Building Evaluation System Capacity for STEM Programs: Enhancing Capability and Advancing Practice

NSF Grant EREC-0535492
Request for Supplemental Funds

Summary of Proposed Work

Funds requested under this supplement will be used to accomplish three distinct tasks that are integrated with the focus of the current grant and are essential to its success:

I. Enhance scope of Pilot Study with the Cornell Center for Materials Research (CCMR). Funds are requested to enable us to extend the pilot study with the Cornell Center for Materials Research in order to include the perspectives and input of the broader initiative of which it is a part, the NSF Materials Research Science and Engineering Centers (MRSEC). The specific additional activities we will accomplish for this task will center on inclusion of relevant NSF staff in the conceptualization of the evaluation model for the CCMR site. This work will take place over the course of three meetings that will include a CCMR staff liaison, our project team, and Materials Research Science and Engineering Centers (MRSEC) program officers and others associated with that initiative at NSF. This task will include the following specific activities:

- development of a systems model of the CCMR educational programs that includes consideration of the different scales of the evaluand and its system (local to CCMR, global to MRSEC, local to other MRSECs), the different time cycles for evaluation feedback, and the different perspectives of the varying relevant stakeholder groups;
- detailing of incentives for various stakeholders to participate in the educational programs and their evaluation;
- development of a pathways logic model that can guide evaluation work;
- delineation of the evolutionary life cycle of the CCMR/MRSEC initiative and their educational programs;
- understanding of the dynamics of the educational programs of CCMR.

II. Add the Santa Fe Institute (SFI) as a third evaluation pilot site. Funds are requested to enable us to include the Santa Fe Institute as a third pilot site for our project. Inclusion of this site will: enable us to address a critically important STEM education context (the independent research and education institute) not well represented in our current two pilot sites (a museum and a university-based research center); significantly enhance the generalizability and utility of our findings; and, enhance the quality of our research through inclusion of an additional world-class scientific research entity. As with

our other two pilot sites, we will accomplish the following specific activities with the Santa Fe Institute as part of this research:

- development of an evaluation capacity assessment that is relevant to SFI;
- implementation of evaluation capacity assessment at beginning of pilot study;
- implementation of evaluation model and protocol with SFI, including: development of a systems model of the evaluand that encompasses multiple perspectives, scales and time cycles; detailing of stakeholder incentives to participate in the educational programs and evaluation; development of pathways logic model; delineation of program lifecycles; and understanding of program dynamics; development of an evaluation plan with methods and measures; assistance in operationalizing and implementing the evaluation plan.
- reassessment of evaluation capacity at the end of the pilot project.

III. Adapt an existing web-based tool for STEM education systems evaluation. One of the most exciting breakthroughs in the first six months of this grant has been the development of a model for a systems-oriented web-based software platform that can both be a practical tool that any STEM education program can use and will provide a basis for implementation of the pilot projects. We are requesting supplemental funding that will enable us to take a web-based system that we have already developed initially in a different evaluation context and adapt and extend it so that it incorporates systems thinking concepts developed under this research and can be used to facilitate implementation of the pilot studies proposed here. The nature of the software and the proposed changes under this supplement are considered in the justification section of this supplement proposal. The specific activities that will be undertaken as part of this task are:

- requirements analysis of changes needed to adapt existing software for STEM context;
- assessment of the incentives that different STEM education stakeholders would have for using such a web-based system;
- reorganization of database structure to accommodate typical STEM structures (e.g., educational program, organization, funder, etc.);
- enhancement of software with specific systems-based features including:
    - linking specific logic model activities with the outputs and outcomes affected by them (i.e., development of a pathways model from a traditional logic model);
    - connecting existing logic model field information for a program and outcome measures to comparable information in other programs at other organizations in the database (local-local connections);
    - enhancing the dynamics of the software so that information entered locally will immediately be linked with comparable information already entered by other local programs or by researchers;
    - develop a pilot version of an interface for researchers and evaluators to see STEM program activities and outcomes and add evidence-based information that is directly relevant;

    - develop a pilot version of an interface for funders and policy-makers to see what types of programs are being developed, and to determine where there is already high-quality evidence-based programming and where such programming needs to be developed;
    - develop a pilot version of an interface for more effective linking and networking of STEM educators, researchers, funders and policymakers.
- testing of the adapted software as part of the pilot projects conducted under this research;
- revisions of software based upon pilot study experiences;
- development of a plan for rolling out the revised software more broadly for other STEM education contexts.

