

Outcome-based Monitoring & Evaluation Framework

NOAA Education

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Outcome-based Monitoring & Evaluation Framework for NOAA Education

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EDITOR AND LEAD AUTHOR: ATZIRI IBANEZ

REVIEWERS & CONTRIBUTING AUTHORS: NOAA EDUCATION MONITORING & EVALUATION WORKGROUP MEMBERS

- CHAIR: ATZIRI IBANEZ, NATIONAL EDUCATION COORDINATOR, NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM
- CO-CHAIR: CHRISTOS MICHALOPOULOS, ASSISTANT DIRECTOR, OFFICE OF EDUCATION
- LEXIE BROWN, OFFICE OF EDUCATION
- JENNIFER HAMMOND, DIRECTOR, NOAA’S TEACHER AT SEA PROGRAM
- KATE THOMPSON, ACTING NATIONAL EDUCATION COORDINATOR, OFFICE OF NATIONAL MARINE SANCTUARIES
- FRANK NIEPOLD, CLIMATE PROGRAM OFFICE
- BRONWEN RICE, OFFICE OF EDUCATION
- IRELENE RICKS, OFFICE OF EDUCATION
- PEG STEFFEN, EDUCATION COORDINATOR, NATIONAL OCEAN SERVICE
- STEVE J. STORCK, OFFICE OF EDUCATION
- PAULA KEENER-CHAVIS, NATIONAL EDUCATION PROGRAM DIRECTOR/MARINE BIOLOGIST, NOAA OFFICE OF OCEAN EXPLORATION

I. OVERVIEW

NOAA's Education Council has embarked on an ambitious monitoring and evaluation (M&E) project that will allow it to assess education program outcomes and impacts across Goals, Line Offices and programs. The purpose of this effort is to link outcome measures to program efforts and to evaluate the success of the agency in meeting the **strategic vision** (as outlined in the 2009-2029 NOAA Education Strategic Plan) and the **strategic directions** outlined in the NOAA 5-Year Education Implementation Plan.

Outcome 1.1 of the 2009-2029 NOAA Education Strategic Plan states that “[N]OAA education programs are developed and refined using the best available research on the effectiveness of environmental and science education.” In addition, and “[a]s part of the quality standards for NOAA Education, the agency is committed to advancing evaluation practices to improve the results of its efforts and to contribute to the body of knowledge regarding effective environmental and science education. Building the evaluation capacity of NOAA educators and developing a coordinated system to capture and share these findings are key elements in achieving this outcome.” The application of an M&E framework will assist in the process of modifying program content, format, activities, and target audiences to improve overall effectiveness of educational efforts and expenditures; refocus NOAA's education programs around measurable objectives; and disseminate information more strategically to target audiences regarding promising practices and potential impacts.

The design and implementation of this Outcome-based M&E Framework has been divided into three stages. Stage I entailed the development of a draft conceptual framework (this document) for the evaluation of all of NOAA's education programs. NOAA's Education Council approved this conceptual framework October 2009 and established priorities for moving forward with some of the tasks identified in this document. Stage II entails the identification of resources needed and the execution of an initial contract with an evaluation expert to refine and put in motion various elements identified in this framework. The contract will include a specific task list and proposed schedule for completion. Stage III entails the development of a full implementation plan, including data collection and analysis, for reporting on program evaluation outcomes to the larger NOAA education community.

1.1. Purpose and Need of the Monitoring & Evaluation Framework

The **purpose** of this document is to provide the NOAA Education Council with a proposed NOAA-wide Outcome-based Monitoring and Evaluation Framework for its education programs. In this regard, this document outlines a vision for the future where NOAA education programs adopt an “evaluative thinking approach” and have a robust evaluation system in place, and it also provides guidance for strategies that address the more immediate five years, 2009-2013. The document will:

- Outline the need and intended purpose of the M&E framework;
- Provide a brief description of what an outcome-based approach entails;
- Describe the strategies and proposed approaches that make up the framework;
- List a series of proposed options for moving forward in implementing this framework; and,
- Include an appendix section which complements various concepts outlined in this framework.

In the near future, this document will become a guidance document that all of NOAA Education Programs across the agency will be able to consult on the official process, tools, and common instruments used to monitor and evaluate educational programming across NOAA. Thus, this document is to be considered a “living”

document that will be refined and updated by NOAA's Education Evaluation Workgroup¹ to ensure that the latest thinking and best practices on evaluation are incorporated.

The primary **need** for this document is internal. NOAA Education Program Directors, Coordinators, Specialists and grantees, need a guiding document that delineates the expectations and guiding mandates for a corporate level monitoring and evaluation framework.

1.2. Vision

The **vision** in designing, refining and implementing this M&E framework is to:

- Create a cultural norm within the agency where evaluation is an integral part of program management;
- Provide a comprehensive framework for education that positions education as a whole, as well as each individual education program, on strong footing to be successful in an external review processes, such as Program Assessment Rating Tool (PART);
- Create a system that can provide agency-wide reporting capability for data calls to document how Federal dollars are invested and where Federal investment in education is being spent (number and type of audiences, people, products, grants, programs, services), philosophical groupings, audiences); and,
- Encourage scientifically "rigorous" evaluation, at the corporate and program level, in order to advance evidence-based policies and practices that demonstrate successful goal attainment and program outcomes.

1.3. Intended Results

Ultimately, through the implementation of a fully developed M&E Framework, the expectation is:

- To enable analysis and reporting of the agency's effectiveness in meeting the education goals and outcomes established in the NOAA Education Strategic Plan
 - Goal 1: **An environmentally literate public** supported by a continuum of lifelong formal and informal education and outreach opportunities in ocean, coastal, Great Lakes, weather, and climate sciences.
 - Goal 2: **A future workforce**, reflecting the diversity of the Nation, skilled in science, technology, engineering, mathematics, and other disciplines critical to NOAA's mission.
- Have easily accessible, public documentation of supporting evidence of the effectiveness of NOAA Education programs in meeting stated goals and objectives.

¹NOAA's Education Evaluation Workgroup is comprised of the following people: Lexie Brown; Jennifer Hammond; Kate Thompson; Christos Michalopoulos; Frank Niepold; Bronwen Rice; Irelene Ricks; Peg Steffen; Steve J.. Storck; Paula Keener-Chavis and Atziri Ibanez

II. AN OUTCOME-BASED MONITORING & EVALUATION FRAMEWORK: THE APPROACH

2.1. Background to the M&E Framework

There are several education programs in NOAA that have made progress in incorporating evaluation in both program design and implementation. An initial and voluntary series of presentations² provided by a few NOAA education programs, made in the first quarter of 2009, revealed that several have worked with outside contractors and/or designed their own tools to evaluate their programs. One such example is the National Marine Sanctuaries Programs (NMSP) which is leading the way in formulating an official evaluation system using the “Targeting Outcomes of Programs” (TOP) model. These combined efforts constitute the foundation for the establishment of a permanent M&E framework for NOAA education programs.

