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SCIENCE MISSION DIRECTORATE, SCIENCE ACTIVATION PROGRAM 2.0:
Compilation of Shared Learning Session Summary Reports



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[Cover photo: NASA astronaut Sunita Williams, Expedition 32 flight engineer, appears to touch the bright sun during the mission's third session of extravehicular activity (EVA). These images were taken by NASA's Johnson Space Center (JSC) on September 5, 2012. Credits: NASA/JSC]

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BACKGROUND

Between May and October of 2023, SciAct Portfolio Evaluators from Pacific Research and Evaluation (PRE) held a series of Shared Learning Sessions that were intended to take a deeper dive into each of the SciAct Mid-Level Objectives (MLOs). The goal of these sessions was to facilitate discussion around how MLOs are being defined and operationalized across projects and to share measurement tools as relevant.

Sessions were organized around singular or paired MLOs. Two 60-minute sessions were offered for each round of Shared Learning Sessions. Sessions were well attended, with an average of 20 individuals participating each time. Participants consistently included a mix of evaluators, PIs, Co-Is, and infrastructure team members; repeat engagement was strong. Across all sessions, all SciAct projects were represented at least once.

The following questions were used as a starting point to guide each conversation:

- ❖ We would like to start by breaking down the definition of this MLO. When you read this MLO, how do you interpret it?
- ❖ In terms of this being an objective or outcome of SciAct, what is this MLO telling you should change as a result of the projects?
- ❖ How is this MLO being defined in your project(s)?
- ❖ How is your project measuring this MLO?
- ❖ What do you like about this MLO?
- ❖ What would you improve about this MLO?
- ❖ If you could change it in any way, what would your recommendation be?

This report compiles all completed Shared Learning Session Summary reports. Reports are organized chronologically:

- ❖ May 2023: Shared Learning Sessions on MLO 1b
- ❖ June/July: Shared Learning Sessions on MLOs 1a and 1c
- ❖ August: Shared Learning Sessions on MLOs 2a and 3a
- ❖ October: Shared Learning Sessions on MLOs 3b and 3c

SHARED LEARNING SESSION SUMMARY – MLO 1B

In May of 2023, SciAct Portfolio Evaluators from Pacific Research and Evaluation (PRE) kicked off a series of shared learning sessions that will take a deeper dive into each of the SciAct Mid-Level Objectives (MLOs). The sessions that took place in May focused on MLO 1b and key takeaways are summarized below. Two 60-minute sessions were offered with 31 projects represented across sessions. There was a total of 30 attendees with two people who attended both sessions. Of those who attended, 21 were evaluators, 6 were PIs or Co-Is, and the remaining 3 had other roles.

KEY TAKEAWAYS

MLO 1b: Provide opportunities for participants to engage with the disciplinary content related to NASA science and engineering.¹

Interpretation

Most projects are interpreting **MLO 1b as a project output** with a focus on counting the number of opportunities that are provided for learners to engage in disciplinary content. Other projects are counting the number of learners that have engaged with disciplinary content. Some projects indicated that they align their counts with the Reach Map, or that they use categories defined on the Reach Map as a baseline for their own efforts. Some projects are interpreting **MLO 1b as a project outcome** and focusing more on the engagement aspect of the objective or the content knowledge of individuals who are delivering the disciplinary content.

Measurement

Interpretation of **MLO 1b as an output** has corresponded to measurement in the form of counting the quantity of people, events, or materials. Projects provided a range of examples of what could be included in these counts:

- ❖ Number of people (learners, professionals, formal educators, informal educators, etc.)
- ❖ Types of people (grade level, demographics, SME area, etc.)
- ❖ One-off events or activities
- ❖ Series or ongoing activities
- ❖ Professional learning sessions
- ❖ Resources or materials produced

¹ To distinguish between participants in Shared Learning Sessions and the “participants” referred to in various MLOs, the latter group is referred to as “learners” throughout this compilation of summary reports.

Interpretation of **MLO 1b as an outcome** has corresponded to measuring learner engagement or measuring the content knowledge of those delivering the disciplinary content. When discussing this approach, some projects further specified that MLO 1b could be viewed as an impact measure that broadens what assessment could look like. Examples include:

- ❖ Changes in behavior or learning, as a result of opportunities provided by projects
- ❖ Effectiveness of using assets to develop STEM skills
- ❖ Learner understanding of the quality of experience, interactions with scientists, and ways disciplines were presented

What's going well with this MLO?

Projects shared what has worked well with regard to MLO 1b. There was agreement that this MLO is widely applicable across projects as evidenced by the fact that 23 projects selected it as one of their focus MLOs when creating evaluation plans. Projects appreciate that this MLO is easy to measure and that it can provide evidence of the volume and reach of activities within a project.

What are the suggestions for improving this MLO?

