

RECOMMENDATIONS

The NASA Science Mission Directorate Informal Education Working Group recommends the following courses of action for the NASA SMD education and public outreach community in designing material resources and implementing professional development for informal educators. These recommendations are derived from the results of a nationally-distributed online survey of informal educators. The survey was designed to answer the following questions: 1) How, when, where and for how long do informal educators prefer to receive science, mathematics, engineering, and/or technology content professional development? 2) What are the professional development and material resources that informal educators prefer that could be provided by current and future NASA SMD Education and Public Outreach (E/PO) efforts? Staff and volunteers from museums (both science- and non-science-focused), parks, public libraries, community/afterschool centers, government agencies, and other organizations participated.

While learning can occur in many different ways outside of the classroom, for the purposes of this document, informal education is defined as:

Informal Education: *Free-choice learning opportunities provided outside of the classroom, based on education standards or content-focused learning objectives, created and/or conducted by qualified informal education practitioners, benefitting people of potentially any age and promoting life-long learning.*

PROFESSIONAL DEVELOPMENT

- NASA should respond to the demand for professional development (PD) for informal educators; PD is required for most respondents across institution types.
- NASA's unique position of combining science and engineering practices with cross cutting content and authentic scientific investigations should be utilized to fulfill STEM content needs expressed by informal educators through professional development.
- Provide in-person PD when possible.
- NASA supports the literature-based philosophy that professional development must be sustained in order to have an impact. However, survey respondents preferred one-day PD (with the exception that Other Non-Profit¹ prefer two-day PD). Providers of NASA PD should collaborate and offer synergistic courses that provide a wider context for educators and build on one another. When scheduling offerings, PD providers should provide one-day trainings on weekdays that do not coincide with holidays. Short-

¹ The institution segmentation abbreviations used in this document are as follows: Science/technology museum/center (STMC), Non-science museum/site (NSMS), State park/park district/city park (PARK), Public library (PUBL), Community/afterschool center (CASC), Other/non-profit (ONON), and Government agency (GOVT).

duration PD may be offered in the morning or afternoon. PD should be offered in the winter (some segments report availability in the fall). All segments report minimal availability in the summer.

- National conferences have a low representation of the overall profession. NASA PD may directly serve more front-line informal educators if it is offered at state and/or local meetings, rather than at national conferences.
- Informal educators are likely to very likely to train others (even though only a small percentage of survey respondents identified their primary roles as trainers). This should be considered as a method for maximizing reach (see more under “Future Studies”).
- Volunteers make up a portion of the informal education workforce. Trainings for some groups of informal educators, such as those who identify as “other/non-profit,” ought to include volunteers.
- PD should focus on instruction about how to facilitate activities and background information about session content. PARK, ONON, and CASC were highly interested in access to a content-matter expert after the session. Only NSMS had a high preference for instruction about how to implement evaluation.
- Access to a community of practice for the session attendees, facilitators, and experts should be provided afterward. In light of the need for long-term professional development in order to make an impact, PD providers could consider partnering with other PD providers to maintain and support combined communities of practice.
- Among STMC, NSMS, and ONON, the need for outside sources of funding for PD was selected more frequently than other funding options. (A significant percentage of ONON pay for PD sessions themselves.) When possible, PD providers should offer funding for participation from these segments. PARK, PUBL, CASC, and GOVT most frequently indicated that their organizations have funds for practitioners to attend PD sessions. However, some percentage of respondents from all segments indicated a need for outside funding, so this should be offered to all segments when possible.
- NASA designers should use these recommendations and the survey results themselves as part of a Project Cycle Design Process. These results can be used as part of the Needs Assessment step followed by goal and objective setting, activity design, implementation, and outcome assessment. (Davis, 2014)
- Many successful NASA informal education professional development programs have already been implemented. Before initiating a new project, designers should review project profiles on <http://smdepo.org> in order to review previous evaluation reports, avoid duplicative programs and maximize impact by collaborating with partners.

