general classroom setting can have different impacts on the achievement and affinity towards STEM for special populations (Briones, 2018; Moore, 2018, dissertations in progress).

My Thoughts: Equal Opportunity

Equal opportunities for selection and participation in a research study is important but sometimes it is critical to obtain evaluation information on specific subgroups.

Opportunities for participation may not be equal but decisions should be made through a process that reflects equitability for participation and equitability in evaluation.

Inclusion is important. However, it is always important to make sure that all participants in a research study dealing with new STEM curriculum, especially participants representing special populations, have the prerequisite skills necessary for success.

Understanding Our Population and Our Workforce

We need a more thorough understanding of tomorrow's STEM workforce as we spend our research and evaluation dollar.

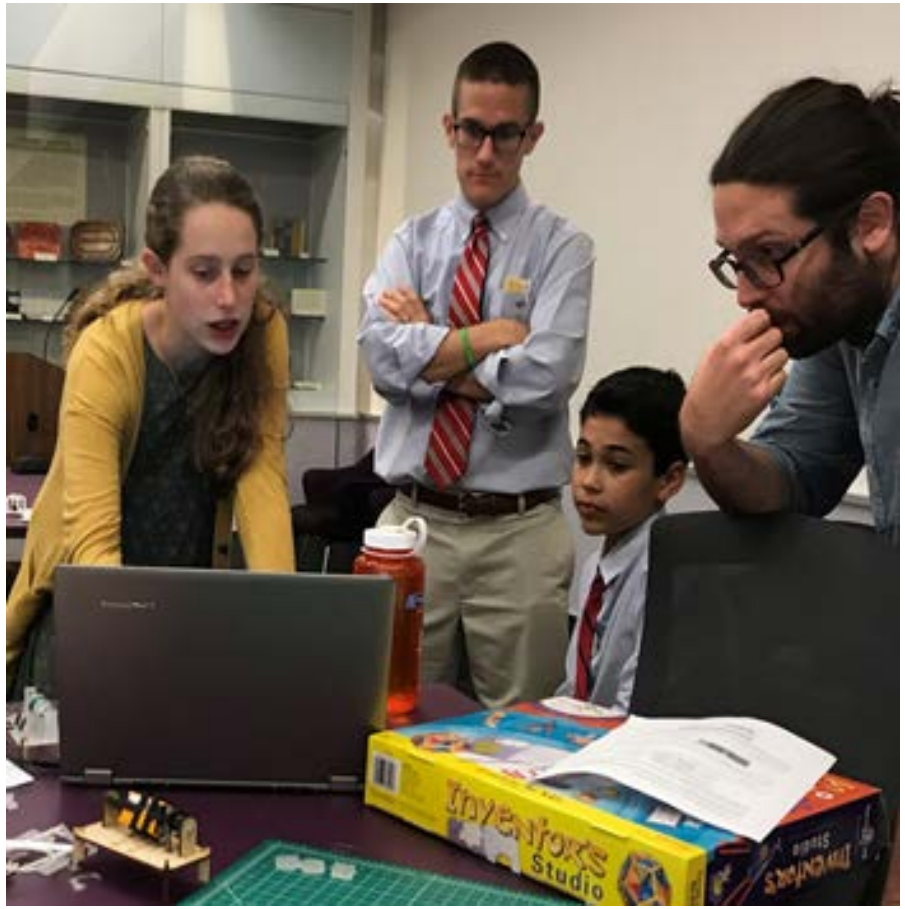
High achievement in STEM subject areas does not equal interest in a STEM career.

Our research goals and initiatives needs to align with tomorrow's jobs.

Not all STEM jobs require a bachelor's degree. High schools and vocational schools can provide extensive training in STEM careers. We need assessment of these options.

Matching individual student's abilities to future employment opportunities, while not limiting a student's potential, is critical.

Final Thoughts



Often there are issues with dissemination from a “test site” to less than “optimal sites” where diverse populations are the majority group. It is important to determine good dissemination practices. Evaluation should determine if a practices is effective with all participants.