As stated in Outcome 1.1 of the 2009- 2029 NOAA Education Strategic Plan and “[a]s part of the quality standards for NOAA Education, the agency is committed to advancing evaluation practices to improve the results of its efforts and to contribute to the body of knowledge regarding effective environmental and science education”. In doing so, the NOAA Education community aims to infuse **rigor** and **validity** in its approach to evaluation and build a **culture of evaluative thinking** for NOAA education programs. This moves the view of evaluation from the study of projects and programs to evaluation as an analytical way of thinking that infuses and informs everything we do. We define *evaluative thinking* as “being clear and specific about what results are being sought and what means are used to achieve them.” It assures the systematic use of evidence to guide and/or report on progress and achievements so that information is used in decision making. This strategy, therefore, addresses not only what will be done at the corporate level, but also how it will work to coordinate, support and advance evaluation at all levels within NOAA education.

Adoption of this M&E Framework will not replace the need for each line office and program to continue to implement their own evaluation processes to meet individual programmatic mandates and requirements. With this understanding, it should be noted that data required from the different NOAA education programs should fulfill the corporate level objectives (as stated in the NOAA Education Strategic Plan) as well as serve the needs of the individual programs. The aggregated data across education programs should be useful on multiple levels, including assisting NOAA education programs in meeting their evaluation needs.

2.2. The Outcome-based Monitoring & Evaluation Approach

This M&E framework uses an outcome-based evaluation approach. An outcome-based evaluation approach is designed to answer the following questions: (1) What outcomes does the NOAA education community want to measure?, (2) What will success look like in achieving these outcomes?; (3) How will the NOAA education community measure progress and success?

This approach combines elements from three of eight³ program planning and evaluation outcome models: (1) Targeting Outcomes of Programs (TOP); (2) Program Action Logic Model; and the (3) Results-Based Accountability (RBA) model. The TOP model, developed by Claude Bennett and Kay Rockwell in 1994 for the USDA Extension Service⁴, was adopted by NOAA’s Education Council in 2008 as the outcome model that

² To see the presentations, logic models and/or supporting documents produced by some of the education programs showing how they can incorporate evaluation in their program designs and implementation, go to <https://secure.oesd.noaa.gov/council/Ed%20Implementation%20Plan/Evaluation/> and review the section titled on “Status of Education Evaluation”.

³ To see a brief description of the eight outcome models, please review Appendix A.

⁴ Bennett and Rockwell, 2006

would be used to frame NOAA education’s evaluative thinking and guide the development of this M&E framework. This outcome-based evaluation approach starts with the desired end and works backward toward the means to achieve them. It describes what a desired result would look like, then defines that result in measurable terms, and, finally, uses those measures to gauge success or failure. Ultimately, through this outcome-based approach NOAA education programs will move from a more traditional input–output focused M&E, a design which is more quantitatively driven, to one where the focus and analysis is on *outcomes* and *impacts* that better reflect longer term societal goals.

The completed list of outcomes, indicators, baselines, and targets becomes the outcome-based M&E framework. Table 1.1 below provides an example of an outcome-based performance M&E framework.

TABLE 1. EXAMPLE OF A M&E FRAMEWORK

Outcomes	Indicators	Baselines	Target
Nation’s preschool aged children have better access to pre-school programs	Percent of children enrolled in pre-school education	In 1995, 75% of children ages 3-5 received pre-school education	By 2008, 85% of children ages 3-5 received pre-school education

Experts

vary on the specific steps in building an M&E framework. Nonetheless, the essential actions involved in building an M&E system are to:

- Formulate goal and outcomes
- Select outcome indicators to monitor
- Gather baseline information on the current condition
- Set specific targets to reach and dates for reaching them
- Regularly collect data to assess whether the targets are being met
- Analyze and report the results.

III. STRATEGIES

To achieve the vision stated in this M&E Framework, the NOAA education community will employ a variety of strategies over the coming years. These strategies will be directed at all members of the Education Council, the Office of Education, and other NOAA staff working on education related activities.

The strategies of the Outcome-based M&E Framework fall into six broad categories:

1. Characterize NOAA’s education portfolio;
2. Institute an outcome-based performance monitoring system;
3. Conduct and disseminate programmatic- and corporate-level evaluations;
4. Engage in methodology development and tools for evaluation;
5. Training in evaluation evaluative thinking;
6. Develop strategic partnerships to support M&E strategies and leverage funds.

3.1. Characterize NOAA’s Education Portfolio

NOAA's Education Evaluation Workgroup proposes to employ two tools to assist us in better characterizing NOAA's overall education portfolio and competencies in program evaluation, the readiness assessment tool and the portfolio analysis tool. The Readiness Assessment and Portfolio Analysis data calls may be gathered using the same tool, though the pros and cons should be analyzed carefully before making this determination.

3.1.1. Readiness Assessment Tool

The "readiness assessment" tool is a diagnostic tool that will help determine where a given NOAA education program stands in incorporating evaluation and *evaluative thinking* in their program design and implementation. The "self-assessment tool", originally developed by the NOAA Education Evaluation Workgroup (see Appendix B), was refined to determine:

1. Level of evaluation training;
2. Progress in developing logic models and evaluation plans;
3. Amount of resources spent of evaluation, both in terms of staff time and programmatic dollars;
4. Level of comfort with various aspects of evaluation and familiarity with terms and methods;
5. Challenges to implementing evaluation for each Administrative Unit;
6. Outputs and outcomes measured; and
7. Status of evaluation reporting to other entities

Implementation Considerations:

- The information generated from this tool is to be examined by NOAA's Monitoring & Evaluation Workgroup and will be used to provide baseline data. The data will also inform the development of a NOAA Education performance measurement writing workshop designed for all NOAA Education Council members.
- A formal database system will need to be established to facilitate easy data reporting, collection and analysis. Start-up funds will need to be allocated to this effort, early on, to ensure efficiencies in the process. The database will need to be able to integrate with other, existing program databases.
- Analysis of the data collected could help identify audience specific tools that could be scaled-up for NOAA-wide use.
- A forum for sharing results of self-assessment, experiences and "lessons learned" also forms part of this component.

All programs that complete the readiness assessment tool will be encouraged to collect and report results of common outcome-based indicators for NOAA-wide aggregation. These indicators are based on the 2009- 2029 NOAA Education Strategic Plan.