Projects expressed a desire to know how SciAct intended this MLO to be interpreted and whether there is a desired focus on counting activities versus measuring outcomes. Discussion also focused on the fact that while this MLO allows for comparisons across projects, such comparisons may not be valid or desirable since the volume of learners, activities, events, etc. may vary significantly (and appropriately) across projects. One project evaluator noted, "My PI has asked me for suggestions about what 'good performance' on this MLO looks like, and it is impossible to answer that question due to differences in project structure, goals, etc."

Questions for consideration

- ❖ If this is a productivity metric, is the goal for projects to show fidelity to planned implementation?
 - How does this limit room for flexibility and adaptability – something Portfolio Evaluation learned was central to advancement of MLO 3b.
- ❖ What potential inequities does MLO 1b have the potential to create if it is measured through counts?
 - For example, some projects may have intensive, multi-week experiences, whereas others may offer a brief webinar. Both could meet MLO 1b but is this an accurate or telling outcome measure?
 - In what ways might interpretation of MLO 1b as an output prioritize the ability to advertise a given activity over investing in depth of engagement?
- ❖ How is engagement being defined for this metric? If all extremes are to be included, is it appropriate to have one MLO apply to all potential interpretations?
- ❖ Should all projects be measuring and reporting on this MLO since producing opportunities seems to be an inherent part of what SciAct projects are funded to do?
- ❖ Is the data collected from MLO1b valuable for evaluation efforts since it is redundant with information reported via the Reach Map?
- ❖ Is it possible to measure MLO 3a without Measuring MLO 1b? Is 1b nested within 3a?

- ❖ For MLOs that use the word “increase,” should there be a defined baseline?

Additional Comments

Broader conversation explored the intent behind the MLOs when they were created. Several projects felt that MLOs could be viewed as nested into one another. Others identified overlap between certain MLOs. Projects shared that their interpretation of how MLOs relate to one another impacted the selections they made when completing their evaluation plans, how they’ve constructed their instruments, and what they report back to SciAct. As noted previously, several projects felt that MLO 3a inherently includes measurement of MLO 1b with the underlying expectation to increase from an undefined baseline. Similarly, MLO 1c could be interpreted as contingent on MLO 1b. In the future, projects would like clarity on reporting expectations for individual MLOs. Projects expressed interest in hearing updates on these conversations at the Annual Meeting.

SHARED LEARNING SESSION SUMMARY – MLOS 1A AND 1C

In late June and mid-July of 2023, SciAct Portfolio Evaluators from Pacific Research and Evaluation (PRE) continued its series of shared learning sessions that dive deeper into each of the SciAct Mid-Level Objectives (MLOs). Two 60-minute sessions took place in June and July, focusing on MLOs 1a and 1c, and key takeaways are summarized below. There were 30 projects represented across sessions and a total of 29 attendees with two people who attended both sessions. Of those who attended, 22 were evaluators, 5 were PIs or Co-Is, and one person was part of SciAct’s backbone team. The following two questions were added to this Shared Learning Session:

- ❖ **MLO 1a Only:** Conversations about Science Capital have increased since the 2022 Annual Meeting. Does this concept change MLO 1a for you in any way?
- ❖ **MLO 1c Only:** The NASA website and resource database is being updated. How, if at all, does the NASA website play into your understanding of MLO 1c?

KEY TAKEAWAYS – MLO 1A

MLO 1a: Inspire participants’ interest in STEM and the development of their identities as science learners.

Interpretation

Projects are interpreting MLO 1a as an outcome and are focused on one of the two constructs identified in the MLO depending on alignment with project activities. Some projects are focused on the **development of a learner’s STEM identity** and others are focused on **inspiring learner interest in STEM**.

- ❖ **Development of STEM identity:** Projects are addressing the development of STEM identity through the use of Subject Matter Experts (SMEs) or trained educators to expose learners to disciplinary content, guiding them through activities intended to develop STEM skills.

- ❖ **Inspiring participation interest in STEM:** Interest-related aspects of this objective center on the creation of engaging activities. Consistent with MLO 1b conversations, the intensity and frequency of referenced activities varied greatly.
- ❖ **Some projects described further progressing interpretation of MLO 1a, to include advanced broadening participation efforts, effectively complementing MLO 3b.** Specifically, they hoped that exposure to Subject Matter Experts (SMEs) from a range of backgrounds will inspire learners, sparking interest in STEM pathways. Discussion of MLO 1a led to a conversation about how SciAct intended “learners” to be defined and we learned that the way a project chose to define “learner” impacted overall interpretation, operationalization, and measurement of the objective.

