

Response to the National Research Council’s Review of NOAA’s Education Program

March 31, 2011

Introduction

The National Research Council (NRC) of the National Academies of Science performed a review of NOAA’s education program, with the goal of providing recommendations for optimizing NOAA’s investment in education. The final NRC report, “NOAA’s Education Program: Review and Critique”, was publically released in 2010 (<http://www.nas.edu/morenews/20100303b.html>). The report provided findings and recommendations in five areas: 1) NOAA’s role in education, 2) Education goals and outcomes, 3) Composition and management of the education portfolio, 4) Education evaluation practices, and 5) Evidence of impact.

NOAA has made significant progress towards implementing recommendations from this report. Two of the most important efforts undertaken, even before the report was finalized, were the development of the 2009 – 2029 Education Strategic Plan a (<http://www.education.noaa.gov/plan/>) and the companion 2010-2014 Education Implementation Plan (http://www.oesd.noaa.gov/planning_policy/IplanFinal_21210.pdf). The Education Strategic Plan describes NOAA’s long term goals and objectives. The Education Implementation Plan outlines specific priority actions to be taken in the next five years to advance the NOAA Education Strategic Plan.

This response to the National Research Council’s Review of NOAA’s Education Program describes the major actions NOAA has undertaken and continues to undertake to respond to the NRC recommendations. It focuses on the work of the NOAA Education Council and specifically the Strategic Plan, the Implementation Plan and other NOAA-wide education activities.

Chapter 1: NOAA’s Role in Education

NRC Recommendation I.1:

NOAA should fulfill its role in education through the use of:

- i. agency and external expertise in science, engineering, technology, and education; cutting-edge scientific research and exploration activities; internationally collected data sets; and advances in technology and engineering;

NOAA Response

1. NOAA is leveraging agency and external expertise and resources in STEM education by leading and participating in interagency education efforts. Specific tasks include:

- co-chairing the STEM education through the Interagency Working Group on Ocean Education;
 - co-chairing climate education through the U.S. Global Change Research Program Education Interagency Working Group;
 - coordinating STEM education through the Interagency Subcommittee on STEM Education;
 - partnering with NASA and NSF on management of the GLOBE Program, an international science and education partnership focusing on hands-on Earth System science in K-12 schools worldwide (111 partner countries);
 - working with the Department of Education and other agencies to promote sustainability efforts through the Sustainability Education Summit and follow-on activities;
 - leading an interagency effort to identify and share best practices in the area of teacher research experiences; and
 - co-hosting a joint meeting of climate education grant recipients from NOAA, NSF and NASA.
2. NOAA is leveraging advances in technology and engineering through use of spherical displays, and other innovative and interactive technologies in partnership with informal science education centers and organizations, to engage the public on climate, atmospheric and ocean sciences. Specific tasks include:
 - supporting Science On a Sphere (SOS) institutions and partners and coordinating SOS related activities, including content development and delivery, through the SOS Network;
 - coordinating the Ocean Today Kiosk network across aquariums, museums and other partners; and
 - awarding competitive education grants through the Environmental Literacy Grants Program to increase atmospheric, climate and ocean literacy, stewardship and STEM education.
 3. NOAA is leveraging internationally collected data sets through new global science and international partnerships focused on K-12 STEM education like the GLOBE Program. In 2010 NOAA resumed leadership of the GLOBE program in partnership with NASA and NSF. GLOBE reaches students in 111 countries and provides a strong link between science and education in support of NOAA's mission.
 4. NOAA is leveraging external expertise and resources by participating in interagency initiatives and partnerships to advance public access to NOAA educational content through electronic media. Specific tasks include:
 - integrating NOAA resources into the Department of Energy's coordinated initiative "scienceeducation.gov";
 - implementing a web-based Federal portal for climate education resources;
 - leveraging resources and disseminating NOAA science and content through key partnerships, such as the American Meteorological Society Teacher online and classroom training, National Science Teachers Association joint webinars, and National Geographic Society's Jason Project on-line resources.

NRC Recommendation I.1:

NOAA should fulfill its role in education through the use of:

- ii. place-based assets that directly connect local issues to national and global science and stewardship issues: marine sanctuaries, estuarine research reserves, fisheries activities, and other natural resources protected and managed by federal, state, and local entities;

NOAA Response:

NOAA's Education Programs are working collaboratively through the NOAA Education Council to utilize the various education networks to directly connect national and regional priorities and drive STEM education and stewardship at the local, state and national levels. Specific tasks include:

- launching an intra-agency collaborative demonstration project, Climate Stewards, focused on increasing climate knowledge and stewardship behavior in PK-20+ education;
- offering competitive grants to promote locally relevant STEM education opportunities to K-12 students, as well as related professional development for educators, that emphasize sustained, hands-on, experiential activities that are aligned with academic learning standards and respond to regional education and environmental priorities;
- developing the "education.noaa.gov" portal to consolidate into one website selected collections of NOAA's online education products, materials and resources to be used by students, educators and the general public; and
- performing a NOAA-wide inventory of STEM education resources and products that utilize emerging and innovative technology to increase the use of these resources and strengthen internal partnerships.

NRC Recommendation I.1:

NOAA should fulfill its role in education through the use of:

- iii. partnerships with local and state education infrastructure, academic institutions, government agencies, business and industry, and private-sector and nonprofit organizations;

NOAA Response:

1. NOAA is leveraging agency and external expertise and resources in STEM education by leading and participating in interagency education efforts. Specific tasks include:

- co-chairing the STEM education through the Interagency Working Group on Ocean Education;
- co-chairing climate education through the U.S. Global Change Research Program Education Interagency Working Group;
- coordinating STEM education through the Interagency Subcommittee on STEM Education;

- partnering with NASA and NSF on management of the GLOBE Program, an international science and education partnership focusing on hands-on Earth System science in K-12 schools worldwide (111 partner countries);
- working with the Department of Education and other agencies to promote sustainability efforts through the Sustainability Education Summit and follow-on activities;
- leading an interagency effort to identify and share best practices in the area of teacher research experiences; and
- co-hosting a joint meeting of climate education grant recipients from NOAA, NSF and NASA.