This M&E framework will not preclude programs from implementing additional rigorous and individualized evaluation strategies. The assumption is that individual programs will select which projects support the NOAA Education Strategic Plan outcomes and report on those projects only.

3.1.2. Portfolio Analysis Tool

A portfolio analysis is defined as a systematic review of programs, projects and activities sponsored by an agency and its partners to examine trends in summary findings and methodological approaches. The portfolio analysis proposed here refines an earlier version of what the Education Council termed the “NOAA Matrix”, which was the Council’s first attempt to collect program-level data across the entire agency. This portfolio analysis will be revised to evaluate quality and consistency of data in current data call; improve data consistency and target focus questions; and include a guidance document that outlines the frequency of data collection, among other things. Most importantly, revisions will be made to ensure that the completion of this tool not be a burdensome task for those that have to collect and submit the data. Revisions to both these tools will be done incorporating feedback from the NOAA Education Council members.

This portfolio analysis tool will be aligned with NOAA’s Blue Book data calls to ensure there be no duplication of effort in the collection of information. NOAA’s Blue Book provides a summary of NOAA’s budget and programs for members of Congress and their staffs, the media, and our constituents and customers. It also highlights NOAA’s past accomplishments.

Implementation Considerations:

- The information generated from the line office programs will continue to be synthesized and analyzed by the NOAA Office of Education and provide baseline data.
- A formal database system will need to be established so that data are reported, collected and analyzed in an easy way. Funds will need to be allocated to this effort, early on, to ensure efficiencies in the process.

3.2. Institute an Outcome-based Performance Monitoring System

The 2009-2029 NOAA Education Strategic Plan identifies two goals with nine corresponding outcome oriented statements (see Box 1). As a first step, these outcomes will need to be disaggregated sufficiently to capture only one improvement area in each outcome statement. This process of disaggregation means that the outcomes will need to be reformulated to answer the following questions: (1) For whom?, (2) Where?, (3) How much?, and (4) By when?.

Overall, the initial steps to design an outcome-based performance monitoring system include:

Box 1. National Oceanic & Atmospheric Administration Education Strategic Plan 2009-2029

Goal 1. Environmental Literacy

Outcome 1.1. NOAA education programs are developed and refined using the best available research on the effectiveness of environmental and science education.

Outcome 1.2. Educators understand and use environmental literacy principles.

Outcome 1.3. Educators, students, and/or the public collect and use ocean, coastal, Great Lakes, weather, and climate data in inquiry and evidence-based activities.

Outcome 1.4. Lifelong learners are provided with information science education opportunities focused on ocean, coastal, Great Lakes, weather, and climate topics.

Outcome 1.5. NOAA works cooperatively to maximize the impact of federal investment in ocean, coastal, Great Lakes, weather, and climate education.

Outcome 1.6. NOAA’s Education Community functions in a unified manner and is coordinated with agency extension, training, outreach, and communications programs to fully engage NOAA audiences.

Goal 2. Workforce Development

Outcome 2.1. A diverse and qualified pool of applicants, particularly from underrepresented groups, pursue students and professional opportunities for career development in NOAA mission-critical disciplines.

Outcome 2.2. NOAA’s employees support programs and activities for students and teachers to learn about and explore NOAA science and stewardship.

Outcome 2.3. A diverse pool of students with degrees in science, technology, engineering, mathematics, and other fields critical to NOAA’s mission connect to career paths at NOAA and in related organizations.

- **Step 1** – Disaggregate *outcomes* into subcomponents that allow us to capture only one improvement area in each outcome statement.
- **Step 2** – Select key *performance indicators* to monitor outcomes
- **Step 3** – Set *baseline* information on each of the performance indicators for each outcome.
- **Step 4** - Establish *targets* —what can be achieved in a specific time toward reaching the outcome.

The completed matrix of outcomes, indicators, baselines, and targets will comprise the performance component of the overall M&E framework.

Implementation Considerations

- This component is resource intensive and will require technical assistance from an expert in the subject.
- The challenge will be to obtain adequate baseline information on each of the performance indicators selected for each outcome. This can quickly become a complex process, so it will be important to be

TABLE 2. EXAMPLE OF A COMPLETED M&E FRAMEWORK BASED ON THE 2009-2029 NOAA EDUCATION STRATEGIC PLAN (FOR DEMONSTRATION PURPOSES ONLY)

Outcome 1.1.	Outcome 1.1. Strategy 2	Indicator	Baseline	Target
NOAA education programs are developed and refined using the best available research on the effectiveness of environmental and science education.	Develop and implement a framework of assessment and evaluation strategies	1. Percent of NOAA education programs contributing data to a common data collection system outlined in the M&E framework 2. Percent change of NOAA educators reporting an increase in evaluation competencies	1. In 2009, 0% of NOAA education programs 2. In 2009, 5% of NOAA educators	1. By 2013, 20% of NOAA education programs 2. By 2013, 30% of NOAA educators

judicious in the number of indicators chosen, because each indicator will need supporting data collection, analysis, and reporting mechanisms behind it.

- Suggested metrics for formal and informal education under consideration by the Academic Competitiveness Council (ACC) will be integrated where appropriate.

3.2.1. Data Collection Methods

The next step in designing an outcome-based performance monitoring system, after indicators have been selected and baseline data has been established is to define the *data collection instruments* required to record the information appropriately. As part of this step, it will be important to define what procedures to use (surveys versus interviews, for example); and how often to access the data sources, and so forth.

There is a variety of data collection methods that can be employed based on the type of desired program outcomes. For example, data collection methods could include questionnaires; visitor card surveys; Likert scale surveys; pre/post tests; conversations with science literate as well as uninformed public populations; random interviews with program participants; participant observation; focus group interviews; direct observations; case studies; and field experiments, among many others. Some programs, like the NMSF are currently piloting a series of data collection methods that could be potentially adopted and adapted to meet the needs of this M&E framework. However, as mentioned before, the selection of indicators should come first before determining the appropriate data collection methods.

3.2.2. Tracking Trends: Educational Statistics

Improving the effectiveness of programs and products by using best practices and the latest knowledge is an important part of NOAA’s approach to environmental literacy (NOAA Education Strategic Plan, 2009). Part of any credible evaluation effort also includes a comprehensive literature review that summarizes and offers an analysis of current educational statistics and trend data on related science education program efforts. Most importantly, a substantive literature review will help to inform the development of key components of NOAA Education’s evaluation process. The collection of national, regional, and state data available from reports and surveys provides a picture of the landscape under which NOAA operates and indicates potential areas for additional efforts. For example, it would be important to capture statistics about the growth or reduction in number of teachers teaching marine science; changes in state standards; responses to the No Child Left Inside Act; among many others. Documents like TERC’s analysis of the state-by-state education standards⁵ and reports from the National Center for Educational Statistics, along with reports produced by NOAA and other partners, are important in helping NOAA implement programs that address broader STEM issues and meet national needs. This background research may be one component of a larger evaluation effort performed by outside experts to support NOAA’s education evaluation plan.

