

Culturally Responsive Evaluation of NASA's OSTEM NGS Evidence-based STEM Products
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Scientists' values and beliefs are influenced by the larger culture in which they live. Such personal views influence the questions they choose to pursue and how they investigate those questions. Adopting a stance on how to present scientific information is the cultural tool used to contextually preserve, orient newcomers, and communicate values, beliefs and findings within and outside of the scientific culture.

Problem Statement & Background Information

STEM focused lessons and activities, in particular, are at risk for being designed and presented without attention to culture because these fields of study and the way that we present information about them can appear to be, on the surface, objective and acultural - conceptually distant from or absent of culture.

Cognitive Diversity. We do not shed our cultural practices just because we are presenting or being presented with facts and/or formulas. "Cognitive diversity suggests that differences in perspective, as a by-product of cultural differences ...cultivates creative problem solving and innovation that should be appreciated and valued" [4]. Gender and culture not only affect STEM itself, but they influence our approach to scientific research, development, strategies for presenting, and the extent to which we accept scientific information [6][5]. Even more, STEM teaching and learning practices have a critical influence on shaping students' scientific identities, motivation and persistence [1][2][10]. As an example, rural European-Americans may tend to see themselves as apart from nature, whereas Native Americans may tend to see themselves as a part of nature – these two cultural orientations result in a difference of insight, which in turn, influences goals, approaches, and acceptance of scientific pursuits.

Multicultural Domains. Social constructs are specific conceptual ideas that are created, defined, and influenced by society. The distinctions that emerge can shape our lives through shared experiences and form a culture within that domain. Common cultural identities, or dimensions of difference, include race/ethnicity, generational age, gender/gender roles, religion, socio-economic status (SES), language, physical and mental [dis]abilities, geographical location, and so on [9][11].

Cultural Responsiveness. It is essential that curriculum developers, educators, and presenters of scientific information possess multi-perspective competency skills (i.e. respect for, value, and ability to effectively translate knowledge about interdisciplinary design, multicultural domains, and cognitive diversity). This fosters respect, value, appreciation for the learner and/or audience that receives the information as well as remove and/or lessen the consequences of implicit biases, stereotype threat, and the "chilly" climate that is associated with STEM. A *culturally responsive professional* honors cognitive diversity and therefore exhibits diverse ways of knowing, understanding, and representing information, and is deliberate to ensure diversity, equity, inclusion, and access [8] is a central and intentional part of STEM processes in research, practice, and messaging. In STEM education, cultural responsiveness is essential for underrepresented students, and also has a positive impact on all students' ability to think critically [6][7].

Solution & Methodology

It is NASA EPDC's goal to (1) utilize the culturally responsive evaluation process as an instructional strategy and tool to enhance multiple perspective competencies and foster intentional culturally responsive practices for educational specialists, and (2) offer a scalable evaluation framework to systematically self-assess STEM products and deliverables for cultural relevance and cultural responsiveness.

We will use The White House [8] government-wide strategic plan for diversity, equity, inclusion, and access as a framework and Collins' (2020) Culturally Responsive Checklist for Student Engagement [3] as a tool to evaluate eighteen (18) of NASA's Office of STEM Engagement (OSTEM) evidence-based STEM products – a series of mission-driven activities and opportunities to engage students in authentic STEM experiences and to enhance STEM literacy to help build a vibrant and diverse next generation STEM (NGS) workforce. Our methodology and plan of action is as follows (see Table 1 for details):

- **By May 30th** - the culturally responsive evaluation (CRE) for the identified *Moon Series* product and development of its accompanying supplement will be submitted for review to NGS team. (KHC & DS; ~ 60 days)
- **By June 30th** – informed by the development of the first supplement, the process for evaluating and creating a supplement for the remaining NGS products will be internally standardized and shared as guidelines for EDCP specialists to conduct the CRE. Generally, two specialists will be assigned to evaluate each of these (KHC, DS, and LH; ~ 30 days)
- **By August 30th** – the CRE for the remaining five (of six) *Moon Series* products will be completed. The App Challenge is outdated and the competition is complete, and will need to be removed from the website and/or updated altogether (10 specialists; ~60 days)
- **By October 15th** – the CRE for the *CCP Series* products will be completed. We are tasked to evaluate six different products, two of which are short storybooks with accompanying related activities. (3 specialists; ~45 days)
- **By October 15th** – the CRE for STEMonstration video and the first *Aeronaut-X Series* product will be completed. (3 specialist; ~45 days)
- **By November 30th** – the CRE for last two *Aeronaut-X Series* will be completed. These are a bit more complicated in terms of materials, processes, and references to include coding. (4 specialists preferably with coding experience; ~ 60 days)

Expected Outcomes & Conclusion

NASA EPDC will offer supplemental products, as appropriate, to ensure that all of OSTEM Next Generation STEM (NGS) products are presented in a way that is culturally responsive and to support its effort to provide an inclusive platform for all students to contribute to NASA’s endeavors in exploration and discovery. (See The Proposed plan of action).