2. NOAA is leveraging advances in technology and engineering through use of spherical displays, and other innovative and interactive technologies in partnership with informal science education centers and organizations, to engage the public on climate, atmospheric and ocean sciences. Specific tasks include:

- supporting Science On a Sphere (SOS) institutions and partners and coordinating SOS related activities, including content development and delivery, through the SOS Network;
- coordinating the Ocean Today Kiosk network across aquariums, museums and other partners; and
- awarding competitive education grants through the Environmental Literacy Grants Program to increase atmospheric, climate and ocean literacy, stewardship and STEM education.

3. NOAA is leveraging external expertise and resources by participating in interagency initiatives and partnerships to advance public access to NOAA educational content through electronic media. Specific tasks include:

- integrating NOAA resources into the Department of Energy’s coordinated initiative “scienceeducation.gov”;
- implementing a web-based Federal portal for climate education resources;
- leveraging resources and disseminating NOAA science and content through key partnerships, such as the American Meteorological Society Teacher online and classroom training, National Science Teachers Association joint webinars and National Geographic Society Jason Project on-line resources.

4. NOAA’s Education Programs are working collaboratively through the Education Council to utilize the various education networks to directly connect national and regional priorities and drive STEM education and stewardship at the local, state and national levels. Specific tasks include:

- launching an intra-agency collaborative demonstration project focused on increasing climate knowledge and stewardship behavior in PK-20+ education;
- offering competitive grants to promote locally relevant STEM education opportunities to K-12 students, as well as related professional development for educators, that emphasize sustained, hands-on, experiential activities that are aligned with academic learning standards and respond to regional education and environmental priorities;
- developing the “education.noaa.gov” portal to consolidate into one website selected collections of NOAA’s online education products, materials and resources to be used by students, educators and the general public; and

- performing a NOAA-wide inventory of STEM education resources and products that utilize emerging and innovative technology to increase the use of these resources and strengthen internal partnerships.

NRC Recommendation I.1:

NOAA should fulfill its role in education through the use of:
iv. the agency’s global science and international partnerships.

NOAA Response:

NOAA is significantly expanding its global science and international partnerships focused on K-12 STEM education through programs like the GLOBE Program. In 2010 NOAA resumed leadership of the GLOBE program in partnership with NASA and NSF. GLOBE reaches students in 111 countries and provides a strong link between research and education in support of NOAA’s mission.

NRC Recommendation I.2:

In order to adequately address the mismatch between its available resources and its ambitious education agenda, NOAA should better align and deploy its resources. This may require the termination of certain activities and programs that, based on appropriate evaluation, do not directly and effectively contribute to its education and stewardship goals.

NOAA Response

NOAA’s Education Strategic Plan and Implementation Plan demonstrate increased collaboration among NOAA’s major education programs and promote better coordination, leveraging of resources, and minimization of redundant efforts. Many of the activities listed in this document are a direct result of this increased collaboration and sharing of resources across the agency. As part of this effort, NOAA is taking steps to better characterize its education portfolio as well as evaluate the success and efficacy of its education programs with the ultimate goal of increasing the overall effectiveness of NOAA’s investment in education. Specific efforts include:

1. NOAA is increasing its ability to track and evaluate the impact of the agency’s investment in education. Specific tasks include:
 - creating an agency-wide inventory of the status of education evaluation;
 - developing a systematic process for collecting, analyzing, and reporting data on resource allocation, inputs, and outputs for education programs;
 - developing a system for collecting and reporting on performance measures (outcome and output) of education programs;
 - offering multiple opportunities for professional development in order to increase the use and proficiency of NOAA education staff in program monitoring and evaluation;

- hiring an external evaluator to assist with conducting an agency-wide evaluation of NOAA's education programs; and
 - performing program-level evaluation to increase overall program efficiency and reach.
2. NOAA has developed an education chapter in the agency's yearly budget release document to Congress (NOAA's Blue Book), to present NOAA's education portfolio and budget to decision-makers. The chapter includes program descriptions, accomplishments, outputs and budget estimates and is updated on a yearly basis.

NRC Recommendation I.3:

Within the constraints of NOAA's mandates in education, the agency should continually evaluate where it leads, collaborates, follows, or declines to participate in partnerships with others. These decisions should be guided by consideration of the agency's role, assets, resources, and priorities in education and the strengths and missions of other agencies, institutions, and organizations engaged in education.

NOAA Response:

1. NOAA's Education Strategic and Implementation Plans provide a clear focus for determining what partnerships to pursue. For example, in the area of K-12 education NOAA has chosen to expand partnerships with organizations that provide community service that is directly related to NOAA's Mission.
2. NOAA is working on identifying existing key partnerships and establishing guidelines for NOAA educators and staff on how to form new partnerships and develop memorandums of understanding (MOUs) with non-government organizations and other state and federal agencies focused on improving STEM education, citizen's environmental literacy and workforce development in NOAA related careers.
3. NOAA is participating in dialogue with informal science education researchers to encourage evaluation of NOAA and partner informal science education methods.

Chapter 2: Education Goals and Outcomes

NRC Recommendation II.1:

NOAA education programs should formally address broadening participation of underrepresented groups as an important outcome through all phases, from the initial stages of planning through implementation and evaluation. The environmental literacy goal, in particular, should include outcomes related to reaching out to underserved and underrepresented communities.