3.2.3. Submission of OMB Review on the Data Collection System

As soon as Stage III (the development of a full implementation plan to include proposed evaluation instruments, data collection systems designed & reporting requirements) of the design and implementation of the M&E Framework is accomplished, it will be necessary to submit NOAA’s evaluation design to the Office of Management and Budget (OMB) for clearance. Evaluation instruments that will be adopted by the NOAA Education Council for the collection of information must meet the provisions of the Paperwork Reduction Act (44 U.S.C. Chapter 35). In accordance with the PRA, OMB approval must be obtained prior to collecting information in any situation where 10 or more respondents are involved and the questions are standardized in nature.

3.3. Conduct and disseminate programmatic- and corporate-level evaluations

The previous sections of this document have focused mainly on the “M” for monitoring function of the M&E. But, monitoring and evaluation approaches complement and support each other—even as each asks different questions and will likely make different uses of information and analyses. This section, therefore, addresses the need to examine the evaluation function or “E” of the M&E Framework.

This framework does not advocate for the implementation of a specific type of evaluation, but it does identify four types of evaluations that could be instituted as part of a corporate level evaluation; it suggests that key research questions be defined *prior* to making any decision on the type of evaluation used; and recommends that efforts be made to define what NOAA education programs mean by “rigorous evaluation”.

3.3.1. Types of Evaluation

Members for the NOAA Education Evaluation Workgroup discussed several types of evaluation that could be instituted as part of a corporate level evaluation, three of which are introduced below:

⁵ Hoffman, Martos and Barstow Daniel. April 2007. *Revolutionizing Earth System Science Education for the 21st Century, Report and Recommendations from a 50-State Analysis of Earth Science Education Standards*. TERC, Cambridge MA. Accessed at: http://www.terc.edu/downloads/TERC_RevEarthSci.pdf

Thematic & Expert Panel Reviews: Case Study Approach

Thematic type studies could be used to focus on cross-cutting agency education themes to (a) reveal innovative practices; (b) assess changes within and across programs (c) capture learning at the corporate level and (d) describe anecdotal information. These studies could be conducted internally (see description of peer reviews below) by an Expert Panel Review or through university contracts. According to the literature, these types of “case studies” are an appropriate evaluation strategy to use when there is a need for in-depth information about how programs are aligned (or misaligned) with desired goals/outcomes.

Peer Reviews

Convening peer reviews help to create and nurture a shared sense of commitment to best practices and the need for programs to meet high quality standards, particularly in instances where objective standards of performance have already been identified and widely accepted by members of that field, discipline, or training. Traditionally, peer reviews in research agencies have set a foundation for developing and sustaining a culture of inquiry and rigor—both within the walls of the agency and in the fields it supports⁶. Periodic peer reviews at NOAA have been suggested on selected programs that possess similar outcomes & objectives. Such reviews could include detailed analysis of information provided through the NOAA matrix, program documents, performance reports, and site visits. Education Council members would volunteer to participate in a review and share this role with a team of external evaluation experts. The timeline of the peer review process can be divided into pre-meeting responsibilities, activities at the meeting, and post-meeting responsibilities. While this timeline seems to reflect a simple process, studies have shown that the effectiveness of peer review depends heavily on the extent to which specific procedures are designed and implemented. In addition, it needs to be accompanied by a strong support system. This infrastructure should include (a) knowledgeable staff (with technical expertise in specific areas); (b) systems for managing the logistics of peer review; (c) technologies to support review and discussion; and (d) a clear mechanism for providing feedback.

Longitudinal Assessments

The M&E Framework would be greatly strengthened by longitudinal assessments that study long term effects that help us better figure out the overall impact of NOAA science education programs on environmental and science literacy on and specific target audiences. Longitudinal evaluations require external expertise, as the development of tools, instruments, timetables, and metrics are typically complex and rigorous. It is proposed that funding should be sought to support this approach.

3.3.2. Defining Research Questions and the Meaning of Rigorous Evaluation

It is important to choose evaluation methods that are appropriate to the research questions being asked and to each program’s stage of development⁷. The objective of the evaluation approaches proposed by the Working Group is to state that overtime the Group will attempt to adopt and adapt rigorous evaluation methods that are practical and appropriate to particular NOAA education contexts for assessing science education program impacts. In order to build this internal capacity for and defining the type(s) of evaluations needed at the corporate level, more discussions will need to happen with all the broader NOAA Education Community to determine:

⁶ http://www.nap.edu/openbook.php?record_id=11042&page=50

⁷ Finding Out What Works, Agency Efforts to Strengthen the Evaluation of STEM Education Programs, December 2008

- The specific research questions the NOAA Education Community would like to have answered through a corporate level evaluation;
- The NOAA Education Community’s interpretation of the National Science and Technology Council (NSTC) Education Subcommittee’s definition of “rigorous evaluation⁸”;
- How to improve the rigor of program evaluations to align with the Academic Competitiveness Council (ACC) report’s⁹ recommendation that emphasizes increased evaluation rigor; and,
- Determine when it is appropriate to adopt one of the models recommended by the ACC report in “Options to Advance Rigorous Evaluation” (see options in Appendix C).

Examples of research questions, that could be used to guide the development of a corporate level evaluation, could include the following (with a focus on outcomes and program impacts):

- How does program design impact teacher development and subsequently student performance?;
- How could the expansion of an intervention (going to scale) have (un)intended impacts?;
- How do we know that resources have been well spent to achieve intended results?;
- How many parts of a program (projects / efforts / sites / collaborators) contribute to achieving an outcome? Why some components have worked well while others have not? And, why is that so?

3.4. Engage in methodology development and tools for evaluation

The road to change is easier to draft on paper than to implement in practice. This is why it is critical that the next iteration of this M&E Framework define lines of authority and articulate clear organizational roles and responsibilities to ensure continuity and integrity of this approach. In addition, and to avoid instituting an outcome-based performance monitoring system in a vacuum, it is important to build M&E systems that capture data at every program component level in which data are produced. A good database can serve an important function by providing users with quick and easy ways to access and display the data for their own reporting needs and analysis.