Assessment of large data sets may provide needed information of at-risk populations.

Through assessment we can gain greater understanding of the educational needs and career needs of under-represented populations in STEM.

We should continue to seek assessment and evaluation methods that maximize appropriate STEM learning opportunities for all.

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HOW DO I KNOW I MADE A DIFFERENCE?

SciGirls Evaluation Strategies

By Dr. Hilarie B. Davis, TLC Inc. hilarie@techforlearning.org

SciGirls For High School STEM/CTE

- STEM/CTE teachers sign up to learn and implement SciGirls strategies
- Semester long professional development
- Self-needs assessment on SciGirls strategies; identify areas for growth
- Discuss, implement, collect evidence, reflect, discuss
- Indicators and ways to measure each strategy

SciGirls Strategies

- Role models
- Student-focused instruction
- Thoughtful, respectful communication and promoting a growth mindset
- Promoting student creativity
- Critical thinking
- Cultural awareness
- Relevant learning experiences

Role Models

Role models help students learn through modeling what is possible for them and develop their capacity to be successful, deal with failure, and achieve their goals.

Incorporating role models can help build students' resilience for facing bias and discrimination, or "leaning in" and supporting others who are facing these obstacles.

Role Models Objectives

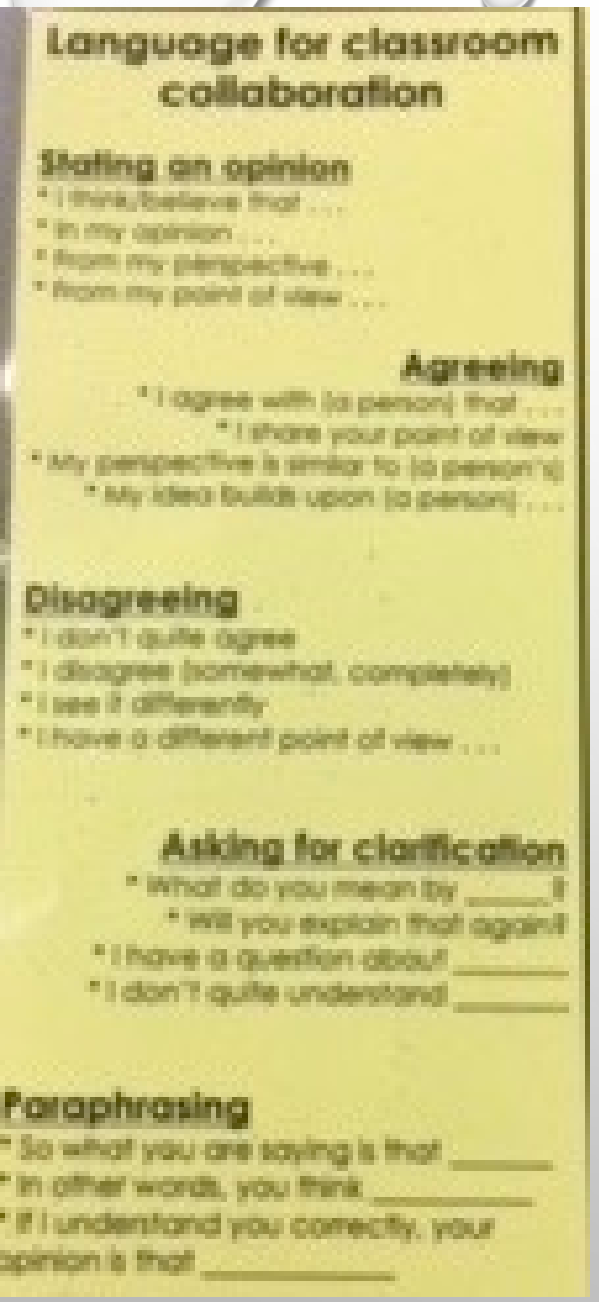
1. More interest in the people behind the ideas in your class
2. Internalizing that STEM professionals are females and males
3. Personal aspirations (academic and career)
4. Change in engagement
5. Change in STEM identity