Measurement

In line with interpretation, measurement of this MLO has been focused on STEM identity development or interest in STEM.² Projects shared that their assessment may include:

- ❖ Development of STEM Identity:
 - Predominately assessed using the STEM Professional Identity Overlap (STEM PIO)
 - A limitation of STEM PIO is that it excludes those who may be generally interested in STEM but not are interested in pursuing it professionally
- ❖ Assessments focused on STEM Interest
 - Building subject-matter knowledge
 - Expression of STEM interest
 - Extent to which learners follow pathways into STEM extracurriculars or leisure time
 - Extent to which SciAct activity influenced learner intent/decision STEM extracurriculars or leisure time activities, and/or careers
- ❖ Assessments focused on STEM Identity
 - Developing subject-matter capacities
 - Extent to which learners follow pathways into STEM academically, STEM extracurriculars or leisure time activities, and/or careers
 - Extent to which SciAct activity influenced learner intent/decision to pursue STEM academically, STEM extracurriculars or leisure time activities, and/or careers

Note: There is overlap between assessment activities for STEM interest and identity, with distinctions often made in a specific measure or through data analysis.

Measurement for projects that are leveraging MLO 1a as a means of broadening participation include:

- ❖ Exploration of participant perceptions of pathways into STEM

² Listed assessment areas are specific to what was voiced in Shared Learning Sessions. They exclude other means of assessing STEM identity and interest, such as changes in or expression of self-identification, efficacy, advocacy, and confidence-building. Though not explicitly shared in Shared Learning Sessions, conversations with projects in other environments suggest that assessment of these behaviors may be included in broader MLO 1a measurement activities.

- ❖ The impact of having SMEs from historically marginalized groups present content to learners from similar backgrounds or demographics
- ❖ Extent to which learners felt represented by SMEs or other individuals presenting the disciplinary content
- ❖ Perceived personal relevance of disciplinary content or affinity with discipline areas

What's going well with this MLO?

There was agreement that **MLO 1a is widely applicable across projects as evidenced by the fact that 22 projects selected it as one of their focus MLOs when creating evaluation plans.** Participants appreciated the many ways that this MLO can be interpreted, operationalized, and measured. It allows projects to provide evidence of how they are connecting learners to and/or supporting them along STEM pathways.

What are the suggestions for improving this MLO?

Projects expressed a desire to know how SciAct intended MLO 1a to be interpreted. **Given the multitude of constructs within the objective, they wondered if SciAct had a particular interest area that projects should be focusing on.** A singular interpretation of "learner" would also be beneficial for creating shared, consistent implementation of MLO 1a. For example, one project felt a tension between a perceived preference for pre/post measurement to assess MLO 1a and the reality that it may take months or years for a learner to truly be able to articulate shifts in their identity and attribute those shifts to the activity they engaged in. **Projects wondered how space could be made in this MLO to accommodate the long-term, fluid nature of identity development.**

Additional Comments – Role of Science Capital in MLO 1a

When asked to reflect on the idea of science capital through the lens of MLO 1a, participants discussed how it plays a role in the identity piece of the objective. **PIs felt like the concept of science capital was complimentary to activities that many projects are currently implementing,** such as community events, building positive feedback loops into activities, offering informal skills-building opportunities, etc. Further, one PI noted that it felt reminiscent of the National Science Foundation's Six Strands of Learning.

One project evaluator shared that, since being introduced to the idea of science capital at the Annual Meeting, their project revised recruitment activities. Application materials for their project activities now include space to share about developing science knowledge in less traditional ways (e.g., those outside of the science classroom). This has resulted in a revision of the indicators used to demonstrate a learner's interest in science careers.

While discussing science capital, some evaluators explored the various ways MLOs can be interpreted with an emphasis on how they could be viewed as prioritizing STEM career pipelines versus everyday science identities. The conversation again highlighted how operationalization and measurement of MLO 1a, or other MLOs, can vary greatly depending on the project focus and interpretation.

KEY TAKEAWAYS – MLO 1C

MLO 1c: Increase number of and frequency with which NASA SMD assets are used by learners across the US.

Interpretation

MLO 1c was commonly understood to be a project output. The primary focus of this MLO is to count the number of instances when a learner has used a NASA SMD asset. Projects indicated that this seemed most feasible for deliverables-based activities (where learners could self-report use) and for online content (which could theoretically be tracked through website analytics). **Few projects indicated they were actively pursuing this MLO, in part due to the challenges in quantifying user engagement in other environments, defining “learners,” and because their projects were better suited to other MLOs.**

Measurement

Interpretation of MLO 1c as an output has corresponded to measurement in the form of counting frequency of use. Participants provided examples of what they believed could be included in these counts:

- ❖ Number of learners interacting with a resource
- ❖ Number of educators using a resource with learners
- ❖ Consistency of usage, as appropriate
- ❖ Repeat usage, as appropriate

What’s going well with this MLO?

MLO 1c allows projects to quantify efforts and succinctly detail use of products.

What are the suggestions for improving this MLO?

