# AC 2012-4718: PROCESS EVALUATION: THE VITAL (AND USUALLY) MISSING PIECE IN EDUCATIONAL RESEARCH

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# Implementation Evaluation: The Vital (and Usually) Missing Piece in Educational Research

## Introduction

Most large educational research projects are challenging to manage. Activities of many people must be coordinated and unanticipated problems commonly arise at every turn. Project directors normally deal with the challenges by trial-and-error; unfortunately, it can take half or more of the term of the grant or contract for them to figure out how to make things work as proposed, and sometimes they never figure it out.

Most researchers are familiar with the need to evaluate the end results of a completed project, which in the professional evaluation community is termed *outcomes evaluation* (or *impact evaluation*). While necessary for funded projects, outcomes evaluation is summative—at best it might reveal what the researchers should have done, but it comes too late to change what they actually did. A formative approach called *utilization-focused evaluation* helps project leaders monitor and improve their project throughout its term.[1] A particularly powerful utilization-focused technique is *implementation evaluation* (or *process evaluation*), in which a trained evaluator is brought into a project from its inception, helps with the project planning (and if brought in early enough, with the proposal writing), continually assesses the implementation, and provides feedback that can keep the project from going off the rails and greatly improve the chances of its achieving its goals. This process has elements in common with continuous quality improvement in industry and with the CQI process associated with the ABET Engineering Criteria, and so it should not be foreign to engineering educators. In a search of papers in the *Journal of Engineering Education* and ASEE conference proceedings, however, many papers reported outcomes evaluations of projects but few mentioned any formal implementation evaluation.

The following questions should be addressed periodically when carrying out an educational research or development project.

1. *Will the project structure and activities lead to the achievement of our long-term goals and objectives? Have we made them clear to everyone who will be involved in their implementation? Are there things we can do to improve them and/or make them clearer?*
2. *How have the completed project activities gone? Are we on track to meet our short-term goals? Are there things we can do to improve and increase our chances of reaching all of our objectives in a timely way?*
3. *How is our project organizational structure working? Are there things we could do to streamline and improve the effectiveness of the project leadership and management?*
4. *Are we gathering the right data to help us evaluate the final project outcomes when the time comes, documenting why and how successful outcomes were achieved and explaining results that failed to meet our expectations? Are there things we could do now to improve that future documentation?*

This paper describes how implementation evaluation can help answer those questions. It gives

illustrative examples for two case studies—a three-year campus-wide NSF-ADVANCE project to increase faculty diversity and improve departmental climates for all faculty, and a three-year NSF-CCLI project to integrate sensor technologies into the civil engineering curriculum—and suggests how to identify an evaluator and work with him or her to get the maximum benefit from the evaluation.

## Why bring in a separate implementation evaluator?

It can be tempting to look at that four-question list and think, "Answering those questions is what a good principal investigator or project management team normally does—why divert precious funds to pay for someone else to come in and do it?"

There are several important reasons, of which the primary one is that while coordinators *should* address those questions throughout the life of a project, they generally don't. Like experimental design, statistical data analysis, budget planning, time and project management, and other elements of a major research study, program evaluation is complex and critically important. Widely ranging evaluation strategies have been developed for the planning, implementation, and closing stages of projects, and since no two projects are exactly the same, the evaluator must determine which of them is most suitable for the project. Professional evaluators learn their craft by getting advanced degrees in evaluation or in certification programs such as the one administered by The Evaluators' Institute at George Washington University (http://*tei.gwu.edu*). Few researchers in engineering education and most other disciplines get any training in program evaluation, however, or even know that there is such a field. They are apt to proceed without a coherent framework or model for meeting the intended project outcomes and producing desired changes, and to formulate activities and assessments that are infeasible, unproductive, or unlikely to yield results that address the project goals. The consequence is that many ambitious projects with the potential to make important contributions in their fields fail to make them. Having a certified implementation evaluator as part of a research team may not guarantee the success of the project, but it can dramatically improve the chances.