Role Models Sample Evidence Gathering Strategies

- Ask students to list at least 10 notables in STEM, or just your topical area (biology, physics) at the beginning of the year and at the end
- Ask students to list 10 adjectives for work in _____ (biology, programming… your class focus). In each lesson or unit, ask students: who did this work? How did they do it? Repeat quarterly to see changes in complexity, breadth, positive vs. negative.
- Give each student a blank 8.5x11” paper and crayons (if you can get them it takes the pressure off) to draw what they think of as a scientist. Do this as the beginning and end of the year, then have each student compare their drawings and write a reflection on what changed and why.

More RM Evidence Gathering Strategies

- Ask students to list any adults locally who are in STEM careers. Then invite STEM locals into the class. At the end of the year, ask the same thing to see how many they can list. Ask if they could see themselves doing any of these local jobs.
- When students are able to “act” in an authentic role in a class activity, it gives them something specific to do, and helps them visualize themselves in the role. Ask them to jot down what they think their role does ahead of time, then after the activity. What did they do in the role? What did they like? What was challenging?



Student-Focused Instruction

Student-focused instruction is means students will learn more and retain it longer because they have an active role in building their understanding of the content and applying the skills they are learning. Student-focused classrooms provide ample time for student voice, interest, and engagement within the learning or advising activities.

Student-Focused Objectives

1. Students in sync with routines
2. Better collaborative skills
3. Improved reflection skills
4. More students engaged

Student-Focused Evidence Gathering Strategies

- Systematically notice how many students are engaged in a routine when you first introduce it, then after a few weeks of use. Notice which routines engage more students, how quickly they are engaged, and which students are engaged with each routine. Refine the routines to get more engagement.
- Early on in the year, ask students to rate their collaborative skills – are they active, listen well, move work ahead with summaries, etc. Ask them to debrief after collaborative work on their own use of collaborative skills and set goals to improve. Have quarterly self-ratings. Build from short highly structured activities to longer more complex interactions with true interdependencies.

More SF Evidence Gathering Strategies

- Have students reflect using a format consistent with your field (log, journal, design doc) to describe what they did, and provide evidence for its quality against some standard (rubric, technical review). Over time, you will see students be more honest and detailed about the extent to which they are meeting expectations.
- If students aren't engaged offer them an opportunity to give you private feedback. Are they bored or lost? Use the feedback to differentiate content, process, or outcomes that may fit the expectations and their prior knowledge and skills better.

Creative Thinking

Asking students to be creative in how they learn or how they show what they learned invites them to do something fun, interesting, and unique. They learn from each other's unique expressions about the same content.

Creative Thinking Objectives

1. Learning options that require creative thinking
2. Increase comfort of students expressing ideas
3. More labeling of different kinds of thinking
4. Conscious use of creative thinking strategies

Creative Thinking Evidence

At the beginning of the year, ask students to think of an example of creative thinking and a definition. Share additional definitions and examples throughout the year and ask students to enhance their definitions over time. Offer (and label) creative options for learning in which students remix ideas, express what they are learning visually, and ask open-ended questions. Look at the change over time in their fluency, flexibility, and originality.

More Creative Thinking Evidence

Ask students what creative thinking strategies they have for creativity in the beginning of class. Then when you give them creative options for learning, ask them to describe the strategies they used. By the end of the year, when asked the creative thinking strategies, they should be able to describe multiple strategies.

Critical Thinking

Rather than memorizing one way of doing a procedure or solving a problem, if we allow problems or tasks to include their natural complexity and help students understand how to use critical thinking to arrive at reasonable responses, a broader array of students will be interested in the work and feel able to contribute to the solutions. Different ways of knowing and coming to solutions are honored when we celebrate and promote critical thinking.