3.4.1. Database for the Collection and Analysis of Performance Indicators

A formal database system will need to be established so that data are reported, collected, stored, retrieved and analyzed in an easy way. NOAA Education must invest early in this effort to ensure the process runs efficiently. The data collected will be much more dependable and useful if, at the beginning, the database is designed to collect all the necessary data in the right time frame and format. Some of the key features needed in such a database could include, but are not limited to, the following:

- Online data entry: A web interface should be developed that allows all users to have quick and easy ways to enter the information, whether they are located at NOAA at Silver Spring, NOAA Headquarters, or in the field. This interface could be password-protected to ensure data integrity and privacy.
- Querying and reporting:

⁸ The Education Subcommittee defines an evaluation to be rigorous if it exhibits the following characteristics: (A) The methodology aligns with the goals of the project or program being evaluated and the questions the evaluation proposes to answer. (B) The evaluation strictly adheres to professionally accepted protocols of design, data collection, and data analysis. (C) The data collection instruments are appropriate, reliable, and valid. (D) The statistical analyses are appropriate and done correctly. (E) The conclusions drawn are supported by the data and its analysis.

⁹ U.S. Department of Education, Report of the Academic Competitiveness Council, Washington, D.C., 2007.

- The database should have a robust search tool that allows the user to dynamically create, display and store ad hoc queries.
- A built on permission groups feature should also be added to allow users the ability to create reports in multiple formats including PDF, HTML, Microsoft Word and Excel, and CSV.
- Users should have the ability to save the reports produced to a “favorites” folder for easy retrieval or be scheduled to send e-mails out at pre-established times (i.e., once a week, once a month, once a quarter).

3.4.2. Evaluation Instruments and Question Bank

The NOAA Education Evaluation Workgroup discussed the need to have a series of evaluation instruments and a “question bank” available to all of NOAA education programs. Many education programs have already embarked on developing and testing different instruments. It would be of great benefit to all programs to have a central location to access such tools and survey questions. The ONMS has set an example by developing a question bank for all of its sites. Some of the key features of the ONMS question bank include (1) questions that have been developed using best practices in their design; (2) the instruments are being piloted first to validate them; (3) and the instruments are organized in categories according to a specific target audience.

In addition, several education programs have contracted outside experts in evaluation to help them evaluate their programs. Contractors’ profiles should be kept in a centralized place for all of NOAA education programs to access. These profiles would allow others to learn about the type of evaluations done for a specific program, methods used, as well as the successes or lessons learned in working with a specific contractor. Having access to such information could help others decide whether or not to work with that contractor.

3.5. Training in evaluation and evaluative thinking

Training in evaluation and evaluative thinking is a core focus of this M&E framework. The strategy proposed over the next five years has two key components:

3.5.1. Training within NOAA

Program evaluation training will be a key component to ensuring successful implementation of the M&E Framework. Training will need to happen at various levels within NOAA; in particular, Education Council members and field office staff will need continuous support and training on all elements designed for the implementation of the monitoring and evaluation systems.

Education Council members and field staff are now able to participate in workshop designed by BridgeWater Education Consulting, currently under contract with NOAA’s Office of Education to offer training in program development, implementation and evaluation. The contractors revised the 2005 Designing Education Projects (DEP) educators’ manual to include more NOAA specific examples and Bennett and Rockwell’s (1995) logic model, Targeting Outcomes of Programs (TOP) and to develop a workshop which consists of two components: (1) online access; and (2) in-person interaction (check Appendix D to see a full description of the two components and list of training topics and objectives covered by the online and in-person components). As the M&E framework evolves, instruments are designed, and methods for collection are instituted, we suggest making some adjustments to the training that incorporates elements of the M&E system.

In addition, there will be a need to provide different types of trainings tailored to specific Line Offices or education staff. For example, there might be a need to train only key staff responsible for coordinating and collecting data on behalf of a Line Office or program. Such training would ensure that everyone understands, in a very practical way, timelines, monitoring, data access, and other tasks commonly associated with evaluation.

3.5.2. Building regional nodes of evaluation expertise

In addition to providing training, it will be important to cultivate and sustain evaluation expertise in the regions. In order to do that, key people across education programs will need to be identified that might be interested and willing to take the lead in a region. A core group of trainers could also be formed through “train-the-trainer” sessions and Webinars, when appropriate. The overall intent of this approach is to generate support structures on evaluation across programs and within regions. Development of these regional areas of expertise could have great benefit in ensuring consistent use of the M&E implementation plan. However, what will be of considerable interest is whether the application of the M&E framework will produce very different outcomes when applied to different local program design and experiences. If resources are made available to support regional evaluations, regional programs could potentially pilot test some of the instruments developed under this framework.

3.6. Develop Strategic Partnerships to Support M&E Strategies and Leverage Funds

3.6.1. Partnerships to support M&E strategies

The full design and implementation of M&E Framework will require the advice, support and contributions from internal NOAA and external partners, with evaluation expertise. Over the next five years, key partners will be identified and brought on board to assist with different components in this M&E framework. Partnerships with evaluation associations will be sought, as well as collaboration with relevant Universities. Additional relationships with local area universities should also be considered as opportunities to seek professional development training to field staff. Below is an initial list of potential partners.

TABLE 3. LIST OF POTENTIAL PARTNERS THAT CAN CONTRIBUTE TO THE M&E FRAMEWORK

Potential Partners	Purpose	Comment(s)
National Academy of Sciences	Review of the National Ocean and Atmospheric Administration’s Education Program	
BridgeWater Education Consulting	Training on Program Design, Implementation and Evaluation	Currently under contract with NOAA’s Office of Education (OEd)
Institute for Learning Innovation (ILI)	Educational evaluation and research	Currently under contract with OEd but have also worked with ONMS
George Washington University, Evaluators Institute	Training on Evaluation Methods	
OMB, the Whitehouse PART group or maybe GPO	Validate the usability of the M&E Framework & provide advice to ensure there a proper alignment	Need to ID key people that could assist us
(1) Hilarie Davies (Technology for Learning Consortium Inc.); (2) Bora Simmons; (3) Chris Parsons (WordCraft) – California; (4) Anita M. Kraemer (Institute)	External Evaluators	List generated from information provided by several NOAA Education Evaluation Workgroup

Potential Partners	Purpose	Comment(s)
for Learning Innovation); (5) Michaela T. Zint (University of Michigan); (6) Jeffrey L. Kirwan (Virginia Tech) – Chesapeake; Joy Quill (C. J. Quill & Associates, Inc.)		members
Alan Friedman	Consultant	
American Educational Research Association (AERA)	Expertise in promoting research to improve education	
TERC, Evaluation Unit	Technical Support and Expertise in the build out of this M&E framework	
Oregon State University Department of Science and Math Education	Technical Support and Expertise in the build out of this M&E framework	John Falk and Lynn Dierking – possible contacts

3.6.2. Partnerships that contribute resources to advance the objectives of this M&E framework

Implementation of this M&E framework will require a funding mechanism to advance immediate tasks. One of the options the NOAA Education Council currently is its internal budgeting process, but even if the NOAA Education community was successful in this process, funds would not become available until 2013. In order to move forward within the next five years, NOAA education programs will need to become creative and partner with different Line Offices to pool some resources and request formal support from the Office of Education (OED). This latter strategy makes an informed assumption that this OED office could better leverage resources on behalf of the Education Council and through PPBES. However, it is not clear that OED will be successful in meeting this objective, as there are many factors that can impede goal attainment. A list of initial tasks that require funding is provided under section V.