Justification for Supplement

During the current first project year, the project team established relationships with three very diverse and distinguished pilot programs: (1) the Cornell Center for Materials Research (CCMR), an interdisciplinary research center funded by NSF through the Materials Research Science and Engineering Centers division (MRSEC), (2) the Museum of the Earth-Paleontological Research Institution (MoE/PRI), a highly acclaimed museum and science center encompassing a wide array of formal and informal STEM education programs, and (3) the Santa Fe Institute, the leading scientific organization for complexity theory, which has an internationally renowned Complex Systems Educational program that provides graduate-level training in interdisciplinary science and complex systems. The selection of these three pilot partners involved intensive research into over 30 existing STEM programs. The three programs selected as pilots were chosen because: (1) each engages in high quality and creative STEM education programs and activities, (2) together they represent a diverse cross-section of STEM programs in terms of educational style, type of programs, organizational structure, evaluation needs, activities and outcomes, and (3) the leadership in each of these programs was keenly committed not only to their own evaluation needs but to the generalizeable needs of all STEM evaluation. In January 2007, our project team and the leaders from each pilot partnership will begin conducting a systems evaluation utilizing the evaluation model and protocol developed under this research. Results from our pilot research will be used to modify the model and protocol and will be submitted for publication in journals related to evaluation, STEM evaluation and STEM education.

Here we provide background information and justification for the three tasks in our supplemental request.

I. Enhance scope of Pilot Study with the Cornell Center for Materials Research.

The central focus of our research project is on the incorporation of systems thinking into evaluation of STEM education. One of the most important and fundamental concepts in systems thinking is the notion of part and whole. All systems can be characterized in terms of part-whole relationships, and understanding the relations of part and whole is essential to effective evaluation. The part-whole concept extends hierarchically at all levels of generality. For instance, part-whole considerations are embedded throughout the STEM endeavor, from the way our society (whole) relates to Congress (part), to the funding Congress (whole) provides to the NSF (part), to the NSF (whole) management of STEM research and education (part), to any STEM education organization (whole) and its relation to its programs (parts), to a specific STEM program (whole) and its activities (parts), and so on. It is a central premise of this research that we cannot do a good job of evaluating a STEM education program without understanding the system within which it is embedded and addressing the features of the system most relevant to the evaluation. While every evaluation will have some part-whole features that are relevant, which specific part-whole relationships are most salient depend on the specific context.

The Cornell Center for Materials Research (CCMR) is one of twenty-nine university-based research centers funded through the NSF Materials Research Science and Engineering Centers (MRSEC) initiative. In this context, the relationship of centers (parts) to initiative (whole) is especially salient. Because of the organizational and hierarchical structure of this part-whole relationship we might refer to it as a "local-global" one where each center is a "local" entity and the MRSEC initiative is considered the "global" entity. It is clear from our preliminary discussions with CCMR and initial meetings with MRSEC leaders that the inclusion of CCMR as a pilot site in our study provides both an opportunity and a challenge. The opportunity is that we are able to use the CCMR pilot as a test bed for understanding local-global relationships in this context, how they affect the evaluation, and how our model and protocol needs to be adapted to address them. The challenge is that our initial proposal assumed that our pilot work would largely be bounded by the pilot site organization itself. From a systems evaluation perspective, it is especially important to address this dimension for the CCMR case.