Again, participants were curious to learn more about SciAct’s intent for how MLO 1c was designed to be interpreted. Specifically, they wondered if there were ways, other than counting, that SciAct was hoping this could be measured. There was consensus that MLO 1c can be challenging to measure because it is often a step removed from most project activities. As one PI shared, “We could do presentations or professional development with partners but we’re not going to have any real analytics beyond what they use in that moment and what they got out of that experience.” Related, some projects volunteered that they started creating resource lists and guides to directly connect educators with assets. This was in response to educator feedback about how difficult it was to locate resources across the breadth of NASA websites. While these efforts might document interactions with NASA resources online, they only tell a portion of the story – they exclude:

- ❖ How user-friendly or easy-to-access these resources were
- ❖ How aware educators or learners were that they were using a NASA asset
- ❖ Extent to which project efforts contributed to the overall usage experience, including the decision to use a given NASA asset

Additional Comments – Impact of NASA Website on Implementation of MLO 1c

Participants noted that **it was difficult to imagine how an updated version of the website could influence MLO 1c or use of NASA SMD assets without reference materials showing planned changes.** Projects

generally viewed the website as an internal resource, with one PI sharing, "It seemed to me that, primarily, it was used for us and connecting across SciAct, rather than a resource externally." Participants were open to reconsidering their usage of the website, though they noted that they were not sure how it could work as part of this MLO or how they might obtain engagement data.

RECURRING THEMES

Broader, higher-level conversations have threaded through the four Shared Learning Sessions PRE has facilitated. They are summarized below.

- ❖ **Defining "Learner":** Across Shared Learning Sessions, projects have explored the intent behind the word "learner" in MLOs and across SciAct. Specifically, they have spoken about how the way "learners" is framed across MLOs varies; in some objectives they are "science learners" (MLO 1a), whereas in other objectives they are simply "learners" (MLO 1c), and in several objectives the term is replaced with "participants" (MLOs 1b, 2a, 3a, 3b, and 3c). Projects also contemplated the extent to which educators – in formal and informal environments – or professionals in STEM/SMEs are to be included in the definition of "learners" or "participants." These variances have impacted how projects chose to interpret and measure activity designed to advance them.
- ❖ **Defining NASA SMD asset:** Similarly, discussion continued to explore the term "NASA SMD asset." **Projects agreed that there are varying interpretations of what "NASA SMD asset" means** (listed in alphabetical order below). Note, several projects both agreed and disagreed about the inclusion of some of these items, with SMEs being the most debated listing.
 - Activities developed by NASA or SciAct Partners
 - Data or Datasets
 - Derivative products that come from projects
 - Educational resources
 - Educational resources that allow users to directly engage with NASA data
 - Hardware
 - NASA science
 - Physical resources (e.g., astromaterials)
 - SciAct projects based on NASA Missions
 - SMEs
 - Software
 - Tools
- ❖ **Use of the words "inspire" or "increase" in the MLOs.:** Participants continued to wonder what baseline or reference point SciAct had in mind when crafting these statements. In the MLO 1a and 1c discussions, one evaluator shared that these terms could be remnants from SciAct 1.0, which had a stronger emphasis on quantifying progress than SciAct 2.0.
- ❖ **Nested MLOs:** The idea of MLOs existing on a continuum or being nested into one another, depending on project activities and broader MLO interpretation, continues to be of interest. Much like MLO 1b, participants felt MLO 1c was inherently part of MLO 3a. Similarly, MLO 1c was also viewed as an output; it was viewed as a mechanism that can be used to achieve MLO 1a or other

MLOs. PIs saw the opportunity for and appeared to be acting on, the advancement of MLO 3b through MLO 1a.

- ❖ **Selecting Project MLOs:** Motivations for MLO selection when drafting evaluation plans were again mentioned and are increasingly providing insights into the decision-making process.
 - **When an individual is only working on one SciAct project, the selection process was rather direct:** a project team would make selections that balanced how applicable an MLO was to their overarching work with how feasible it was to measure within planned activity.
 - **Those who work on multiple projects have described a more nuanced approach to their MLO selections.** They mapped out activities across projects and selected the MLOs they would pursue within a given project relative to one another. This allowed them to focus investigative activities to where they were most likely to return meaningful results and strategically broaden the number of overall MLOs they were measuring across projects.

SHARED LEARNING SESSION SUMMARY – MLOS 2A AND 3A

In August of 2023, SciAct Portfolio Evaluators from Pacific Research and Evaluation (PRE) continued its series of shared learning sessions that dive deeper into each of the SciAct Mid-Level Objectives (MLOs). Two 60-minute sessions took place, focusing on MLOs 2a and 3a, and key takeaways are summarized below. There were 29 projects represented across sessions and a total of 28 attendees with two people who attended both sessions. Of those who attended, 22 were evaluators and six were PIs or Co-Is.

KEY TAKEAWAYS – MLO 2A

MLO 2a: Advance participants' understanding of the process of science using NASA SMD assets.