Describing all of the possible implementation evaluation strategies that might be adopted under different circumstances is beyond the scope of this paper. (See Reference 1 for a comprehensive review.) Instead, one robust approach to answering the four focal questions in the Introduction will be outlined and illustrated with case studies of two projects on which the author served as implementation evaluator. Both projects are currently in their final stages, and complete details of their goals, methods, and results will be presented elsewhere; their role in this paper will simply be to illustrate the functions and benefits of program implementation evaluation.

## Elements of implementation evaluation

### Develop a logic model and assist in project planning

*Will the project structure and activities lead to the achievement of our long-term goals and objectives? Have we made them clear to everyone who will be involved in their implementation? Are there things we can do to improve them and/or make them clearer?*

One of the most valuable tools in project planning is a *logic model*, a concise representation of the major activities in a project and the short-, medium- and long-term objectives for each activity.[2] A implementation evaluator can work with the project leadership team to develop a logic model that makes explicit the change model that underlies the project plan. Development of the logic model can help get all the leaders on the same page regarding project implementation and assessment, and the model provides a framework for quickly identifying causes and remedies of problems when things do not go as planned.

In its simplest form, the logic model is a matrix that captures the inputs, outputs, and outcomes of a project. It provides a way of putting all of the activities and objectives into a one- or two-page document that is easy to use. (See Table 1)

Table 1: Template for a simple logic model

| **Inputs** | | **Outputs** | | **Outcomes** | |
|---|---|---|---|---|---|
| | **Activities** | **Participation** | **Short-Term** | **Medium-Term** | **Long-Term** |
| **What are the resources being brought to bear? Who are the stakeholders?** | **What we do** | **Who we reach** | **What are the immediate expected outcomes?** | **What are the outcomes over the life of the grant?** | **What are the long-term outcomes that will remain?** |
| | | | | | |

Logic models have many variations including flow charts and webs. A simple search of "logic model examples" yields thousands of examples, and several training modules and publications are available online to aid with preparation and use of logic models.[2,3]

Another important task of the planning phase is to determine the data that should be collected and to develop a collection strategy. An often-omitted consideration involves baseline data. Too often, a moment comes deep in the life of the project when someone realizes that baseline data would enable comparisons and show changes that have occurred as a consequence of project activities. Sadly, the time for gathering the data is then long past. If a plan is developed early in the project, ideally before the project activities begin, that problem is less likely to occur. Developing a plan for data collection can be as simple as making a list indicating the data to be collected in each semester and who is responsible for collecting it.

**Monitor implementation**

*How have the completed project activities gone? Are we on track to meet our short-term goals? Are there things we can do to improve and increase our chances of reaching all of our objectives in a timely way?*

The main job of the implementation evaluator is to provide feedback on how well the grant activities are being managed and, if appropriate, offer recommendations. There are a number of

things the evaluator can do gather this information:

- Attend meetings and activities to see first hand how the program activities are progressing.
- Gather data from participants after activities (retreats, workshops, etc.) to gauge their effectiveness in reaching short-term objectives. Data should always be gathered immediately after an activity to measure participant satisfaction and learning, and it can be even more useful to follow up after some time has elapsed to see the effects of the activity over time.
- Gather data from participants in the project through surveys, individual interviews, focus groups, and retreat sessions. The data might provide measures of the effectiveness of the project, its impact on individuals, success stories, and ideas for changes and improvements.

Data collected during implementation should be fed back quickly to the project and activity leaders. It can be done in a formal report, but it may be better delivered in person in a meeting or in a short, easy-to-use document. The evaluator may make recommendations based on what he or she has collected or the data may simply be provided so that the leaders can decide what they want to do about it.

**Monitor leadership team functioning**

*How is our project organizational structure working? Are there things we could do to streamline and improve the effectiveness of the project leadership and management?*

Administering a large project effectively is a nontrivial challenge. Often there are multiple leaders who must juggle other responsibilities while working on the project. An implementation evaluator can help by participating in team meetings as an observer, gathering data about patterns of communication, problem-solving, and conflict resolution, and providing feedback on how things are going and ideas for helping the team to work more effectively.