NOAA Response

1. NOAA education programs are reaching out to underserved and underrepresented groups with the goal to increase a diverse candidate pool for NOAA-related careers. Examples include:
 - Leveraging the significant capability NOAA has developed for support for underrepresented students and faculty at Minority Serving Institutions by better connecting those students and faculty with other programs in NOAA and other relevant partners; and
 - reaching out to underserved communities to increase ocean, atmospheric and watershed awareness and stewardship among diverse youth and families, and community groups through programs like the Merito Program.
2. NOAA education programs are putting a priority on education projects that address reaching underrepresented and underserved groups, including elementary-level teachers and students.
3. NOAA is consolidating a list of existing student opportunities from various NOAA websites to increase the effectiveness of these resources. These lists include student opportunities specifically targeted at underrepresented and underserved groups.

NRC Recommendation II.2:

To reach NOAA’s environmental literacy goal, the Education Council should develop its implementation plan and future revisions of the education strategic plan to:

- i. clarify how it will capitalize on scientific findings, engineering advances, and stewardship activities that relate broad national priorities to local concerns to engage individuals of all ages in education;

NOAA Response

1. NOAA’s Education Programs, working collaboratively through the Education Council, have developed an Education Implementation Plan that utilizes the various education networks to directly connect national and regional priorities and drive STEM education and stewardship at the local, state and national levels. Specific tasks include:
 - launching an intra-agency collaborative demonstration project focused on increasing climate knowledge and stewardship behavior in PK-20+ education;
 - building new partnerships to promote locally relevant environmental education opportunities to K-12 students, as well as related professional development for educators, that emphasize sustained, hands-on, experiential activities that are aligned with academic learning standards and respond to regional education and environmental priorities;
 - developing the “education.noaa.gov” portal to consolidate into one website selected collections of NOAA’s online education products, materials and resources to be used by students, educators and the general public; and

- performing a NOAA-wide inventory of STEM education resources and products that utilize emerging and innovative technology to increase the use of these resources and strengthen internal partnerships.

NRC Recommendation II.2:

To reach NOAA’s environmental literacy goal, the Education Council should develop its implementation plan and future revisions of the education strategic plan to:

- ii. articulate how NOAA education programs will draw on the scientific, engineering, research, and other expertise accessible within the agency as well as in the broader community;

NOAA Response

1. Through its Education Implementation Plan, NOAA is leveraging advances in technology and engineering from within the agency as well as in the broader community through use of spherical displays, and other innovative and interactive technologies in partnership with informal science education centers and organizations, to engage the public on climate, atmospheric and ocean sciences. Specific tasks include:
 - supporting Science On a Sphere (SOS) institutions and partners and coordinating SOS related activities, including content development and delivery, through the SOS Network;
 - coordinating the Ocean Today Kiosk network across aquariums, museums and other partners; and
 - building new partnerships to increase environmental, climate, atmospheric and ocean literacy principles, stewardship and STEM education.

2. NOAA is leveraging agency and external expertise and resources in STEM education by leading and participating in interagency education efforts. Specific tasks include:
 - co-chairing the STEM education through the Interagency Working Group on Ocean Education;
 - co-chairing climate education through the U.S. Global Change Research Program Education Interagency Working Group;
 - coordinating STEM education through the Interagency Subcommittee on STEM Education;
 - partnering with NASA and NSF on management of the GLOBE Program, an international science and education partnership focusing on hands-on Earth System science in K-12 schools worldwide (111 partner countries);
 - working with the Department of Education and other agencies to promote sustainability efforts through the Sustainability Education Summit and follow-on activities;
 - leading an interagency effort to identify and share best practices in the area of teacher research experiences; and
 - co-hosting a joint meeting of climate education grant recipients from NOAA, NSF and NASA.

3. See also NOAA response 1 under NRC Recommendation II.2.i.

NRC Recommendation II.2:

To reach NOAA's environmental literacy goal, the Education Council should develop its implementation plan and future revisions of the education strategic plan to:

- iii. address the mismatch between the lack of an outcome related to stewardship and the focus on stewardship outcomes in local programs;

NOAA Response

NOAA agrees that there needs to be a stronger emphasis on stewardship within the Environmental Literacy goal of its Education Strategic Plan and companion Education Implementation Plan. The NOAA Education Council will work toward incorporating specific stewardship outcomes within the Environmental Literacy goal in future versions of both plans.

NRC Recommendation II.2:

To reach NOAA's environmental literacy goal, the Education Council should develop its implementation plan and future revisions of the education strategic plan to:

- iv. consistently define outcomes as measurable concepts that allow an assessment of whether a goal is being reached, to clearly distinguish outcomes on audiences (impact) from outputs of activities;

NOAA Response

NOAA agrees that the Education Strategic Plan should consistently define outcomes as measurable concepts that allow an assessment of whether a goal is being reached to clearly distinguish outcomes on audiences (impact) from outputs of activities, and will work toward incorporating them into the next edition of its Education Strategic Plan.

1. NOAA held an Expert Evaluation Meeting that brought together evaluation experts, including members from the NAS review committee on NOAA Education, to discuss with NOAA Education program managers and coordinators best practices for program evaluation and to provide assistance with advancing NOAA's efforts with conducting an agency-wide evaluation of NOAA's education activities.
2. NOAA is increasing its ability to track and evaluate the impact of the agency's investment in education. Specific tasks include:
 - creating an agency-wide inventory of the status of education evaluation;
 - developing a systematic process for collecting, analyzing, and reporting data on resource allocation, inputs, and outputs for education programs;
 - developing a system for collecting and reporting on performance measures (outcome and output) of education programs;

- offering multiple opportunities for professional development in order to increase the use and proficiency of NOAA education staff in program monitoring and evaluation;
- hiring an external evaluator to assist with conducting an agency-wide evaluation of NOAA’s education programs; and
- performing program-level evaluation to increase overall program efficiency and reach.