Interpretation

Projects are interpreting MLO 2a as an outcome and are primarily focused on the process of science. **Projects vary their definition of “the process of science” and adapt it to suit their intended audiences and/or reflect processes evident in their project work.** There was a shared understanding that, regardless of audience, **the goal of the MLO was to help people learn how science is done at NASA.** One evaluator commented that the incorporation of “using NASA SMD assets” in the MLO effectively “bounds” the way the process of science can be defined and measured. In other words, they felt the MLO gave the guidance that scientific processes demonstrated in efforts external to NASA (e.g., demonstration of science process at Space X) should be excluded from any activities intended to advance this objective. Ways projects are advancing MLO 2a include:

- ❖ Co-design activities
- ❖ Curriculum for use in K-12 learning environments or research labs in higher education

- ❖ Digital learning experiences
- ❖ Internships
- ❖ Mentorship and role modeling

Measurement

Measurement of this MLO is influenced by a project’s intended audience; they will adapt the definition of “the process of science” and the extent to which understanding is evident accordingly. Assessment of this construct includes pre/post assessments, retrospective post-assessment, or a general post-assessment. Projects shared that their assessment may include:

- ❖ K-12 Learners
 - Assessing evidence of science and engineering practices and skills when problem solving
 - Sometimes further specified to align with NGSS framework
 - Extent to which activities impacted or changed student understanding of the process of science
 - Ability to communicate scientific process
- ❖ Informal, learner-centered experiences of youth and young adults
 - Ways activities informed learner’s understanding of the process of science
 - Changes in learner understanding of the process of science
 - Ways activities allowed learners to practice the process of science
 - Depth of engagement
- ❖ Educators/Mentors using NASA SMD Assets
 - Ways in which NASA SMD assets used in trainings advanced individual understanding of the process of science
 - Extent to which training prepared them to use NASA SMD assets to communicate the process of science
 - Depth of engagement

What’s going well with this MLO?

Participants appreciated the variety of ways elements of the MLO can be interpreted, operationalized, and measured. Specifically, projects liked that they could tailor project definitions of “understanding” and “NASA SMD assets” to align with project work, and evaluators appreciated the flexibility this afforded them when measuring this MLO. Though the added focus on “NASA SMD assets” helped ground the MLO, some described the addendum as “less relevant” and reinforcing “what we’re supposed to be doing” as SciAct-funded projects.

What are the suggestions for improving this MLO?

Participants discussed the extent to which MLOs seemingly erred towards applied sciences versus “science in society.” As one evaluator shared, “When you’re talking about applied science, and a lot of NASA’s work is applied science, there are socio-scientific issues, decision-making, all of those things that aren’t necessarily science, but they’re connected to science.” They wondered the extent to which these broader contextual factors or realities should play a role in how the “process of science” is understood, communicated, or measured. Some felt the MLOs were constrained by the Top-Line Objectives (TLOs),

and therefore limited by the extent to which interpretation could be broadened to explore concepts like "science in society."

KEY TAKEAWAYS – MLO 3A

MLO 3a: Increase participation in learner-centered experiences based on NASA SMD assets.

Interpretation

MLO 3a was primarily seen as a project output, though it was occasionally progressed to also be a project outcome. The primary focus of this MLO was to broaden the number of opportunities learners had to participate in experiences using, informed by, or facilitated by NASA SMD assets. Participants who indicated their project was actively pursuing this MLO tended to offer activities in formal K-12 learning environments. **Projects operationalize this MLO by giving learners opportunities to "do science." The added specification of basing these experiences on NASA SMD assets helped define or limit the scope of experiences possible.** As one participant shared, "We're going to learn science by doing science. We will understand what science is by using NASA materials and learning how to do science by doing and engaging with NASA. Learning how NASA does science, engaging in its research." Activities that projects are using to advance MLO 3a include:

- ❖ Curriculum for use in K-12 learning environments
- ❖ Professional development focused on implementing curriculum
 - Can be facilitated by a SME
- ❖ Mentorship and role modeling
- ❖ Library and out-of-school programming
- ❖ Digital learning experiences

Measurement

Interpretation of MLO 3a as an output has corresponded to measurement in the form of counting frequency of implementation and engagement. Given that many projects are tracking engagement in formal learning environments, engagement was often tracked relative to an individual being a learner/student or a facilitator/educator. Participants provided examples of how they measure this MLO:

- ❖ Outputs: Learners/Students
 - Tracking student participation in activities based on or actively using NASA SMD assets
- ❖ Outputs: Facilitators/Educators
 - Documenting teacher participation in professional development sessions
 - Extent to which professional development prepared teachers to implement curriculum based on or using NASA SMD assets, specific to the process of science
 - Perceptions of learner/student engagement and change in knowledge

Less commonly, interpretation of MLO 3a as an outcome resulted in assessing the extent to which a given activity impacted a learner. When measuring outcomes, projects tended to use the same audience groups: learners/students and facilitators/educators.