Critical Thinking Objectives

1. Learning options that require critical thinking
2. Students build arguments from evidence
3. Students collaborate in critical thinking

Critical Thinking Evidence

- As a baseline, ask each student to describe the steps to thinking critically. Then after using these steps for a while, ask them to reflect and refine the steps. When students do a critical thinking task, ask them to describe their thinking in terms of the steps. Compare beginning end of the year steps with the baseline.
- Give students a conclusion and ask them to create an argument with evidence for that conclusion. Then have them work in groups to refine that argument and evidence and develop criteria for what makes a well-supported argument. Evaluate students' arguments over time.

Cultural Awareness

Young women are culturally diverse so recognizing and celebrating their diverse ethnic and cultural backgrounds increases their interest, confidence and achievement.

Girls need advocates for their place in STEM learning environments and careers while celebrating their culture. Explicitly discussing cultural practices, inequities, and strategies invites girls into STEM.

Cultural Awareness Objectives

1. Become aware of your own cultural practices
2. Students from cultures other than yours feel supported
3. Include histories, language, identities, intersectionalities that are representative of various backgrounds in the curriculum and classroom activities

Cultural Awareness Evidence

Reflect on your own practices and how they may differ from your students. You can enhance this with a journaling process in which you note assumptions around your own perceptions of what feels “right” in terms of: dress, language and dialect, body language and space, eye contact, learning/work style, confidence, affective responsiveness to others, interests, access to resources, religious beliefs, and family structure. Chart the same ideas in terms of the cultures of your students.

More Cultural Awareness Evidence

At the beginning of the year, create a concept map of the ethnic backgrounds of students in your setting. Each quarter add more details you have learned to the map. Share the map with other counselors and educators to invite dialogue about what each of you can contribute to the shared appreciation for the unique backgrounds of the students and families you serve.

Relevant Learning Experiences

If the examples we share and the applications we model are not of interest to our students then the work they need to do to achieve those outcomes won't feel worthwhile.

When we can make the application and examples easy for our students to relate to, then they can bring their background knowledge into the content which will aid with retention as well as interest and engagement.

Relevant Learning Experiences Objectives

1. Create activities that are relevant to students
2. Students seek to make learning relevant

Relevant Learning Experiences Evidence

1. Track your activities from the beginning of the year to see how often and in what ways you make them relevant to living and which activities seem to engage the girls.
2. Ask students to work in groups to take a recent topic from class and make connections to people's lives; why does this matter? How will it help people? How will it make life better?

Culturally Responsive Evaluation: The Utilization Of A Cultural Guide

Dr. Enos Massie
Massie & Associates, President & CEO
Eastern Michigan University, Professor
DAPCEP Evaluator

DAPCEP (Detroit Area Pre-College Engineering Program) is a nationally recognized non-profit organization providing Science, Technology, Engineering & Math (STEM) programming to Pre-K through 12th grade students.

DAPCEP's mission is to increase the number of historically underrepresented minorities that are prepared to pursue STEM professions.

2111 Woodward Ave., • Suite 506-1 • Detroit, MI 48201 • 313-831-3050 • dapcep.org

DAPCEP Executive Director: Michelle L. Reaves

Areas of Engagement

Elementary

Explorers
The DAPCEP Explorers curriculum is correlated with national education standards and is designed to develop key school and life readiness skills such as critical thinking, creativity, confidence, communication and collaboration.

Middle School

Pathfinders
Pathfinders discover their passion and career aspirations by participating in a broad variety of learning modules on university and corporate campuses.

Pop-Up Workshops
Pop-Up workshops are designed to peak curiosity and bring awareness to a variety of STEM topics.

- In School -
STEM project-based learning and teacher professional development.

Residential Summer Programs. Students live and learn on a university campus. Residing in dorms and participate in specially designed advanced STEM courses and laboratories during the day.

High School

Talents Tours & Bridge Program. DAPCEP Talent Tours introduce youth to available career paths in specific STEM fields.

Preparing African American Males for Energy & Education (PAAMEE)

PAAMEE Mission

To increase the participation rates of African American Males in Power Generation and Renewable Energy (PR &RE) Industries

University Partners

Lawrence Tech
THEORY AND PRACTICE 1932
Possible is everything.