**Prepare for outcomes evaluation**

> *Are we gathering the right data to help us evaluate the final project outcomes when the time comes, documenting why and how successful outcomes were achieved and explaining results that failed to meet our expectations? Are there things we could do now to improve that future documentation?*

Outcomes evaluation is summative in nature and includes making a judgment about how well the project has achieved its objectives. Sometimes, the same person does implementation evaluation and outcomes evaluation, but in larger projects it is preferable to separate the functions. The close involvement of the implementation evaluator in leadership meetings and other grant activities may be difficult for him or her to have the objectivity an external evaluator or evaluation team can bring to the conclusion of the project.

There are two things the implementation evaluator can do to help prepare a project for outcomes evaluation: set up the data collection process to assure that the important data will be available

for the final evaluation, and interpret data as they are collected—particularly statements made during interviews and focus groups and open-ended written questionnaire responses—to help explain why certain outcomes were or were not achieved.

## Case Study 1. ADVANCE PAID Grant on Developing Diverse Departments

This three-year project has the following goals:

1. Increase the number of women on the senior faculty;
2. Increase the number of faculty of color at all ranks;
3. Increase the number of women and faculty of color in leadership positions (department head, dean, provost);
4. Cultivate change agents for promoting diversity;
5. Change faculty attitudes about seeking diversity in hiring.

There are three major elements of the project:

1. Scholars Study Groups. Over the three-year period of the grant, two small groups of women and minority faculty members—emerging leaders and senior leaders—read and study issues of diversity and unconscious bias at the university and to develop and complete projects related to the topics.
2. Leadership Development Workshops. Each year a group of minority and women faculty members participate in a series of 6-7 workshops to introduce them to important leadership issues and to build their interest in pursuing leadership positions.
3. Climate Workshops for Department Heads. Each year several department heads participate in four sessions to increase their understanding of issues related to departmental climate. The faculties and staffs in their departments are surveyed and the results provide a basis for the heads to address climate issues within their departments.

Each year the project also hosts a retreat to disseminate information and to spark discussion of diversity and climate issues within the wider university community. For a more complete description of the project, see Reference 4.

My role as evaluator in the ADVANCE project involves activities in each of the four major project components described previously.

### Logic model and project planning

I facilitated two sessions with the ADVANCE leadership team to develop the logic model several months into the grant. (See the complete result in Appendix A.) Before its development, there was a lot of confusion on the team about different elements of the project. In developing the logic model, I first asked the team to think about an inclusive university climate and brainstorm things that might contribute to it. Then we took each element of the project and discussed the objectives for it, keeping in mind the overriding goals of developing change agents and leaders for a more inclusive climate. We focused on a number of different project activities in turn and clarified their structure. For example, one of the Scholar activities was the development of individual initiatives. There was almost no structure for these initiatives in the

language of the project proposal, so we discussed what that structure should be and made decisions about how to design it to lead to the achievement of the ADVANCE project objectives.

The development of the logic model led to much greater clarity about the nature and purpose of the planned grant activities. Members of the leadership team began to bring the model with them to meetings to help them keep track of the different project elements. At many points throughout the grant, we all looked back at the logic model to see how we were progressing and to adjust the plan as conditions changed.

**Monitoring implementation**

Evaluation activities were designed for each of the three principal components of the project and the retreat.