NRC Recommendation II.2:

To reach NOAA’s environmental literacy goal, the Education Council should develop its implementation plan and future revisions of the education strategic plan to:

- v. provide more opportunities for local and regional education staff from all education programs to share effective practices and lessons learned.

NOAA Response

1. NOAA is working toward creating an internal system for improving the capacity of NOAA Education Managers and Staff to create and manage education programs and projects. Specific tasks include:
 - offering annually the NOAA Designing Education Projects (DEP) course for NOAA educators and education managers;
 - offering basic and advanced evaluation training to educators through the Coastal Service Center training program;
 - offering a series of professional development opportunities through partner organizations and contractual agreements to serve both internal and external needs; and
 - encouraging informal education recipients of NOAA’s Environmental Literacy Grants to enter their evaluation reports and materials on “informalscience.org” website for sharing evaluation resources with interested parties.
2. NOAA is developing materials and training NOAA education personnel on best practices for formal and informal climate education. Specific tasks include:
 - identifying best practices in informal and formal climate education; and
 - creating a resource toolkit for climate science education in formal and informal settings.

NRC Recommendation II.3:

To achieve the workforce development goal, the education strategic plan, the education implementation plan, or both should call for periodic assessment of the current and anticipated needs in fields critical to NOAA’s mission to guide investment in appropriate workforce development activities.

NOAA Response

1. NOAA recognizes the importance of this recommendation and that it highlights an existing gap that needs to be addressed. The NOAA Education Council is working closely with the

Human Capitol Council to lead an agency-wide effort to better understand and respond to the agencies' workforce needs.

2. NOAA is building an integrated Pre K-20+ workforce development strategy to increase candidate pool for NOAA-related careers. Specific tasks include:
 - forming new partnerships with non-government organizations and other state and federal agencies focused on improving STEM education, citizen's environmental literacy and workforce development in NOAA related careers;
 - identifying and analyzing current data reports from NOAA Workforce Management and national workforce trends; and
 - leveraging existing programs that provide financial assistance, (e.g., the Educational Partnership Program grants to students and Minority Serving Institutions, Hollings and Nancy Foster Scholarships, Knauss Marine Policy Fellowships and American Meteorological Society's Student Fellowships) to support the training of students and research in NOAA mission sciences.

NRC Recommendation II.4:

NOAA education programs should draw from current and relevant scientific and engineering advances regardless of what agency, institution, or organization they are originated or funded by.

NOAA Response

NOAA is drawing from current and relevant scientific and engineering advances through internal and external partnerships and increased collaboration. NOAA's Education Strategic and Implementation Plans provide a clear direction on which types of partnerships will help to maximize the efficiency and reach of NOAA's education efforts. Specific examples follow.

1. NOAA is leveraging advances in technology and engineering through use of spherical displays, and other innovative and interactive technologies in partnership with informal science education centers and organizations, to engage the public on climate, atmospheric and ocean sciences. Specific tasks include:
 - supporting Science On a Sphere (SOS) institutions and partners and coordinating SOS related activities, including content development and delivery, through the SOS Network;
 - coordinating the Ocean Today Kiosk network across aquariums, museums and other partners; and
 - supporting new partnerships focused on increasing environmental, climate and ocean literacy principles, stewardship and STEM education.
2. NOAA is leveraging agency and external expertise and resources in STEM education by leading and participating in interagency education efforts. Specific tasks include:
 - co-chairing the STEM education through the Interagency Working Group on Ocean Education;
 - co-chairing climate education through the U.S. Global Change Research Program Education Interagency Working Group;

- coordinating STEM education through the Interagency Subcommittee on STEM Education;
- partnering with NASA and NSF on management of the GLOBE Program, an international science and education partnership focusing on hands-on Earth System science in K-12 schools worldwide (111 partner countries);
- working with the Department of Education and other agencies to promote sustainability efforts through the Sustainability Education Summit and follow-on activities;
- leading an interagency effort to identify and share best practices in the area of teacher research experiences; and
- co-hosting a joint meeting of climate education grant recipients from NOAA, NSF and NASA.

Chapter 3: Composition and Management of the Education Portfolio

NRC Recommendation III.1:

NOAA should develop and implement a system to monitor and catalogue its education portfolio and guide decisions regarding what programs should be developed, continued, modified, or ended. In balancing the portfolio, the Education Council should call for:

- increased attention to climate and atmospheric science education programs to complement the current focus on ocean science. These programs should emphasize the strong connections and interactions among the ocean, the atmosphere, the land, and human and nonhuman species;

NOAA Response

- NOAA is increasing its attention toward Climate and Atmospheric Sciences, of which engagement and specifically education are strong components. The Climate Goal of NOAA's Next Generation Strategic Plan is the only goal to have its own climate literacy section dedicated to increasing public understanding and awareness of climate sciences and inform decision making. This increased visibility and focus will help build climate and atmospheric education efforts across NOAA and create a more balanced portfolio.
- NOAA is coordinating the integration and evaluation of climate literacy principles into formal and informal education efforts nationwide. Specific tasks include:
 - conducting needs assessments to identify gaps in various audience needs around climate change education products and materials;
 - coordinating the integration and evaluation of climate literacy principles into formal and informal education efforts nationwide through newly formed NOAA Education Council Climate Education working Group;
 - developing, conducting, and evaluating topic differentiated Climate Science Tutorials for engagement professionals in all regions of the nation;
 - creating and delivering directly or through agency wide partnerships and/or contracts annual professional development opportunities for formal and informal educators in climate science;

- developing and maintaining a climate education component of climate.gov to serve as a single source portal to climate education materials and educator professional development resources from NOAA and other federal agencies; and
 - supporting new partnerships that increase climate literacy.
3. NOAA is leading and participating in interagency efforts to advance climate literacy education by co-chairing the interagency working group at the US Global Change Research Program.