It is important to note that NOAA internal partnerships can be built to leverage additional resources to support this framework; however it is not the ideal mechanism to sustain a comprehensive M&E framework. Some modest activities may be undertaken, but this approach might not build the expertise that is desired by programs in the field that seek to and avoid being overtaxed with sophisticated evaluation tools and requirements. Keeping this in mind, contributions to the build-out of this M&E framework need to be tightly tied to clear milestones. By doing so, partners and programs will benchmark progress and understand how far those resources might take us.

IV. DISSEMINATING AND UTILIZING EVALUATION RESULTS

Using findings to improve the NOAA education programs’ performance and accountability is an objective of the M&E Framework. It is this important to ensure that this information be accessible to all potential users and be provided in a timely fashion. The development of an intranet site can be a useful method for the NOAA education community to share its findings and the production of a series of reports can help disseminate those results.

4.1. Intranet Site

The NOAA Office of Education has established a resource page on its intranet site. In addition, it has established several working spaces for the various Education Council working groups to allow for improved

collaboration and file sharing. The M&E Workgroup uses the Google application to keep track of its plan of action and share resources.

4.2. Reports

To demonstrate progress in the design & implementation of the M&E Framework, the following three reports will be produced, starting in the year 2011:

- *Progress Report – Published 2011*: This progress report will include the results and analysis of the readiness assessment tool, the results from the data collected through the NOAA Blue Book data call and the NOAA Education Portfolio analysis tool. This report will thus provide a summary of NOAA-wide education programming efforts (type of activities, reach, thematic content, progress made in support of the Strategic Plan and Implementation Plan Strategic Directions), programmatic distribution of resources (budget, personnel, audiences, primary content) and a description of evaluation efforts at the programmatic level;
- *Progress Report – Published 2013*: This report will include the same information listed above plus (1) the results of a pilot program aimed at testing the applicability of the indicators identified (at the output and outcome levels); and (2) a progress report on the build-out of the overall M&E framework and key components;
- *Progress Report – Published 2015*: This report will demonstrate progress towards measuring outcomes (eg: examples of specific evaluation reports showing outputs and outcomes). In addition, this report will incorporate updated data from the readiness assessment tool and the education portfolio analysis tool. Depending on the rate of progress, this report may be able to provide analyses showing how NOAA's evaluation efforts compare to national science education efforts.

4.3. Use results to build expertise

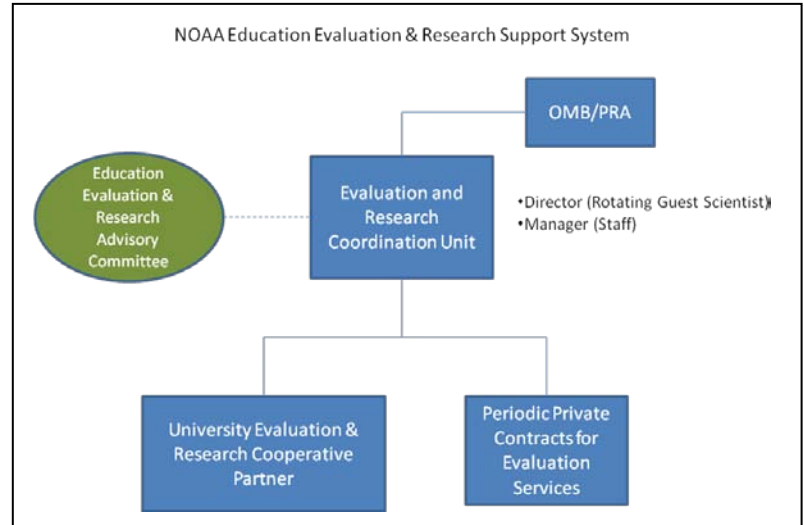
Field staff have valuable experiences and useful lessons in evaluation that would be important to share throughout the NOAA education network. To truly build a *learning environment around evaluation*, formal venues need to be established for people to share their expertise and lessons learned. These venues need to incorporate the knowledge of field staff; generate support and professional capacity in the field of evaluation; and generate support for the implementation of this M&E framework. Some of these formal venues could include regular meetings at national and/or regional conferences from NMEA, NSTA or NAAEE. Another option could be to convene annual meetings with key field and Education Council members involved in evaluation, or a series of regional annual meetings.

V. RESOURCES NEEDED & IMPLEMENTATION OPTIONS

5.1. Human Resources

Currently NOAA does not have the internal capacity to implement evaluations across programs or at the Corporate Level. In large part, line offices and programs that implement evaluations do so by contracting external expertise. The Evaluation Workgroup envisions the need to establish, sometime in the future, a dedicated unit within NOAA that could serve as a coordinating body that provides advice and support for evaluation efforts across all education programs. With a specialty in program and systems evaluation, this unit could, among several other things:

- Be responsible for the maintenance of the data collection system;
- Build a partnership with a University(ies) and involve trained social science graduate students in evaluating various education activities;
- Issue periodic and independent contracts for evaluation services;
- Provide evaluation oversight for all education programs;
- Provide ongoing technical assistance to all NOAA education programs; and
- Administer evaluation and training for NOAA educators



5.2. Steps for Moving Forward in the Implementation of this M&E Framework

It was the task of the Evaluation Workgroup to prepare a discussion document that outlined the overall vision and specific components that make-up this M&E Framework. The Evaluation Workgroup recognizes that to implement this whole M&E Framework the NOAA education community would need to have resources provided at all different levels of engagement, from the Office of Education to individual programs. In order to move forward with some of these approaches, the NOAA Education Council agreed to:

- Produce the readiness assessment tool and have all NOAA Education Council members complete it (Task completed – July 2010)
- Initiate an inventory of existing evaluation and performance monitoring data bases (In progress)
- Elicit feedback on M&E framework from external experts (In progress)
- Pool some resources from the different line offices and request support from the Office of Education to hire outside expertise to lead a performance measure writing workshop, provide technical advice, develop the appropriate evaluation instruments, guide the design of a database, and produce an implementation plan for the M&E framework (Stage III) – (In progress)
- Convene a 2 day performance measure writing workshop for NOAA Education Council members AND selected educators from the field & representatives from various line offices & 1 day follow-up to review the guidance document and ensure consistency in use of definitions. The objective could be to take the outcomes in the Education Strategic Plan and have small groups draft 3 or 4 potential performance indicators for each that meet the criteria and guidance presented by the expert(s)- (In progress)
- Refine the Portfolio Analysis Tool – The M&E Workgroup has recommended that this task be put on hold until the Office of Education can bring in some outside expertise to help refine this tool.