- Scholars study groups: An online survey collected data on the senior and emerging leaders' motivation for committing three years to the project and baseline data on their personal and professional goals and leadership self-efficacy. The groups met monthly for facilitated discussions and work on their projects, and each of the first two years of the grant ended with an *appreciative inquiry* session for each group. (Appreciative inquiry is an evaluation technique to gain insight into the strengths of a project directly from the people involved and have them identify ways to build on those strengths.[5]) In the final year of the grant, all scholars will be surveyed to identify changes in their goals and leadership self-efficacy and interviewed to collect their stories of the effects of their participation in the project.
- Leadership development workshops: For each cohort of participants, data on motivations and goals for participation in the workshop series and baseline data on leadership plans (intentions of pursuing a leadership position) and self-efficacy were collected. Immediately following the workshop series, the participants were surveyed to see if there were changes in their leadership plans and self-efficacy and to gather their ideas for improvement of the workshops. One year after their workshop series ended, the cohorts were again surveyed to find out if they had sought or assumed new leadership positions.
- Climate workshops for department heads: After the first two workshops, the staff and faculty in each of the participating departments were surveyed regarding their perceptions of the department climate. Before the third workshop, summary reports for each department were presented to the corresponding department heads, taking care to preserve the respondents' anonymity. The department heads were surveyed one year after the fourth and final workshop to see how the survey results had been used and what (if any) changes had taken place in the climate of their departments.
- Retreat: At the end of the retreat, the participants filled out an evaluation form in which they rated the different parts of the program and commented on what worked well and things they thought could be improved.

For each of these project elements, I summarized and analyzed the data collected, noted any observed deviations from the project plan and the logic model, and recommended modifications in future implementations, and I met with the people leading the activities and helped them to plan adjustments. For instance, I met with the leaders of the two Scholars groups shortly after the

Appreciative Inquiry sessions at the end of years one and two to discuss the participants' comments. The discussions led to instituting additional opportunities for the two groups to meet together and share ideas, greater emphasis on support for carrying out individual projects, and selection of more practical and less theoretical articles for readings and discussion. The same types of adjustments were made in all the activities as the result of the formative feedback.

**Monitoring leadership team functioning**

In the initial stages of the project, I attended most leadership team meetings and provided suggestions to the PI and leadership team about how to manage the project more effectively. Suggestions included keeping a more careful record of meeting activities and sending it out to all members of the team, establishing a clear agenda with time estimates for meetings, and using facilitation mechanisms to ensure that all team members were heard on key decisions.

About midway through the grant, I surveyed the team using an online survey of mostly open-ended questions regarding how the team was spending its time and what priorities they had for the second half of the grant. The responses led to discussions about the need to shift from overinvolvement in minor details of current activities to planning for institutionalization of the successful parts of the project and identifying sources of future funding for additional activities. The team also was able to discuss communication problems and take steps to address them.

Groups often find it hard to focus on how well they are functioning unless there is a specific mechanism for doing so. They tend to simply proceed with the work, ignoring warning signs of problems until they explode. Timely feedback of the type just described impelled the ADVANCE grant team to address problems and make adjustments before that point was reached. The feedback itself did not solve the problems, but it got the issues on the table for discussion, which led to a better working environment for the team and a better overall project.

**Preparing for outcomes evaluation**

A team of external evaluators will do the outcomes evaluation for this project in the fall of 2012. As implementation evaluator, my role is to organize all the evaluation data and activities from the three years of the grant. I will be conducting a series of site visits to departments in the university (some with high participation and some who have not participated in the grant activities) to collect their ideas about hiring and retaining a diverse faculty. The responses combined with the data collected over the life of the project should provide answers to questions about whether and why the projected outcomes were reached or not, as well as insights about the impact of the project on participating departments.

## Case Study 2: CCLI Exploratory Project on Integration of Sensor Technologies into the Civil Engineering Curriculum

This three-year project was designed to install civil engineering sensors in new campus buildings, provide online access to real-time data collected by the sensors for instructional purposes, and develop and test hands-on instructional modules about sensors to be integrated into the civil engineering curriculum. The project involves two faculty members and two graduate

students. Since it is much smaller and more focused than the ADVANCE project, the implementation evaluation has taken place on a much smaller scale.

**Project planning**

I was involved during the writing of the grant to provide input into the design of the project and the evaluation data that would be gathered. Tasks included helping to clarify the project objectives, develop ways to assess whether the objectives were being met, and offer mechanisms to gather student input to improve the modules. The limited scope of the project made the formalism of a logic model unnecessary. The fact that both implementation and outcomes evaluation were built into the grant proposal was cited positively in the reviews that led to the project being funded.