NRC Recommendation III.1:

NOAA should develop and implement a system to monitor and catalogue its education portfolio and guide decisions regarding what programs should be developed, continued, modified, or ended. In balancing the portfolio, the Education Council should call for:

- ii. purposeful attention to both STEM learning and stewardship goals so as to enable synergies;

NOAA Response

1. NOAA is increasing its ability to track and evaluate the impact of the agency’s investment in STEM education. Specific tasks include:
 - creating an agency-wide inventory of the status of education evaluation;
 - developing a systematic process for collecting, analyzing, and reporting data on resource allocation, inputs, and outputs for education programs;
 - developing a system for collecting and reporting on performance measures (outcome and output) of education programs;
 - offering multiple opportunities for professional development in order to increase the use and proficiency of NOAA education staff in program monitoring and evaluation;
 - hiring an external evaluator to assist with conducting an agency-wide evaluation of NOAA’s education programs; and
 - performing program-level evaluation to increase overall program efficiency and reach.
2. NOAA has developed an education chapter in the agency’s yearly budgeted release document to Congress (NOAA’s Blue Book), to better categorize and present NOAA’s education portfolio. The chapter includes program descriptions, accomplishments, outputs and budget estimates.
3. NOAA’s new strategic planning efforts place a strong emphasis on education. NOAA’s new mission statement includes “sharing knowledge and information with others” as a core part of what the agency needs to do. NOAA’s Next Generation Strategic Plan also includes an education objective calling for “An engaged and educated public with an improved capacity to make scientifically informed environmental decisions”. This engagement strategy provides direction for the agency and supports ongoing efforts to better monitor and manage NOAA’s education portfolio.

NRC Recommendation III.1:

NOAA should develop and implement a system to monitor and catalogue its education portfolio and guide decisions regarding what programs should be developed, continued, modified, or ended. In balancing the portfolio, the Education Council should call for:

- iii. decisions based on national education needs, the education priorities of the agency, and a clear picture of its education portfolio.

NOAA Response

1. NOAA is increasing its ability to track and evaluate the impact of the agency's investment in STEM education. Specific tasks include:
 - creating an agency-wide inventory of the status of education evaluation;
 - developing a systematic process for collecting, analyzing, and reporting data on resource allocation, inputs, and outputs for education programs;
 - developing a system for collecting and reporting on performance measures (outcome and output) of education programs;
 - offering multiple opportunities for professional development in order to increase the use and proficiency of NOAA education staff in program monitoring and evaluation;
 - hiring an external evaluator to assist with conducting an agency-wide evaluation of NOAA's education programs; and
 - performing program-level evaluation to increase overall program efficiency and reach.
2. NOAA has developed an education chapter in the agency's yearly budget release document to Congress (NOAA's Blue Book), to better categorize and present NOAA's education portfolio. The chapter includes program descriptions, accomplishments, outputs and budget estimates.
3. NOAA's new strategic planning efforts place a strong emphasis on education. NOAA's new mission statement includes "sharing knowledge and information with others" as a core part of what the agency needs to do. NOAA's Next Generation Strategic Plan also includes an education objective calling for "An engaged and educated public with an improved capacity to make scientifically informed environmental decisions". This engagement strategy provides direction for the agency and supports ongoing efforts to better monitor and manage NOAA's education portfolio.

Chapter 4: Education Evaluation Practices

NRC Recommendation IV.1:

The Education Council should continue to improve the evaluation expertise of its education program managers, contract with external evaluators for summative evaluation, and require the incorporation of the most appropriate and rigorous evaluation strategies during program development to guide design, continual improvement, and delivery of its education programs.

NOAA Response

1. NOAA is increasing its ability to track and evaluate the impact of the agency's investment in STEM education. Specific tasks include:
 - creating an agency-wide inventory of the status of education evaluation;
 - developing a systematic process for collecting, analyzing, and reporting data on resource allocation, inputs, and outputs for education programs;
 - developing a system for collecting and reporting on performance measures (outcome and output) of education programs;
 - offering multiple opportunities for professional development in order to increase the use and proficiency of NOAA education staff in program monitoring and evaluation;
 - hiring an external evaluator to assist with conducting an agency-wide evaluation of NOAA's education programs; and
 - performing program-level evaluation to increase overall program efficiency and reach.

2. NOAA will establish and maintain a coordinated approach for evaluating the effectiveness and impacts of NOAA's investment in informal science education. Specific tasks include:
 - creating an agency-wide framework for reporting informal science education evaluation measures for internal programs and grantee reporting;
 - participating in dialogue with outside informal science education research funding organizations to encourage evaluation of NOAA and partner informal science education methods;
 - creating standardized language in NOAA informal science education grants requiring effective evaluation;
 - synthesizing findings of informal science education effectiveness from grantee and partner projects;
 - reporting on Science On a Sphere best practices; and
 - developing education models based on needs assessments of users.

3. NOAA held an Expert Evaluation Meeting that brought together evaluation experts, including members from the NAS review committee on NOAA Education, to discuss with NOAA Education Program Managers and Coordinators best practices for program evaluation and to provide assistance with advancing NOAA's efforts with conducting an agency-wide evaluation of NOAA's education activities.

4. NOAA will coordinate the integration and evaluation of climate literacy principles into formal and informal education efforts nationwide. Specific tasks include:
 - conducting needs assessments to identify gaps in various audience needs around climate change education products and materials;
 - developing, conducting, and evaluating topic-differentiated climate science tutorials for engagement professionals in all regions of the nation; and
 - training NOAA personnel in evaluation of climate education projects.