Our supplemental request is for a small amount of funding to expand out CCMR pilot study to be able to encompass the CCMR-MRSEC local-global relationship in the evaluation planning. We expect that this can be accomplished through several meetings, and with some small funding to increase our level of staff support for this work. The potential benefit for this research grant in particular and for STEM education evaluation in general is considerable. The MRSEC is one of the oldest, largest and most prestigious of the NSF large center-grant initiatives. As such, our work on this expanded pilot will enable us to speak to the evaluation issues of such large initiatives in a way that was not anticipated in the original proposal. In addition, we believe that this expanded pilot would provide an important foundation for subsequent expansion of this research effort to other MRSEC centers and possibly to the MRSEC initiative as a whole. We expect that this supplemental funding will provide a basis for subsequent funding proposals to MRSEC and other entities to support extending this effort more broadly. This pilot will also have implications for other large initiatives at NSF by demonstrating how they might move to more effective system evaluation of their initiatives.

II. Add the Santa Fe Institute as a third evaluation pilot site.

The purpose of working with pilot sites is to test the systems evaluation model and protocol in a program context, and to assess subsequently if such intervention improved each site's evaluation capacity. The original proposed project included work with two different sites to help assure that the intervention and its measure(s) will be ready for wider scale implementation subsequent to this research. After careful review of more than 30 STEM education programs, we selected as pilot sites a university-based research center (Cornell Center for Materials Research) and a highly regarded regional science museum (the Museum of the Earth-Paleontological Research Institution). However, we realized that these sites did not represent well another important STEM education context – the independent science research and education center. To address this, we made contact with one of the world's leading independent research organizations, the Santa Fe Institute (SFI). Like our other two pilot sites, it is also heavily involved in NSF-funded

STEM education efforts. But it differs from these two sites in important ways.

The Santa Fe Institute is a private, not-for-profit, independent research and education center whose stated mission is to conduct and foster scientific research that is:

- *Transdisciplinary*, as topics of interest transcend any single scientific discipline and cannot be studied adequately in traditional disciplinary contexts;
- *Excellent*, as SFI applies rigorous standards of excellence to its program and thus sets new directions for science by undertaking high-risk research, which often takes years to complete;
- *Fresh*, in that SFI's efforts complement rather than compete with work carried out at other institutions, and new work is usually not chosen if it is likely to be done at other major institutions; and
- *Catalytic* because SFI wants to spread its ideas and methodologies in hopes of influencing the way science is done in the next century, and encourages many people from other institutions to experience the SFI atmosphere as visiting researchers.

Central to SFI's education efforts is the Complex Systems Summer School (CSSS) which is held annually at sites in Santa Fe, New Mexico and in China. The CSSS offers graduate students and postdoctoral fellows an intensive four-week introduction to complex behavior in mathematical, physical, living, and social systems. The school is ideal for participants who desire background and hands-on experience in preparation for interdisciplinary research in areas related to complex systems. Each school consists of a series of lectures, laboratories, and discussion sessions focusing on foundational ideas, tools, and current topics in complex systems research. These include nonlinear dynamics and pattern formation, scaling theory, information theory and computation theory, adaptation and evolution, network structure and dynamics, adaptive computation techniques, computer modeling tools, and specific applications of these core topics to various disciplines. In addition, participants formulate and carry out team projects related to topics covered in the school. Colleagues at SFI are enthusiastic to participate as an evaluation pilot site, with an emphasis on exploring their capacity to adequately evaluate the impact of the CSSS on student's learning and future engagement in science.

Our supplemental request includes a small amount of funding to add SFI as a third pilot site. This inclusion has several critically important benefits for this research grant. First, it greatly enhances the generalizability of our research by adding an important and different type of STEM education context, one that represents both the independent research center and independent graduate and postgraduate education. Second, because it is not locally accessible to our research team (our other two pilots are in Ithaca, New York), it will help us to understand the challenges of implementing our model remotely with STEM education sites. Although we are requesting a small amount of travel funding for this third pilot, we will still not be able to be as accessible to this site as we are to the other two. This will enable us to examine potential difficulties in translating our model to other contexts with high fidelity. Third, SFI is a world-renowned premier research institution. Inclusion of it in this research will reflect well on the project and will provide a

compelling additional pilot. Finally, SFI is especially apt as a pilot site for this research because of our shared common substantive interests in systems thinking. SFI is the leader in complexity and complex adaptive systems. Much of the substantive focus of our grant is on how we can most effectively use evaluation in complex adaptive system contexts. We fully expect that the staff at SFI will be able to make a substantive contribution through our collaboration, in addition to being a pilot site for our research.