**Monitoring implementation**

During implementation, I assisted in the design of pre- and post-tests on the content of the instructional modules, analyzed the data for several semesters, and provided feedback on the design of the modules. Results of the first administration of the pre- and post-tests helped fine-tune the module content. After three offerings, I designed an online survey to get student input on what in the modules helped them learn and what hindered their learning. Students made several good suggestions—including bringing sensors into the classroom—that will be incorporated in future course offerings. I also examined the website containing the real-time sensor data and offered suggestions for improvement. Reports of the results of these assessments were presented in periodic meetings with the project leaders. The implementation evaluation data led the project PI and involved faculty and graduate students to critically examine how the project was going and to make adjustments that improved it.

**Preparing for outcomes evaluation**

For this project I will do both implementation and outcomes evaluation. Because of the implementation evaluation, the outcomes evaluation should flow naturally out of the collected data.

## Finding and Working with an Implementation Evaluator

Almost any funded project in engineering education could benefit from implementation evaluation. Here are some suggestions for finding qualified evaluators and making the most of their services:

1. Early in planning for a project, take some time to think about what an implementation evaluator could contribute, using the four focal questions described in this paper as a starting point.
2. Consider what you can and are willing to pay for evaluation. In a funded project, allocating 10-15% of the total budget to implementation and outcomes evaluation is a good rule of thumb. If you separate implementation and outcomes evaluation, be sure to allocate a sufficient amount to the former because its activities are continuing and time-

intensive throughout the lifetime of the project. If the amount seems high, remember the potential value of formative evaluation in helping achieve desired project outcomes and the positive impact its inclusion in the proposal is likely to have on reviewers.

3. With your tentative list of possible evaluation activities and the amount you can pay in hand, contact one or two evaluators to discuss the possibilities. There are several ways to find evaluators. If your university has an education program and particularly if it offers courses in program evaluation, faculty there might be able to offer possibilities. You might also look at the website for the American Evaluation Association <http://www.eval.org/>, which maintains a "Find an Evaluator" page you can search by location and keywords. Word-of-mouth from others who have recently used evaluators is another good source of leads.
4. Meet with prospective evaluators and discuss your needs, being open to ideas they may offer. Discuss the fee you propose to pay. The amount will often dictate how involved the evaluator can be in the project and what activities can be planned. Above all, look for someone with good credentials, experience, and recommendations with whom you feel you can work effectively.
5. Once you have identified the evaluator, outline a work plan for your project and be open to the plan changing over the life of the project. I have never done implementation evaluation where unexpected needs did not arise that necessitated adjusting the work plan. Be sure to build in some flexibility so that the evaluator can help you when a new need comes along.

## Summary

Program implementation evaluation is a formative technique in which a trained evaluator is brought into a project, helps formulate a coherent framework for planning and conducting the project, continually assesses the implementation and provides feedback that can keep the project running smoothly and staying on track, and helps make sure that all of the information needed for the final evaluation of the project outcomes is in place.

There are several benefits of a well-conducted implementation evaluation:

1. At the beginning of a project, it can help clarify proposed objectives and activities, give everyone involved a common view of what they are trying to do, and identify the data to be collected and the mechanisms to collect it throughout the life of the project.
2. During the project, it can provide data on the effectiveness of activities and project management to help shape the project and increase the likelihood that the objectives will be met.
3. At the conclusion of the project, it can make the outcomes evaluation go much more smoothly because the necessary data will have been collected to determine whether and why objectives were or were not met.

Most researchers have neither training nor experience in many of the tasks performed in implementation evaluation, so that in their studies those tasks are either carried out poorly or not

at all and the studies consequently fall short of meeting their objectives. Including a trained—and ideally, certified—program evaluator on the research project team can significantly improve the likelihood that the project will succeed.

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