References

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Table 1. Proposed Plan of Action & Timeline

| Title Direct Link to Activity | Pub. Date: Product # Guide or Lesson? #Activities | Supplement Completion Goal Date/ EPDC Specialists Assigned Comments |
|---|--|---|
| NASA's NGS Moon Series https://www.nasa.gov/stem/nextgenstem/moon/index.html | | |
| Landing Humans on the Moon https://www.nasa.gov/stem-ed-resources/landing-humans-on-the-moon.html | Pub. Date: 2021 #NP-2021-03-2937-HQ Educator Guide 4 Activities | Goal Date: May 30th <i>Kristina and Deepika will conduct an evaluation for this product to serve as an exemplar for other evaluations.</i> |
| App Development Challenge https://www.nasa.gov/stem/nextgenstem/moon/app_challenge_getting_started.html | <i>Pre-Requisite: Lead Teacher must complete EPDC Moon to Mars webinar and submit a certificate of completion.</i> | Information and Competition outdated: 2020-2021 Goal Date: NA <i>EPDC Specialists Assigned TBD</i> |
| Habitation with Gateway https://www.nasa.gov/stem-ed-resources/gateway.html | Pub Date: 2020 # NP-2020-02-2803-HQ Educator Guide 4 Activities | Goal Date: August 30th <i>EPDC Specialists Assigned TBD</i> |
| Propulsion with the Space Launch System https://www.nasa.gov/stem-ed-resources/propulsion.html | Pub Date: 2020 # NP-2020-02-2804-HQ Educator Guide 4 Activities | Goal Date: August 30th <i>EPDC Specialists Assigned TBD</i> |
| Crew Transportation with Orion https://www.nasa.gov/stem-ed-resources/transportation.html | Pub Date: 2020 #NP-2020-02-2805-HQ Educator Guide 4 Activities | Goal Date: August 30th <i>EPDC Specialists Assigned TBD</i> |
| Hazards to Deep Space Astronauts https://www.nasa.gov/stem-ed-resources/hazards-to-deep-space-astronauts.html | Pub Date: 2021 #NP- NP-2021-09-2975-HQ Educator Guide 5 Activities | Goal Date: August 30th <i>EPDC Specialists Assigned TBD</i> |
| Deep Space Communications https://www.nasa.gov/stem-ed-resources/deep-space-communications.html | Pub Date: 2021 #NP- NP-2021-09-2987-HQ Educator Guide 4 Activities | Goal Date: August 30th <i>EPDC Specialists Assigned TBD</i> |
| Next Gen STEM Commercial Crew Program Series https://www.nasa.gov/stem/nextgenstem/commercial_crew/index.html | | |
| <i>Astro-not-yets</i> Explore Microgravity Storybook https://www.nasa.gov/stem-ed-resources/the-astro-not-yets-explore-microgravity-storybook.html | Pub Date: 2021 #NP-2021-01-001-JSC <i>Storybook with Related Activity: In-Flight Education Downlinks</i> | NOT TASKED |
| Astro-not-yets Explore Energy Storybook https://www.nasa.gov/stem-ed-resources/the-astro-not-yets-explore-energy-storybook.html | Pub Date: 2021 #NP-2021-01-001-JSC <i>Storybook with Related Activity: EPPC</i> | Goal Date: October 15th <i>EPDC Specialist Assigned TBD</i> |
| Astros-not-yet Explore Sound Storybook https://www.nasa.gov/st | Pub Date: 2020 #NP-2020-02-005-JSC | Goal Date: October 15th <i>EPDC Specialist Assigned TBD</i> |