- ❖ Outcomes: Learners/Students
 - Extent to which activities impacted or changed student understanding of the process of science
 - Impact of learner-centered experiences, generally
 - If the experience included collaboration or working on a team, the impact of this component of the experience on the learner
 - Impact of learner-centered experiences using NASA SMD assets
 - If the NASA SMD asset was a formal mentor, the impact of this individual on the learner
 - Expression of STEM interest as a result of learner-centered experience and/or NASA SMD asset
 - Progress towards STEM-related academic and professional goals
- ❖ Outcomes: Facilitators/Educators
 - Extent to which professional development prepared teachers to implement curriculum based on or using NASA SMD assets, specific to the process of science
 - Perceptions of learner/student engagement and change in knowledge

What's going well with this MLO?

MLO 3a allows projects to quantify efforts and explore the impact of these experiences on learners. **As an output, measurement of this MLO allows for projects to create baselines; as an outcome, measurement of this MLO allows for projects to track engagement and changes or progression on the impact of experiences over time.** This MLO felt easy to understand, with participants agreeing that “learner-centered experiences” could be consistently interpreted across projects and was generally understood to be something all projects were inherently doing as a result of their work.

What are the suggestions for improving this MLO?

Projects had minimal feedback on how this MLO could be improved. There was some discussion on what is meant by “based on” with regard to how involved/present the NASA SMD asset is in the final learner-centered experience for it to be sufficiently meeting this objective.

RECURRING THEMES

Broader, higher-level conversations have threaded through the Shared Learning Sessions PRE has facilitated. They are summarized below.

- ❖ **MLOs are worded to allow for broad interpretation:** Consistently, participants have shared that one of the things they most like about the MLOs is the various ways they can be understood and operationalized. One evaluator shared, “When we look across the spectrum of projects, we get a lot of interesting information because everybody interprets these differently.” Though projects value this flexibility, they often wonder about the implications of it. Questions that have come up each Session are “What was intended?” and “What does SciAct/NASA want to be able to report out?” If there is a preference for a more cohesive interpretation of these MLOs, they would prefer that be articulated before SciAct 3.0.

- ❖ **MLOs are worded to emphasize outputs over outcomes:** Evaluators noted that the way MLOs are worded errs towards measuring the instances of experiences and opportunities more so than the impact of these activities on learners. Though there is flexibility to also assess outcomes, that allowance often feels secondary to what the MLO is asking projects to measure.
- ❖ **Quantifying use of NASA SMD assets:** Participants progressed earlier conversations about defining a NASA SMD asset and the usage of words like “inspire,” “increase,” “advance,” etc. by posing questions about how much an asset needed to be used – and in what ways – to sufficiently contribute to advancing the MLOs. For example, do participants/learners need to have direct access to an asset, or is it enough that an asset informed the development of a product (e.g., a flier or presentation) that participants/learners interact with?
- ❖ **Defining NASA SMD asset:** Projects touched on the various ways “NASA SMD asset” could be defined, though to a lesser extent than in previous Shared Learning Sessions. They felt previous documentation on the range of ways this was being interpreted was sufficient and, unless otherwise notified, would continue defining NASA SMD asset as appropriate to individual project needs.
 - *Note: Shortly after this round of Shared Learning Sessions was completed an updated version of the Science Activation Glossary was published, which now includes a definition of “NASA SMD asset.” [The Science Activation Glossary 10.0 can be found in the SciAct Google Drive under 1.6 SciAct Reference Library.](#)*
- ❖ **How the National Academies Review will impact SciAct 3.0:** Increasingly, participants have been trying to anticipate how the National Academies might review the MLOs and what kind of insights or recommendations could come from their work. Of particular interest is ensuring that the perspectives of all project personnel are factored into their review, with some expectation that insights from Portfolio Evaluation (including documentation from Shared Learning Sessions) help inform how MLOs are being operationalized. Pending actual recommendations for the Academies, projects anticipate the following changes may result from this effort:
 - Refining and aligning terminology used in MLOs
 - Learner/Participant
 - Defining key terms to ensure cohesive understanding
 - Learner/Participant
 - NASA SMD asset
 - Clarity on whether MLOs should be viewed as existing on a continuum or nested, or if they should be viewed as distinct objectives under their guiding TLO

SHARED LEARNING SESSION SUMMARY – MLOS 3B AND 3C

In October of 2023, SciAct Portfolio Evaluators from Pacific Research and Evaluation (PRE) concluded its series of Shared Learning Sessions that dive deeper into each of the SciAct Mid-Level Objectives (MLOs). With a goal to facilitate discussion around how MLOs are being defined and operationalized across projects and to share relevant measurement tools, two 60-minute sessions took place, focusing on MLOs 3b and 3c. Key takeaways from these conversations are summarized below. There were 17 projects represented across sessions and a total of 19 attendees. Of those who attended, 14 were evaluators and five were PIs or Co-Is.

KEY TAKEAWAYS – MLO 3B

MLO 3b: Increase the diversity of participants reached by Science Activation through intentional, inclusive programming.