VI. REFERENCES

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APPENDIX

Appendix A. Eight Outcome Models

Appendix B. Readiness Assessment Questionnaire

Appendix C. Options to advance rigorous evaluation: Definitions.

Competitive Priority. *The program gives priority consideration to award applicants that propose to conduct a scientifically-rigorous evaluation of their project. Such applicants are given additional points in the proposal evaluation process, and may also be awarded additional funds to conduct the evaluation.*

Required of All Applicants. *The program requires award applicants to conduct a scientifically-rigorous evaluation of their project, and awards them additional funds to conduct the evaluation. Agency issues standards to govern quality of evaluations.*

Cross-Project Evaluation Sponsored by the Program. *The program or agency itself sponsors a scientifically-rigorous evaluation of one or more distinct interventions (e.g., a specific course curriculum) that a number of program awardees have adopted. The program or agency selects an independent researcher team to conduct this cross-project evaluation. The program requires its awardees to participate in such evaluations if asked.*

Sheltered Competition. *The program sets aside a portion of its funds to conduct a “sheltered competition” for funding awards to implement a specific intervention that the program seeks to evaluate (e.g., a well-defined teacher training model that a federal teacher professional development program seeks to evaluate). The program then selects an independent research team to conduct a scientifically-rigorous evaluation of the intervention, and requires the selected awardees to participate in the evaluation.*

Waivers to Allow Impact Study. *The agency or program waives provisions of law or regulation to allow program awardees to carry out demonstration projects of new interventions (e.g., new methods of program delivery), and in return requires such awardees to conduct a scientifically-rigorous evaluation of their demonstration project. (This option is more applicable to formula grant rather than discretionary grant programs.)*

Appendix D. Brief Description of the Training Developed by BridgeWater Education Consulting

GLOSSARY OF COMMON EVALUATION TERMS

Education Evaluation Glossary of Evaluation Terms

NOAA Education Council Evaluation Working Group

Draft 5/18/09

Relationship of Program Evaluation and Performance Measurement

Placeholder for diagram and brief discussion on the relationship between program evaluation and performance measurement.

Program Evaluation

Program evaluation is an objective and formal assessment of the results, impact, or effects of a program or policy. While most often aimed at assessing the degree to which a program's stated objectives are being or have been realized, program evaluations are also frequently used for measurement of "unintended" results, good or bad, that were not explicitly included in the original statement of objectives or foreseen in the implementation design. Thus, they can serve to validate or find error in the basic purposes and premises that underlay a program or policy. Finally, this definition should be read as including evaluations of program implementation process and operating policies and practices when the primary concern is about these issues rather than program outcome. However, the definition is not intended to include program monitoring activities that are (or should be) a routine component of good program management.

Types of Evaluation

Front-end Evaluation (Needs Assessment) provides background information for future program planning. It typically is designed to determine an audience's general knowledge, questions, expectations, experiences, learning styles, and concerns regarding a topic or theme.

Formative Evaluation provides information about how an interpretive media or program can be improved and occurs while a project is under development. It is a process of systematically checking assumptions and products in order to make changes that improve design or implementation.

Remedial Evaluation is concentrated near the end of a project, like summative evaluation, and may use the same tools. But the purpose of remedial evaluation is different: it is performed to make one last round of improvements to the project's deliverables, rather than to evaluate the impact of the project. Remedial evaluation can take place before, during, or after summative evaluation, and may even use the same data. (from NSF Framework p. 17)

Summative Evaluation is conducted after an interpretive media or program is completed and provides information about the *impact* of that project. It can be as simple as a head count of program attendance or as complex as a study of what individual's learned; what is assessed should be tied to project goals and objectives.

Evaluation Methodologies

The most significant aspect of program effectiveness is *impact*—the outcome of the program, which otherwise would not have occurred without the program intervention. Where it is feasible to measure the impact of the program, RCTs are generally the highest quality, unbiased evaluation to demonstrate the actual impact of the program. However, these studies are not suitable or feasible for every program, and a variety of evaluation methods may need to be considered because Federal programs vary so dramatically. Other types of evaluations may provide useful information about the impact of a program (but should be scrutinized given the increased possibility of an erroneous conclusion) or can help address how or why a program is effective (or ineffective) (i.e., meeting performance targets, achieving efficiency, fulfilling stated purpose). Some of primary evaluation methods are listed and described below. (Source OMB PART 2008)

Randomized Controlled Trials – An RCT is a study that measures an intervention’s effect by randomly assigning, for example, individuals (or other units, such as schools or police precincts) into an intervention group, which receives the intervention, and into a control group, which does not. At some point following the intervention, measurements are taken to establish the difference between the intervention group and the control group. Because the control group simulates what would have happened if there were no intervention, the difference in outcomes between the groups demonstrates the “outcome” or impact one would expect for the intervention more generally. There are many programs for which it would not be possible to conduct an RCT. To carry out an RCT, there must be a possibility of selecting randomized intervention and control groups—those who will receive a program intervention and those who will not (or will receive a different intervention). For practical, legal, and ethical reasons, this may not always be possible. (See examples in Section IV.D. of some types of programs for which RCTs may not be possible.)

Direct Controlled Trials – A Direct Controlled Trial is a study where various factors that might influence test results are directly controllable to such a degree that potentially undesirable or external influences are eliminated as significant uncertainties in the outcome of the trial. Such trials are most often possible in technology or engineering programs. For example, in weapon system tests in the Department of Defense, a newly developed weapon will have a test plan that measures the performance of the new weapon under a hostile or adverse environment which simulates a battlefield situation. The performance of the weapon will be measured, analyzed using appropriate statistical and other analytic tools, and the results of that analysis will be compared to the pre-existing but demanding test performance thresholds. In such a case, this evaluation can provide the full measure of rigor needed for evaluation of the development program and for use in acquisition decisions. Another example of this type of evaluation may be a National Aeronautics and Space Administration program to develop a satellite. The test plan would employ appropriate measures and standards of performance so that the satellite subsystem or system could be tested in an appropriate and representative variety of environments and evaluated directly using proper analytical techniques to determine if the development effort has met its goals.