III. Adapt and enhance a web-based software tool for use in STEM education evaluation.

There are two purposes to this task of the supplemental request: to adapt an existing web-based software system (that we developed for another context) to use as a tool for STEM education evaluation; and to enhance that software using systems thinking concepts that we have developed under this grant.

The existing software was developed by the P.I. as a tool for evaluating educational programs for Cornell Cooperative Extension (CCE). It is currently being beta-tested at the CCE office in New York City and will be implemented in five other counties in New York State over the next year. The software enables an educator to enter information about an educational program (inputs, assumptions, contextual issues, activities, outputs and outcomes) and its evaluation (questions, participants, measures, design, analysis, reporting) and immediately generate both a logic model and a draft evaluation plan. In addition, the system can be used to enter program participant data and produce simple reports about participation by activity, program or program area. An illustrative screen shot of the program screen for the New York City office is provided in Figure 1. We are requesting a small amount of supplemental funding to enable us to create the necessary database structures and user interface to make this database immediately useable by STEM education programs. Here we detail the specific activities that we propose the supplemental funds be allocated to cover.

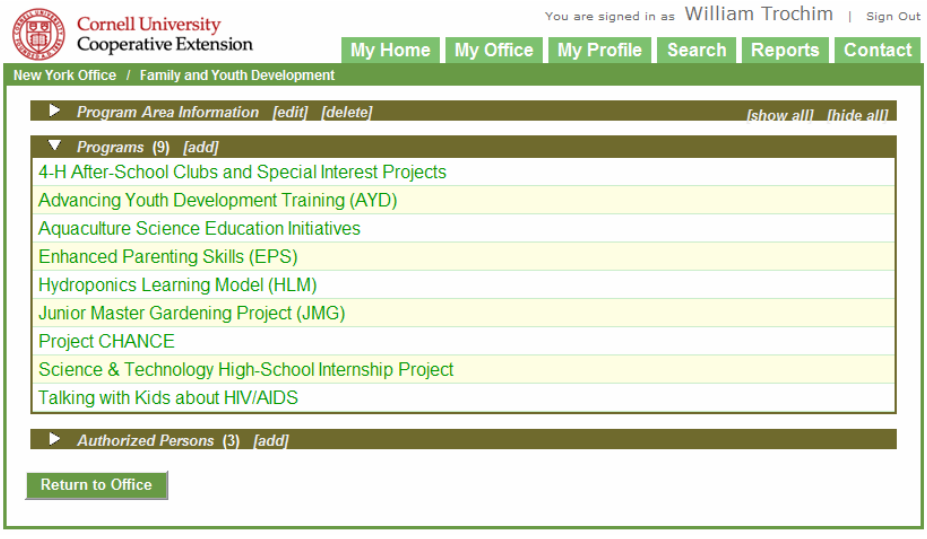

Figure 1. Screen shot of the Cornell Cooperative Extension Netway© web-based software system showing the programs for the Family and Youth Development program area.

Pathway Models. To understand how we intend to enhance this software using systems thinking approaches for evaluation we begin by considering the idea of a logic model. In its most common representational form, logic models tend to be columnar in nature. That is, program activities, outputs and outcomes are listed in separate columns but are not individually linked to one another. This is in contrast to models developed under Theory of Change approaches where causal "pathway" models are the more typical representation. While similar in general to columnar logic models, the pathway model explicitly links individual activities, outputs and outcomes with causal arrows. These two approaches are illustrated in Figure 2.