NRC Recommendation IV.2:

The Education Council should increase the emphasis on high-quality evaluations. Summative evaluations should focus on the program outcomes related to learning and stewardship, not only satisfaction with education experiences, and should use the most appropriate and rigorous evaluation designs.

NOAA Response

1. NOAA is increasing its ability to track and evaluate the impact of the agency's investment in STEM education. Specific tasks include:
 - creating an agency-wide inventory of the status of education evaluation;
 - developing a systematic process for collecting, analyzing, and reporting data on resource allocation, inputs, and outputs for education programs;
 - developing a system for collecting and reporting on performance measures (outcome and output) of education programs;
 - offering multiple opportunities for professional development in order to increase the use and proficiency of NOAA education staff in program monitoring and evaluation;
 - hiring an external evaluator to assist with conducting an agency-wide evaluation of NOAA's education programs; and
 - performing program-level evaluation to increase overall program efficiency and reach.
2. NOAA will establish and maintain a coordinated approach for evaluating the effectiveness and impacts of NOAA's investment in informal science education. Specific tasks include:
 - creating an agency-wide framework for reporting informal science education evaluation measures for internal programs and grantee reporting;
 - participating in dialogue with outside informal science education research funding organizations to encourage evaluation of NOAA and partner informal science education methods;
 - creating standardized language in NOAA informal science education grants requiring effective evaluation;
 - synthesizing findings of informal science education effectiveness from grantee and partner projects;
 - reporting on Science On a Sphere best practices; and
 - developing education models based on needs assessments of users.
3. NOAA held an Expert Evaluation Meeting that brought together evaluation experts, including members from the NAS review committee on NOAA Education, to discuss with NOAA Education Program Managers and Coordinators best practices for program evaluation and to provide assistance with advancing NOAA's efforts with conducting an agency-wide evaluation of NOAA's education activities.
4. NOAA will coordinate the integration and evaluation of climate literacy principles into formal and informal education efforts nationwide. Specific tasks include:
 - conducting needs assessments to identify gaps in various audience needs around climate change education products and materials;
 - developing, conducting, and evaluating topic differentiated climate science tutorials for engagement professionals in all regions of the nation; and

- training NOAA personnel in evaluation of climate education projects.

NRC Recommendation IV.3

The Education Council should consider developing a number of approaches to inform strategic portfolio management and how evaluation findings can be used to inform decisions about portfolio balance.

NOAA Response

1. NOAA has developed an education chapter in the agency's yearly budget release document to Congress (NOAA's Blue Book), to better categorize and present NOAA's education portfolio. The chapter includes program descriptions, accomplishments, outputs and budget estimates.
2. NOAA's new strategic planning efforts place a strong emphasis on education. NOAA's new mission statement includes "sharing knowledge and information with others" as a core part of what the agency needs to do. NOAA's Next Generation Strategic Plan also includes an education objective calling for "An engaged and educated public with an improved capacity to make scientifically informed environmental decisions". This engagement strategy provides direction for the agency and supports ongoing efforts to better monitor and manage NOAA's education portfolio.
3. NOAA is increasing its ability to track and evaluate the impact of the agency's investment in STEM education. Specific tasks include:
 - creating an agency-wide inventory of the status of education evaluation;
 - developing a systematic process for collecting, analyzing, and reporting data on resource allocation, inputs, and outputs for education programs;
 - developing a system for collecting and reporting on performance measures (outcome and output) of education programs;
 - offering multiple opportunities for professional development in order to increase the use and proficiency of NOAA education staff in program monitoring and evaluation;
 - hiring an external evaluator to assist with conducting an agency-wide evaluation of NOAA's education programs; and
 - performing program-level evaluation to increase overall program efficiency and reach.

NRC Recommendation IV.4

Education programs should evaluate internal collaboration among line offices and between education and operational and scientific staff, as well as the quality of external partnerships with other agencies, institutions, organizations, and the broader STEM community.

NOAA Response:

NOAA's Education Strategic and Implementation Plans provide a clear direction on which types of partnerships to pursue to maximize the efficiency and reach of NOAA's education efforts. Specific examples follow.

1. NOAA is leveraging advances in technology and engineering through use of spherical displays, and other innovative and interactive technologies in partnership with informal science education centers and organizations, to engage the public on climate, atmospheric and ocean sciences. Specific tasks include:
 - supporting Science On a Sphere (SOS) institutions and partners and coordinating SOS related activities, including content development and delivery, through the SOS Network;
 - coordinating the Ocean Today Kiosk network across aquariums, museums and other partners; and
 - supporting new partnerships to increase environmental, climate and ocean literacy principles, stewardship and STEM education.
2. NOAA is leveraging agency and external expertise and resources in STEM education by leading and participating in interagency education efforts. Specific tasks include:
 - co-chairing the STEM education through the Interagency Working Group on Ocean Education;
 - co-chairing climate education through the U.S. Global Change Research Program Education Interagency Working Group;
 - coordinating STEM education through the Interagency Subcommittee on STEM Education;
 - partnering with NASA and NSF on management of the GLOBE Program, an international science and education partnership focusing on hands-on Earth System science in K-12 schools worldwide (111 partner countries);
 - working with the Department of Education and other agencies to promote sustainability efforts through the Sustainability Education Summit and follow-on activities;
 - leading an interagency effort to identify and share best practices in the area of teacher research experiences; and
 - co-hosting a joint meeting of climate education grant recipients from NOAA, NSF and NASA.
3. NOAA is working on identifying existing key partnerships and establishing guidelines for NOAA educators and staff on how to form new partnerships and develop memorandums of understanding (MOUs) with non-government organizations and other state and federal agencies focused on improving STEM education, citizen's environmental literacy and workforce development in NOAA related careers.
4. NOAA's Education Programs are working collaboratively through the Education Council to utilize the various education networks to directly connect national and regional priorities and drive STEM education and stewardship at the local, state and national levels. Specific tasks include:
 - launching an intra-agency collaborative demonstration project focused on increasing climate knowledge and stewardship behavior in PK-20+ education;