RESOURCES

- The needs of informal educators vary widely. Resource providers must design resources for specific informal education audiences.
- Science, technology, engineering, and mathematics (STEM) topics are covered at some frequency (daily, monthly, to a few times per year) by many informal education institutions. Many institutions already

address science (in particular, Earth science) and, to a lesser extent, engineering. Resource developers can help informal education institutions go beyond what they already do by offering connections into technology and mathematics.

- Relative to other content areas, the nature of science is rarely covered (except at STMC and GOVT). NASA's high visibility in the public sphere provides an exciting window into the ongoing work of scientists. This position should be leveraged in future resource development to provide an additional avenue for informal educators to address this topic.
- Informal education institutions frequently cover applications of science. Framing NASA resources in terms of this content area may encourage more informal education institutions to adopt them.
- Informal education institutions have barriers for implementing STEM programs. PD sessions should focus on easy-to-use materials and time-saving techniques to help institutions overcome the barriers of lack of funds, materials and resources, and staff to implement programs.
- NASA Resource developers should avoid duplicative efforts by reviewing existing materials through <http://nasawavelength.org>.
- NASA resource developers can maximize the usability and adoption of their resources by following these guidelines:
 - NASA STEM content that is suitable for grades 3-5 can be disseminated to all informal education institution segments. With the exception of ONON and GOVT, grades K-2 are another primary population served by informal educators.
 - NASA STEM content that is suitable for grades 6-8 will best overlap the audiences of ONON, GOVT, STMC, and CASC, which see this group among their top three largest audiences.
 - NASA STEM content that is suitable for grades 9-12 will best overlap the audiences of ONON and GOVT, which see this group as their third largest audience.
 - NASA scientific data and images can be incorporated into resources for use by STMC, ONON, and GOVT.
 - Pre-produced text/images that an institution can print and display are especially valued by NSMS, PARK, PUBL, and GOVT.
 - Downloadable posters/colorful handouts were selected among the top three informal education resource needs by only two segments (NSMS and CASC), indicating that these materials are not as effective an investment for NASA as lesson plans and other types of resources. This reconfirms results from similar studies conducted by NASA in 2005.
 - Provide a point of contact so that informal educators can locate additional copies, get connected with NASA scientists or ask clarifying questions about the resources. As stated above, informal educators are very likely to train others using materials that they receive.
 - New and existing resources should be aligned to state standards, when practical, since there is alignment in all segments. Attention should be paid to the Common Core standards, since there

is alignment in most segments. Only four segments have significant alignment to NGSS. For informal audiences working with teachers, alignment to standards is key. NASA resource and PD designers should reference *Supporting the Implementation of NGSS through Research: Informal Science Education*
http://www.narst.org/NGSSpapers/Informal_Science_Education_June2014.pdf

FUTURE STUDIES

EVALUATION

- Limited information regarding evaluation practices in informal learning institutions is available through this survey. Across all institution segments, the greatest percentage of respondents are responsible for evaluation their own programs, resources, and/or materials. Over one quarter of respondents from public libraries and other non-profit organizations don't formally evaluate their programs. However, evaluation is occurring in public libraries and potentially could become an important practice in future years. Additional assessments regarding the evaluation needs and practices of informal education practitioners are needed.

ASSESSMENT TOOLS

- Survey respondents were not given the option to select lesson plans with or without assessment tools. Future studies should characterize the type of assessment tools that would be implemented by informal education practitioners.

TRAIN-THE-TRAINER PD MODELS

- Future studies should consider analyzing the effectiveness of train-the-trainer type models in informal education settings. The train-the-trainer model may allow NASA PD providers to offer trainings to a select group of informal education practitioners, who in turn disseminate what they've learned at state and/or local meetings. Upon considering this research, NASA PD providers may find this to be a viable option for maximizing NASA funds.

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