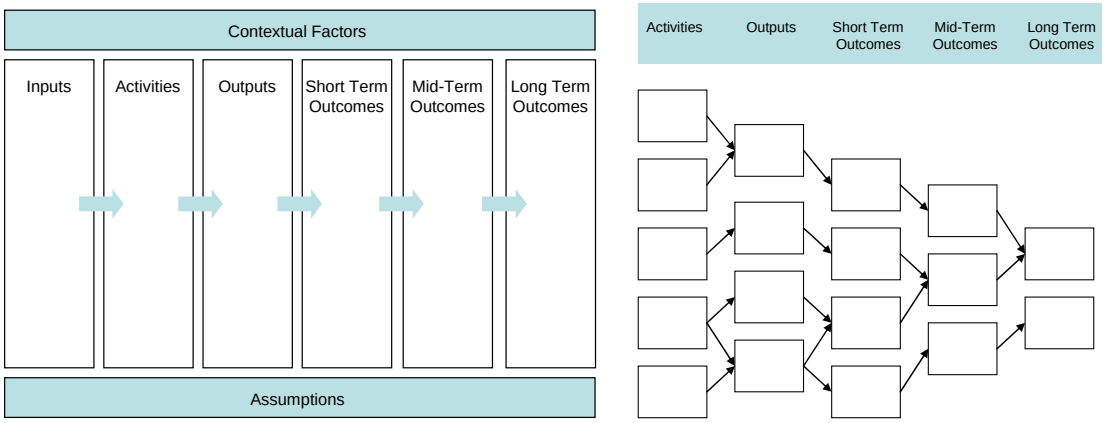

Figure 2. Traditional columnar logic model (left) and causal pathways model (right).

The software that we described above already enables educators to develop a traditional columnar logic model. We propose to enhance it so that educators can easily develop pathway models as well. This will require developing an interface that enables the user to specify the links between any activity, output or outcome with another.

Netway (Networked Pathway) models. Now, imagine that we have multiple educational programs – a "system" of programs – as is the case in STEM education. And, imagine that some of the programs have identical activities, outputs or outcomes. For instance, two STEM education programs might share a common activity like a hands-on lesson with a microscope. Or, they might both have a mid-term outcome of affecting children's attitudes towards science. A hypothetical case of four programs that share some common pathway elements is depicted in Figure 3.

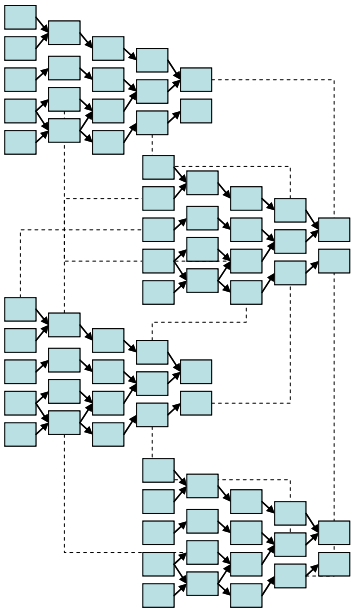

Figure 3. Hypothetical case of four program pathway models that have elements in common.

When we have causal pathway models that share elements, we term this a "networked pathway" model or a "netway" model for short[1]. A netway model is a representation of a system of programs. We propose enhancing the web-based software by developing data structures that enable us to identify and depict netway models of this nature.

Dynamic Local-Local Connections. But, how will we connect logic models of different programs that are already entered into the system? It would be possible to scan through existing models and manually "connect" activities, outputs or outcomes that are identical or similar beyond some threshold criterion. But this would be time consuming, require considerable resources and be dependent on the judgment of the analyst. A far more effective and efficient systems approach would be to distribute the effort throughout the system by enabling the educators themselves to make such connections. Whenever an educator enters information about a program, activity, output or outcome, the software can be doing a simple keyword search for other programs already in the system that already have similar entries. These could be displayed for the user as options they could select. For example, if an educator enters an activity like "hands-on demonstration with a microscope" the software could show any other existing entries that use those key terms, with the best fitting ones shown first. The educator would have the option of choosing any existing entities that they think appropriate, or of continuing to enter their own. This has several important effects from a systems perspective. It helps the educator think of things they might not have thought of. It shows the educator that there are others out there doing this kind of activity or looking at this kind of output or outcome. And, if they select an existing entry, it immediately links their pathway model to another, while creating a new node on the netway. Note that if they elect not to choose an existing

[1] The term Netway© is both a generic descriptive term and a proprietary product name that we have developed to refer to the specific software system. When referring to the specific software product, one should use the copyright and capitalize the term; when referring to the general model, this is not necessary.

element, the one they enter becomes part of the system and may be selected subsequently by others.