Interpretation

Projects **primarily interpret MLO 3b as an output focused on increasing either the quantity of diverse learners who engage with their activities and/or the range of diverse learners their activities reach.** Though projects adapt their understanding of “diversity of [learners]” to suit intended audiences, they acknowledged that there are general categorical groupings that can be made across various interpretations, such as:

- ❖ Learners with differing physical abilities
- ❖ Learners who are neurodiverse
- ❖ Learners from non-white racial/ethnic groups, specifically:
 - African American and/or Black communities
 - Native American, Alaska Native, and/or Indigenous communities
 - Hispanic and/or Latino communities
- ❖ Learners from minority-serving institutions, such as:
 - Tribal Colleges
 - Historically Black Colleges and Universities
 - Hispanic-serving Institutions
 - Community Colleges
- ❖ Learners who are female-identifying and nonbinary individuals
- ❖ Learners from rural communities

Less commonly, **some projects are interpreting MLO 3b as a formative objective, focused on the *process* of creating “intentional, inclusive programming.”** Mention of this perspective in the Shared Learning Sessions sparked much interest and conversation among participants. Ways projects are advancing this interpretation of MLO 3b include:

- ❖ Using Universal Design for learning experiences
- ❖ Creating accessible versions of resources (e.g., multilingual versions)
- ❖ Centering adaptability into resource or experience design
- ❖ Using a co-design process
- ❖ Developing inclusive action toolkits to support activity implementation

Measurement

Measurement of this MLO primarily centers on tracking demographic data of learners, documenting baselines and changes in the demographic diversity of those reached by SciAct. Though not explicitly shared in Shared Learning Sessions, conversations with projects in other environments suggest that assessment of this construct likely occurs on activity registration forms and/or through demographic sections on post-assessment forms. Measurement activities are primarily designed to:

- ❖ Using counts, report the extent to which intended communities are represented
 - Some projects have set specific targets, relative to selected focal audiences, that they are measuring progress towards
- ❖ Using counts, report changes in learner demographics
- ❖ Report additional metrics detailing geographic reach

When interpreted as a formative objective, assessment activities tend to explore the efficacy of processes designed to ensure programming is intentional and inclusive. Examples of what some projects are focusing their formative assessment of MLO 3b on include:

- ❖ How “intentional, inclusive programming” is impacting learners
 - Extent to which DEIA is considered in the development of resources or programming
 - Usage of inclusive action toolkits and any other available resources
 - Observations of change in learner behavior, knowledge, skills development, etc.
 - Ways in which activity facilitators are practicing inclusive behaviors
 - Learner perceptions of how activities designed to center inclusivity are impacting them
 - Extent to which activities are fulfilling to learners
 - Extent to which activities are contributing to future planning for academic or career pathways
- ❖ Impact of multilingual resources on learners
 - Engagement with or use of multilingual resources
 - The impact of having multilingual resources on learner knowledge or performance (e.g., before/after comparisons if translated versions were not historically available)
- ❖ Efficacy of project-level processes to support broadening participation
 - Tracking the number of new partnerships formed annually
 - Surveying partners to explore their trust in, feel respected by, and have a sense of belonging with a given SciAct project partner/team
 - Success of co-design activities
 - Extent to which learners were able to participate in co-design process
 - Impact of learner engagement in the co-design process

What’s going well with this MLO?

The broadness of this MLO appeals to projects. Participants liked that they could “fit a lot” into the definition, particularly the “intentional, inclusive programming” piece of the MLO. **Treating MLO 3b as an output allows for projects to easily quantify and baseline efforts. Treating MLO 3b as an outcome creates**

the opportunity for projects to gather quantitative and qualitative data on the process of creating programs *and* the impact of these experiences on learners.

What are the suggestions for improving this MLO?

Discussion on how to advance MLO 3b focused on the intent behind its broader conceptual directives, with limited discussion on logistical barriers. This may have been due to the emergent interest in formative treatment of MLO 3b.

Conceptual

- ❖ Though projects have been primarily treating MLO 3b as an output, Shared Learning Session conversation around outcome-focused opportunities resonated with participants. Projects discussed how, if this were to be a more intended or explicit function of the MLO, it would then prioritize formative elements of evaluative activity. To that end, **refining interpretation, or measurement of the MLO to focus on process would signal to projects that taking the time to co-design, iterate, refine, and share lessons learned are all expected, valued parts of general project activities.**
- ❖ When thinking about theoretical future assessment areas, one PI suggested measuring the ways interpretation of “diversity of [learners]” has been broadened across projects.
- ❖ Project partners are often a driving factor for broadening participation and supporting diversification goals. One PI commented on how partners can work to advance science or STEM goals, but often have missions that are aligned to broader societal issues or that can support other domains (e.g., the arts). They contemplated how these external focal points effectively influence how partnerships are leveraged and the ripple effect SciAct can have when thinking about the mutual benefits of community partnerships.