Quasi-Experimental -- Like randomized controlled trials, these evaluations assess the differences that result from a Federally supported activity and the result that would have occurred without the intervention. For example, for a welfare program, the comparison may be between an intervention group that receives the benefits of a program and a comparison group that does not. However, the control activity (comparison group) is not randomly assigned. Instead, it is formed based on the judgment of the evaluator as to how to minimize any differences between the two groups, or it may be a pre-existing group. Quasi-experimental evaluations often are called “comparison group studies.” Under certain circumstances, well-matched comparison group studies can approach the rigor of randomized controlled trials and should be considered if

random assignment is not feasible or appropriate. However, use of comparison group studies does increase the risk of misleading results because of the difficulty in eliminating bias in the selection of the control group. Awareness of this risk is crucial to the design of such evaluations. (Also see Section III.B.3.)

Non-Experimental Direct Analysis -- These evaluations examine only the intervention subject (e.g., group)—the subject (group) receiving the program intervention (e.g., for groups, the intervention may be benefits); there is no comparison subject (group). A common example of this type of evaluation, the “pre-post study,” examines only an intervention group (no separate comparison group is selected), with outcomes compared both before and after program benefits are received. “Longitudinal studies,” which also examine changes over time and relate those changes back to the original condition of the intervention group, are another example.¹ Other examples of non-experimental tools and methods include correlation analyses, surveys, questionnaires, participant observation studies, implementation studies, peer reviews, and case studies. These evaluations often lack rigor and may lead to false conclusions if used to measure program effectiveness, and therefore, should be used in limited situations and only when necessary. Such methods may have use for examining how or why a program is effective, or for providing information that is useful for program management (Also see discussion at end of Section III.B.3.).

Non-Experimental Indirect Analysis – In some cases, such as with the results of basic research, the results may be so preliminary in the near-term or so predominantly long-term in nature that a review by a panel of independent experts may be the most appropriate form of assessment. The use of such surrogate analysis must be justified for a specific program based on the lack of viable alternative evaluations that would provide for more meaningful conclusions. Nevertheless, in some cases, such a review may be the best type of assessment available.

Portfolio Analysis - A systematic review of programs, projects and activities sponsored by an agency and its partners to examine trends in summary findings and methodological approaches. This process enables an organization to optimize its operations, consciously allocating risk and potential for success to achieve the greatest benefit of allocated resources. This review is greatly enhanced if the programs, projects and activities are reported in a framework that utilizes common terminology and thematic groupings of outcomes.

Logic Model

A logic model is a graphic representation of a program showing the intended relationships between investments and results. Most logic models incorporate the following components:

Inputs - resources dedicated to or consumed by the program. Examples are money staff and staff time, volunteers and volunteer time, facilities, equipment, and supplies.

Outputs - the products and services that are produced by a program. These are generally tabulated as counts, percentages, time allocations and/or dollar amounts.

Outcomes - the changes that show movement toward achieving ultimate goals and objectives.

Short-term – outcomes from a program that are realized at the immediate end of an activity and include participant reactions, changes in awareness, knowledge, skills, attitudes, opinions and intent.

Mid-term – lasting impacts on individuals or others in direct contact with program participants including as changes in behaviors, decision-making and actions.

Long-term – (ultimate goals) broader systemic impacts which reach beyond program participants including changes in social, economic, civic, and environmental conditions

Unintended Results – outcomes which occur as a result of the program that were not part of the original objectives and/or desired outcomes.

Assumptions - The beliefs we have about: the program, the people involved, and how we think the program will work. Assumptions include our ideas about the problem or situation; the way the program will operate; what the program expects to achieve; how the participants learn and behave, their motivations, etc.; the resources and staff; the external environment; the knowledge base; and the internal environment. Faulty assumptions are often the reason for poor results.

External factors - Aspects external to the program that influence the way the program operates, and are influenced by the program. Dynamic systems interactions include the cultural milieu, biophysical environment, economic structure, housing patterns, demographic makeup, family circumstances, values, political environment, background and experiences of participants, media, policies and priorities, etc. Elements that effect the program over which there is little control.

Performance Measurement

The following terms serve as the components of a Government Performance Results Act (GPRA) performance measure. Although establishment of GPRA measures is a formal agency process the language of GPRA provides clear guidance on the Federal requirements for acceptable performance measurement language, format and reporting. GPRA measures are comprised of 6 elements in a hierarchical order read from left to right in the following table:

Outcomes	Performance Objectives	Performance Indicator (Measure)	Performance Indicator (Measure) Baseline	Performance Goals (Targets)
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Performance measurement is the ongoing monitoring and reporting of program accomplishments, particularly progress towards pre-established goals. It is typically conducted by program or agency management. Performance measures may address the type or level of program activities conducted (process), the direct products and services delivered by a program (outputs), and/or the results of those products and services (outcomes). A “program” may be any activity, project, function, or policy that has an identifiable purpose or set of objectives.

Outcome – the intended long-term end state that program activities are designed to support.

Performance Objective – a statement of a specific, measurable, and observable result desired from program activities.

Performance Indicator (measure) - is a specific value or characteristic used to measure output or outcome. In other words, it is what will be measured.

Types of Performance Indicators –

Outcome Measure - an assessment of the results of a program activity compared to its intended purpose.

Long-Term Indicators – Social, Economic, Civic, and/or Environmental conditions

Mid-Term Indicators – Behavior, Practice, Decision-Making, Policies, Social Action

Short-Term Indicators – Awareness, Knowledge, Skills, Attitudes, Opinions, Aspirations, Motivations

Output Measure - the tabulation, calculation, or recording of activity or effort and can be expressed in a quantitative or qualitative manner.

Quantitative indicators are used in measuring work-load, production, transactions, records, and various rates, such as utilization, consumption, and frequency.

Qualitative indicators are used to measure timeliness, stoppage or out-of-service conditions, and various rates such as error or defect rates, inventory fill, and maintenance or repair intervals.

Quality of service indicators include measures of complaints, customer satisfaction levels, and responsiveness rates.

Efficiency indicators measure relative transaction or production costs.

Financial indicators are numerous and can include receipt, collection, and credit obligation rates.

Other examples of indicators include milestone and activity schedules, design specifications (such as hardware performance levels), operating parameters (such as mean failure rates), status of conditions (such as highway miles in good repair), and percentage coverage (such as eligible population).

Performance Indicator Baseline - the metric benchmark against which performance of the specified indicator is measured.

Proxy Indicators (measures) -

If research supports a strong connection between intermediate and ultimate outcomes, the measurement of intermediate outcomes alone can be used to satisfy GPRA requirements (USGAO, 1998). These are commonly referred to as "proxy measures."

Performance Goal - a target level of performance expressed as a tangible, measurable objective, against which actual achievement can be compared, including a goal expressed as a quantitative standard, value, or rate.