One other aspect of dynamic local-local connections through the web-based software is that once a connection is made to another pathway model, it is possible for the educator to benefit by seeing what the other pathway linked to the connected element. Continuing with the microscope example, if the educator selects an existing activity that is identically or similarly worded to "hands-on demonstration with a microscope", the software would also be able to display the programs, activities, outputs and outcomes that were connected with that activity in the other pathway model. This is analogous to the function in many current websites like amazon.com that show "others who made this selection also liked…" when you select a book or movie.

This is a simple and profound change in a traditional database structure. It is inherently a systems approach in that it connects local-local nodes and enables a global network to emerge from these connections organically. Over time, and with more users, the web-based system would become more powerful and useful. The probability that an educator/user would find features that match what they are interested in doing would increase. The system enables local-local learning to occur immediately at the point of need for the educator. They immediately see other relevant information that can be used to improve their program planning and evaluation. And, in the major STEM education topical areas, it is likely that over time a broad-based consensus would emerge where new programs that replicate older ones would find that they could quite rapidly adopt the standards used earlier. At the same time, the system allows for continuous adaptability, even in more established, emergent, normative areas.

Researcher and Evaluator Interface. The netway model becomes even more powerful when we add different stakeholder groups to the system. As part of this supplemental request, we propose exploring the development of pilot versions of three additional interfaces – three additional windows or portals into the same database structure. These would be undertaken to explore the possibilities for future expansion and development of the system.

The first portal would be for researchers and evaluators. They would be able to log on and see what new programs, activities, outputs and outcomes are being entered by educators. In essence, the system helps to establish the link between what is happening in practice with what research has already found. Similarly, researchers will have real time access to the questions and concerns that practitioners are confronting and will be able to target the dissemination of their research findings and have knowledge of areas where there are gaps in the research. For instance, when an educator enters in a new program, a researcher may already be aware of an evidence-based program that is similar. Or, they may have a measure that has been well tested that would be relevant to an outcome that an educator entered. If the researcher enters information about that program or outcome the educator can immediately be notified that new relevant information has been entered, and thus can become aware of evidence-based programs and measures that already exist. In addition, the next time an educator connects to the same elements, this information can

immediately be presented at the time the program is being designed or developed. Furthermore, the researcher learns something very important by using this system – they learn what kinds of educational needs new programs are currently trying to address. They receive real-time input about what's "hot" among educators. This can signal to them emerging areas of need for the research they engage in. It will be important to develop mechanisms for adjudicating quality of information in such a system. We intend to explore several possible approaches. One would be to have system users rate information, in much the same way that cutting edge websites are beginning to do. Each research element can be rated and over time the quality of the raters can also be determined (by ratings of their rating contributions). Or, we could base ratings in part on the frequency with which research elements get selected to be linked to their models by educators. Almost certainly, multiple criteria will be needed to assure reasonable quality judgments.

The researcher interface also allows the linkage of the educator entered theory of change and the evidence-base. In other words, the logic behind the theory of change will be checked against existing research. For example, the educator may have entered "hands-on demonstration with a microscope" as an activity and then linked this activity with the outcome "increased interest in taking science classes". The database would then be queried for research that supports the logic that people who engage in activities such as a hands-on demonstration with a microscope exhibit increased interest in taking science classes. Thus, the logic behind the netway model is supported by an evidence-base.

In addition to checking the database for evidence-based research that support the logic of the netway model, the database will also be queried for measures, tools, and other resources for measuring outcomes. This will limit the "reinventing of the wheel" that commonly occurs when individual programs try to create measurement tools for evaluating their programs.

This researcher and evaluator portal significantly extends the idea of evidence-based practice. In a sense, it provides an environment where we also have practice-based evidence – where the immediate issues educators are trying to address get signaled immediately to the research community.