| Title Direct Link to Activity | Pub. Date: Product # Guide or Lesson? #Activities | Supplement Completion Goal Date/ EPDC Specialists Assigned Comments |
|--|--|---|
| em-ed-resources/the-astro-not-yets-storybook.html | Storybook with Related Activity: SOOC | |
| Astros-not-yet Sound on a String (SOOS) Educators' Guide https://www.nasa.gov/stem-ed-resources/the-astro-not-yets-sound-on-a-string-educator-guide-for-grades-k-2.html | Pub Date: NL Product #: None Educator Guide | Goal Date: October 15th <i>EPDC Specialist Assigned TBD</i> |
| Sound on a String Student Activity | Pub Date: NL Product #: None 1 Center Activity | Goal Date: October 15th <i>EPDC Specialist Assigned TBD</i> |
| Eggstronaut Parachute Challenge (EPPC) Educator Guide https://www.nasa.gov/sites/default/files/atoms/files/eggstronaut-parachute-challenge-educator-guide.pdf | Pub Date: NL Product #: None Educator Guide 2 Activity Sheets, Grades 5-8, 9-12 | Goal Date: October 15th <i>EPDC Specialist Assigned TBD</i> |
| Eggstronaut Parachute Elementary Student Activity Only https://www.nasa.gov/sites/default/files/atoms/files/eggstronaut-parachute-elementary-student-activity.pdf | Pub Date: NL Product #: None Student Activity Sheet, Grade 3-4 related to EPPC Guide | Goal Date: October 15th <i>EPDC Specialist Assigned TBD</i> |
| Eggstronaut Parachute Challenge Over-easy https://www.nasa.gov/sites/default/files/atoms/files/eggstronaut-parachute-challenge-over-easy.pdf | Pub Date: NL Product #: None Student Activity Sheet, Grade 5-12 related to EPPC Guide | Goal Date: October 15th <i>EPDC Specialist Assigned TBD</i> |
| Crew Orbital Docking Simulation (CODing Sim) Guide https://www.nasa.gov/stem-ed-resources/crew-orbital-docking-simulation-coding-sim.html | Pub Date: NL Product #: None Educator Guide with necessary files: https://www.nasa.gov/sites/default/files/atoms/files/commercial-crew-coding-simulation.zip | NOT TASKED |
| Explore the Alphabet: Commercial Crew A to Z Activity and Coloring Booklet https://www.nasa.gov/stem-ed-resources/commercial-crew-a-to-z-activity-and-coloring-booklet.html | Pub Date: NL Product #: None Similar to Storybook with referenced links throughout | NOT TASKED |
| NGS STEMonstrations: https://www.nasa.gov/stemonstrations | | |
| Moment of Inertia Classroom Connection (STEMonstratio <i>ns-moment-of-inertia.html</i> https://www.nasa.gov/stemonstrations-moment-of-inertia.html | Pub Date: NL Product #: None Video: 60 minutes | Goal Date: October 15th <i>EPDC Specialists Assigned TBD</i> |
| Other STEMonstrations | 17 of 18 | NOT TASKED |
| Next Gen STEM Aeronaut-X Series https://www.nasa.gov/stem/nextgenstem/aeronaut-x/index.html | | |

| Title Direct Link to Activity | Pub. Date: Product # Guide or Lesson? #Activities | Supplement Completion Goal Date/ EPDC Specialists Assigned <i>Comments</i> |
|--|--|--|
| Senses of Sound https://www.nasa.gov/stem-ed-resources/senses-of-sound.html (Instructional video listed as optional within pdf) | Pub Date: NL Product #: None Lesson Plan with Small Tips Giant Leaps: Senses of Sound Activity Demo Instructional Video embedded on Webpage (not listed as optional) | Goal Date: October 15th <i>EPDC Specialist Assigned TBD</i> |
| Robotics Search and Rescue Challenge https://www.nasa.gov/stem-ed-resources/robotic-search-and-rescue-challenge.html | Pub Date: 2021 #NP-2021-08-2974-HQ Include EDP reference (2019, November 1; Blog & White Paper Section): https://www.txstate-epdc.net/models-of-the-engineering-design-process/ which references NASA BEST: https://www.nasa.gov/audience/for_educators/best/index.html | Goal Date: November 30th <i>EPDC Specialists Assigned TBD</i> <i>15-20 hours plus Requires Prior Knowledge of basic block programming. (referenced on p.5: with example links: https://edu.Sphero.com/cwists/preview/21499x and https://code.org/</i> |
| Unmanned Aircraft Systems Educator Guide https://www.nasa.gov/stem-ed-resources/unmanned-aircraft-systems-educator-guide.html | Pub Date: 2021 #NP-2021-08-2976-HQ Educator Guide 4 Activities | Goal Date: November 30th <i>EPDC Specialists Assigned TBD</i> |