Logistical

It can be difficult for some projects to capture the diversity of learners. This was particularly true for projects with broad, national reach. One PI shared that because of the scope of their project, having an IRB protocol that allowed for that level of data collection with learners was not feasible. Due to this limitation, that project leans on activity facilitators to share their impression of learner impact, rather than reporting out metrics that detail changes in the diversity of learner demographics.

KEY TAKEAWAYS – MLO 3C

MLO 3c: Engage participants in learning experiences that promote development of skills for STEM careers.

Interpretation

MLO 3c is commonly understood to be a project outcome. **Though few projects, overall and in the Shared Learning Session, are focusing efforts on advancing this MLO, participants felt the promotion of STEM skills to be the primary function of this MLO.** When seeking to interpret “skills for STEM careers,” several projects gravitated toward preexisting definitions, such as 21st Century Skills. **Projects operationalize this MLO through activating other components of the full statement: engaging learning experiences that allowed learners to develop these skills.** Specific activities projects use to advance this MLO include:

- ❖ Promoting skills development and careers
 - Some projects further specified this to be responsive to the needs of or considerations for learners from specific audience groups (e.g., neurodiverse learners, younger learners)
- ❖ Building STEM content knowledge and competency, with the intention of building connections to STEM studies and careers
- ❖ Supporting learners towards joining professional STEM communities through career-building activities (e.g., resumes, CVs, mock interviews, building peer networks, facilitating mentorship opportunities, etc.)
- ❖ Intentionally introducing learners to STEM professionals via webinars, internships, mentorships, etc.

Measurement

Interpretation of MLO 3c as an outcome has resulted in assessing the extent to which a given activity fosters skills development. When measuring outcomes, assessment activities have included:

- ❖ Review of how projects are *promoting* skills development through activity implementation
 - How skills are being taught to learners
 - Ways skills are practiced in a learning experience
- ❖ Learner awareness of how interpersonal skills, executive functioning, and self-advocacy skills can contribute to a STEM career
- ❖ Learner demonstration of professional skills (e.g., showing up on time, being engaged in project activities)
- ❖ Experiential feedback from learners on program components that supported skills development
- ❖ Knowledge of STEM disciplines and potential career paths within them

What's going well with this MLO?

Though few projects are actively pursuing MLO 3c, participants appreciated that there is an MLO exploring ways SciAct is contributing to the STEM workforce. **The emphasis on promoting career skills development, rather than career acquisition, also resonated with projects.** This enabled some projects to think broadly about how to activate the MLO; one even specified that centering on promotion of skills development meant they could include younger audiences in their work (e.g., developing activities centered on teamwork and collaboration activities).

What are the suggestions for improving this MLO?

Projects also contemplated how "STEM careers" was meant to be defined, particularly since the MLO is not specific to STEM careers *at NASA*. Given this, **projects have broadened their understanding to include a range of professions that contain facets of STEM expertise but exist outside of NASA, such as high school science teachers.** When discussing assessment, one evaluator wondered if it would be worthwhile to explore perceptions around STEM careers, either at NASA or more generally across the workforce.

A few participants noted that, **while their project activities certainly support the development of STEM skills, they are not focused on supporting learners toward a STEM career. They view their work as operating on the periphery of this MLO and, as such, do not consider themselves to be actively advancing MLO 3c** (and did not select it as a focal MLO when drafting evaluation plans). Related, conversation also

explored how it is difficult to know when a learner is transitioning from having a general STEM interest into having an interest in a STEM career. Unless a project is actively working to support the STEM workforce, it can be difficult to measure progress towards this MLO.

RECURRING THEMES

A summary of broader conversations that have continued across Shared Learning Sessions is shared below.

- ❖ **MLOs are worded to allow for broad interpretation:** Participants continued to reiterate their appreciation for how the MLOs can be broadly understood and operationalized, allowing projects to tailor their interpretation to meet the needs of the communities they work with.
- ❖ **MLOs contain multiple directives, allowing for projects to activate different elements of each objective as appropriate:** Participants continued to unpack the various opportunities built into each full statement. While it can be challenging to know if there is a particular priority within a full objective, projects appreciated having flexibility to support the broader objective through targeted interpretation.
- ❖ **Distribution of MLO activities across projects:** Conversations around MLOs often include the question of “how many” projects are actively seeking to advance a given MLO and if there’s a desired number or distribution of MLOs across projects. **Projects prefer being able to focus on MLOs they are best suited to advance.** There is some concern that if broad or complete participation in activating one MLO were to be expected and include common measurement, depending on the MLO, it could potentially dilute the quality of information received. This felt particularly true in recent discussions focused on MLO 3c, which has the fewest number of projects intentionally seeking to advance it. Hypothetically, if all projects were tasked with working towards this objective, there was concern that unless an activity explicitly included career development, information gathered around STEM skills development could not meaningfully be linked to STEM careers.