Michigan Technological University
1885

MICHIGAN STATE UNIVERSITY

OAKLAND UNIVERSITY

Corporate Partners

DTE Energy
Know Your Own Power™

walker-miller
Energy Services, L.L.C.

MARATHON

Consumers Energy
Count on Us

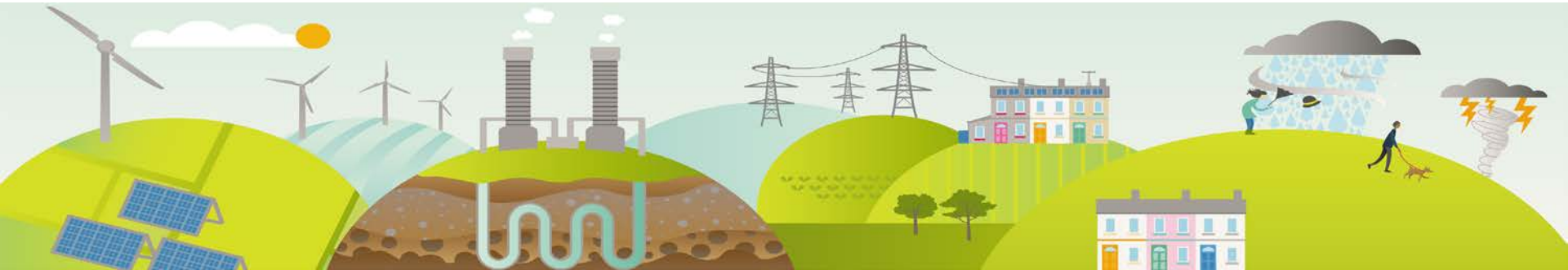
Program Course Topics

- Energy Efficiency (WME)
- Nuclear Power Generation (LTU)
- Petroleum & Automotive Applications (OU)
- Renewable Energy Systems (MSU & MTU)

Program Outline

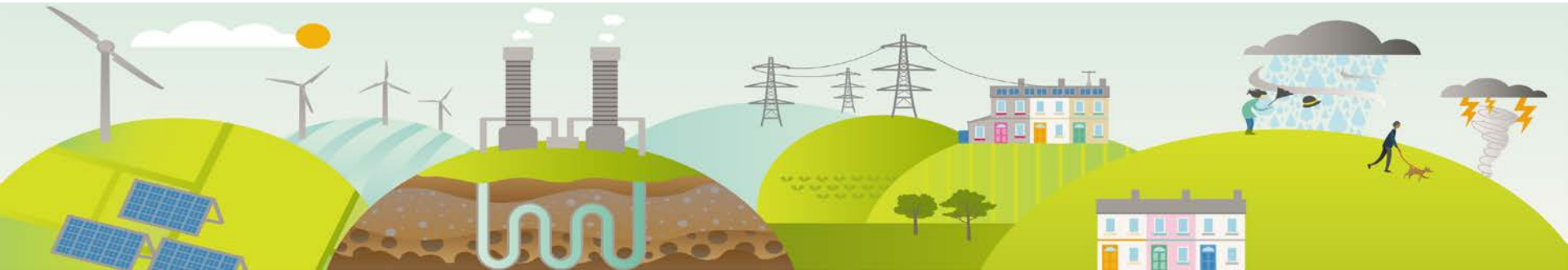
- Attend (3) eight-week Saturday courses facilitated by:
  - Lawrence Tech University
  - Oakland University
  - Walker-Miller Energy Services
- Attend (2)one-week summer residential camps at:
  - Michigan State University
  - Michigan Technological University
- Visit corporate partner facilities to engage with professional staff

"CULTURALLY RESPONSIVE EVALUATION INCORPORATES CULTURE, HISTORY, TRUST, AND RESPECT IN ASPECTS OF THE EVALUATION STRATEGY AND METHODOLOGY"



Cultural Guide: Key Strategy

- Definition
- Selection
- Utilization
- Recommendations



Cultural Guide: Key Strategy

- Lessons Learned
- Case Examples