- offering competitive grants to promote locally relevant STEM education opportunities to K-12 students, as well as related professional development for educators, that emphasize sustained, hands-on, experiential activities that are aligned with academic learning standards and respond to regional education and environmental priorities;
- developing the “education.noaa.gov” portal to consolidate into one website selected collections of NOAA’s online education products, materials and resources to be used by students, educators and the general public; and
- performing a NOAA-wide inventory of STEM education resources and products that utilize emerging and innovative technology to increase the use of these resources and strengthen internal partnerships.

Chapter 5: Evidence of Impact

NRC Recommendation V.1:

NOAA education staff should draw on evidence from education research, evaluations of NOAA programs, and external education expertise to identify and implement effective practices for supporting education activities.

NOAA Response:

1. NOAA is working toward creating an internal system for improving the capacity of NOAA Education Managers and Staff to create and manage education programs and projects. Specific tasks include:
 - offering annually the NOAA Designing Education Projects (DEP) course for NOAA educators and education managers;
 - offering basic and advanced evaluation training to educators through the Coastal Service Center training program;
 - offering a series of professional development opportunities through partner organizations and contractual agreements to serve both internal and external needs; and
 - encouraging informal education recipients of NOAA’s Environmental Literacy Grants to enter their evaluation reports and materials on “informalscience.org” website for sharing evaluation resources with interested parties.
2. NOAA is developing materials and training NOAA education personnel on best practices for formal and informal climate education. Specific tasks include:
 - identifying best practices in informal and formal climate education; and
 - creating a resource toolkit for climate science education in formal and informal settings.

The following summary provides a crosswalk between the objectives and tasks listed in the 2010-2014 NOAA Education Implementation Plan (http://www.oesd.noaa.gov/planning_policy/IplanFinal_21210.pdf) with specific NRC report recommendations.

| NOAA Education Implementation Plan Objectives and Tasks | NRC Recommendations Addressed |
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| <p>NOAA is developing and initiating a collaborative strategy for incorporating sciences related to NOAA’s mission in PK-20+ Education. Specific tasks include:</p> <ul style="list-style-type: none"> • establishing greater NOAA Education program integration to impact the stewardship and sustainability of our resources; • developing an intra-agency collaborative demonstration project focused on increasing climate knowledge and stewardship behavior in PK-20+ education; • working with intra-and interagency programs and partners to advance NOAA Educational goals to increase the number of PK-20+ Science Technology Engineering and Mathematics (STEM) students; and increase interest in STEM occupations; • forming new partnerships with non-government organizations and other state and federal agencies focused on improving STEM education, citizen’s environmental literacy and workforce development in NOAA related careers; and • identifying existing key partnerships and publish basic information about establishing new partnerships. | <p>I.1, I.3, II.2</p> |
| <p>NOAA is coordinating and expanding partnership opportunities with Informal Science Education Centers to integrate NOAA content and environmental literacy principles. Specific tasks include:</p> <ul style="list-style-type: none"> • coordinating Science On a Sphere (SOS) institutions and partners through the SOS Network; and • developing the Community Conversations on Climate program to improve citizens’ access to climate information and increase public climate literacy through a partnership with the Association of Science-Technology Centers (ASTC). | <p>I.1, I.3, III.1</p> |
| <p>NOAA is leading and participating in interagency efforts to advance climate and ocean literacy education and to leverage collaborative resources. Specific tasks include:</p> <ul style="list-style-type: none"> • coordinating climate education through interagency working group at the US Global Change Research Program; • leading and coordinating interagency activities through the Interagency Working Group on Ocean Education; • partnering with federal agencies on the GLOBE Program, with a specific focus on the Student Climate Research Campaign to support NOAA’s global science and international partnerships; • implementing a web-based Federal portal for climate education resources; • continuing to work with the Department of Education and other agencies through the Green Summit Steering Committee on the Sustainability Education Summit; and • conducting a Federal gap analysis of existing climate change education resources; | <p>I.1, II.4, III.1</p> |

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| <p>NOAA will continue to leverage external expertise and resources by partnering with educational organizations, through national and regional competitive education grants, that promote environmental and climate literacy principles, stewardship and STEM education.</p> | <p>I.1, II.4</p> |
| <p>NOAA is working toward increasing its ability to track and evaluate the impact of the agency’s investment in education. Specific tasks include:</p> <ul style="list-style-type: none"> • creating a tracking and reporting system to document progress on the implementation of the NOAA Education Strategic Plan; • creating an agency-wide inventory of the status of education evaluation; • developing a systematic process for collecting, analyzing, and reporting data on resource allocation, inputs, and outputs for education programs; • developing a portfolio of education evaluation reports on NOAA sponsored education initiatives; • developing a system for collecting and reporting on performance measures (outcome and output) of education programs; and • offering multiple opportunities for professional development in order to increase the use and proficiency of NOAA education staff in program monitoring and evaluation. | <p>I.2, II.2, III.1, IV.1, IV.2, IV.3</p> |
| <p>NOAA is establishing a systematic process for identification, integration, and distribution of relevant education content and experiential learning opportunities for the future STEM workforce. Specific tasks include</p> <ul style="list-style-type: none"> • developing a survey instrument to assess existing NOAA internal and external partnerships; • developing a best practice report of successful federal science agency partnerships which improve STEM education and workforce development; • securing an external evaluator to conduct formative evaluation of a stewardship pilot program; • partnering with the Climate Literacy and Energy Awareness Network (CLEAN) Pathway to steward a broad collection of scientific educational resources; • producing a gap analysis report of existing pre-kindergarten career resources, with particular focus on materials relevant to underrepresented and underserved students; and • compiling lists of existing student opportunities from various NOAA websites to increase the effectiveness of these resources. These lists include student opportunities specifically targeted at underrepresented and underserved groups. | <p>II.1, IV.2, IV.4, V.1</p> |
| <p>NOAA participates in interagency initiatives and partnerships to advance public access to NOAA educational content through electronic media. Specific tasks include:</p> <ul style="list-style-type: none"> • integrating NOAA resources into the Department of Energy’s coordinated initiative “scienceeducation.gov”; • integrating federal partners in Science On a Sphere (SOS) Network workshops; • establishing guidelines for digital learning network education program content development and program delivery by NOAA and NASA education programs; • leveraging resources and disseminating NOAA science and content through key partnerships, such as the American Meteorological Society Teacher online training, National Science Teachers Association joint webinars and National Geographic Society Monster Storms Project; • coordinating data products from NOAA, NASA and other partners available for Science On a Sphere and other spherical displays; and • implementing a web-based Federal portal for climate education resources. | <p>I.3, II.2, V.1</p> |

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| <p>NOAA is establishing and maintaining a coordinated approach for evaluating the effectiveness and impacts of NOAA’s investment in informal science education. Specific tasks include:</p> <ul style="list-style-type: none"> • creating an agency-wide framework for reporting informal science education evaluation measures for internal programs and grantee reporting; • participating in dialogue with outside informal science education research funding organizations to encourage evaluation of NOAA and partner informal science education methods; • creating standardized language in NOAA informal science education grants requiring effectiveness evaluation; • synthesizing findings of informal science education effectiveness from grantee and partner projects; and • reporting on Science On a Sphere best practices. | <p>I.3, IV.1</p> |
| <p>NOAA will expand partnerships with youth-serving organizations to integrate environmental literacy principles, hands-on science, and workforce exploration of NOAA related fields.</p> | <p>I.3</p> |
| <p>NOAA will establish and implement an integrated PK-20+ workforce development strategy to increase candidate pool for climate-related careers. Specific tasks include:</p> <ul style="list-style-type: none"> • establishing new partnerships with organizations that serve underrepresented and underserved students and professionals with interest in NOAA’s climate program; • identifying and analyzing current data reports from NOAA Workforce Management and national workforce trends; and • monitoring trends in climate-related workforce development and labor statistics. | <p>II.1, II.3</p> |
| <p>NOAA is offering a federal funding opportunity with a special interest in environmental literacy education projects that target underrepresented and underserved groups, which includes elementary educators and students.</p> | <p>II.1</p> |
| <p>NOAA is working toward creating an internal system for improving the capacity of NOAA Education Managers and Staff to create and manage education programs and projects. Specific tasks include:</p> <ul style="list-style-type: none"> • offering annually the NOAA Designing Education Projects (DEP) course for NOAA educators and education managers; • creating an intranet website for best practices materials; • developing an electronic infrastructure to facilitate ongoing affinity group discussions on emerging education issues by NOAA education program managers, staff, and other interested parties; and • offering a series of professional development opportunities through partner organizations and contractual agreements to serve both internal and external needs. | <p>II.2, V.1</p> |
| <p>NOAA is developing materials and training NOAA education personnel on best practices for formal and informal climate education. Specific tasks include:</p> <ul style="list-style-type: none"> • identifying best practices in informal and formal climate education; • creating and implementing a training program for NOAA program managers and educators; and • creating a resource toolkit for climate science education in formal and informal settings. | <p>II.2, V.1</p> |

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| <p>NOAA is improving the effective utilization of innovative technologies in the delivery of environmental literacy and workforce development concepts and content by the agency and through its partners.</p> | <p>II.4, V.1</p> |
| <p>NOAA will coordinate the integration and evaluation of climate literacy principles into formal and informal education efforts nationwide. Specific tasks include:</p> <ul style="list-style-type: none"> • conducting needs assessments to identify gaps in various audience needs around climate change education products and materials; • coordinating the integration and evaluation of climate literacy principles into formal and informal education efforts nationwide through the NOAA Education Council Climate Education working Group; • contributing to the establishment of a USGCRP Education Working Group recommendation for a voluntary national climate education curriculum through the NSDL Pathway Climate Literacy Energy Awareness Network (CLEAN) grant; • creating and delivering directly or through agency wide partnerships and/or contracts annual professional development opportunities for formal and informal educators in climate science; • developing and maintaining a climate education component of climate.gov to serve as a single source portal to climate education materials and educator professional development resources from NOAA and other federal agencies; • developing, conducting, and evaluating topic differentiated Climate Science Tutorials for engagement professionals in all regions of the nation; and • training NOAA personnel in evaluation of climate education projects. | <p>III.1, IV.1, IV.2, IV.3</p> |
| <p>NOAA will increase utilization and access to scientific data and data models to be used for educational purposes. Specific tasks include:</p> <ul style="list-style-type: none"> • creating an inventory of current education products and programs integrating NOAA data and science; • undergoing a needs assessment of target audience use of NOAA data and science; • developing strategy for public access, use, and understanding of NOAA data and science for educational use; • developing standard guidelines for publishing NOAA data and scientific visualization products for educational use; and • creating an inventory of NOAA educational products and tools that utilize emerging and innovative technologies. | <p>II.2, II.4</p> |
| <p>NOAA is offering a federal funding opportunity with a special interest in environmental literacy education projects that increase climate literacy.</p> | <p>III.1</p> |