Funder and Policy Maker Interface. In an analogous manner, we propose developing a pilot version of a web-based portal for funders and policy-makers. When they log on to the system, they would be able to see a summary of the areas where STEM educational activity is occurring. They could look at it by subject area, by type of program, by program activities, by outputs or outcomes, by geographical area, or by any number of other dimensions. This would provide them with high-level global feedback about how the educational "system" is evolving. It would enable them to spot important trends and to identify gaps that are not being addressed. They would be able to enter information about potential funding opportunities that educators and researchers would be able to see. For example, imagine that NSF has a funding source that can be used for educational efforts with children that would include providing hands-on experience with microscopes. The funder logs onto the system and sees that someone recently added a program activity in that area. The funder could then enter an element into the database

that connects to that entry that alerts the educator to the funding opportunity (and the educator could be contacted immediately via e-mail that such an entry was made). In addition, any educator who subsequently enters in a similar activity could immediately see that "activities like this have the following potential current funding opportunities…"

Network Communications Interface. Finally, we propose developing a capability in this enhanced web-based system for enabling direct networking and communication among the various stakeholders who are participating in the system. Educators should be able to find other educators who are doing similar programs. They should be able to find researchers who have relevant research or funders with relevant funding opportunities. Researchers should be able to identify potential collaborators or sites for research. Funders should be able to see who is doing educational programming in areas they are interested in funding. When one user identifies a connection to another user, it should be possible to contact them directly via e-mail. It would also be possible to protect the identity of the person being contacted by using an anonymous invitation system. For example, if a researcher finds an educational program in the system that is doing something closely related to their research and thinks there might be a possibility for collaboration, they could click on a link that would enable them to compose an e-mail invitation to the educator to contact them about discussing such an opportunity. In this way, connections can be made while preserving the privacy of the participants.

Summary of Activities. We can summarize the six activities that we will undertake to enhance the existing web-based software as part of this supplement. The first three activities will be the primary focus and are feasible to accomplish within the scope of this supplement. The last three anticipate the future evolution of the system and provide a basis for exploring and testing such features.

- **Pathway Models**: linking specific logic model activities with the outputs and outcomes affected by them (i.e., development of a pathways model from a traditional logic model);
- **Netway (Networked Pathway) models**: connecting existing logic model field information for a program and outcome measures to comparable information in other programs at other organizations in the database (local-local connections);
- **Dynamic Local-Local Connections**: enhancing the dynamics of the software so that information entered locally will immediately be linked with comparable information already entered by other local programs or by researchers;
- **Researcher and Evaluator Interface**: develop a pilot version of an interface for researchers and evaluators to see STEM program activities and outcomes and add evidence-based information that is directly relevant;
- **Funder and Policy Maker Interface**: develop a pilot version of an interface for funders and policy-makers to see what types of programs are being developed, and to determine where there is already high-quality evidence-based programming and where such needs to be developed;
- **Network Communications Interface**: develop a pilot version of an interface for more effective linking and networking of STEM educators, researchers, funders and policymakers.

The netway model and software are inherently rooted in systems thinking concepts and were developed, in part, in connection with this grant project. One of the most important aspects of this approach is that it is based on a systems analysis of the incentives that different stakeholders have for using the software. The central idea is that the system will work best when each stakeholder group is incentivized to use it. This is most likely to occur when the user gets something immediately valuable from using the system. The system should be designed so that each user locally gets what they need or want from the system and – consciously or not – gives the system something someone else needs or wants. An evolutionary systems analogy for this dynamic interrelationship is pollination. The bee picks up the nectar from the flower in order to convert it to honey. Inadvertently – and without awareness – the bee is also picking up pollen grains that are then transmitted to other flowers and enable fertilization of them. The flower does not know that the bee is collecting nectar to make honey – it is simply being fertilized through the process. Thus, each entity – the bee and the flower – is both getting something essential from the exchange and providing something essential to the other, with no need for awareness that they are doing so.

In a similar manner, the netway approach is based on a system of incentives that encourage dynamic exchange. The educator is getting a system that makes program planning and evaluation easier, immediately suggests other ways to do what they are trying to do, and connects them to potentially useful research and funding resources. At the same time, the educators are providing important information to researchers and funders about what problems they are trying to address through education, what activities they are currently engaging in, and what they are trying to measure. The researcher finds out what problems are currently being addressed and can identify potential collaborators for research. In exchange, the researcher is distributing research that they know about. Funders are learning what the system is trying to address and can see areas of emphasis and identify potential areas where funding is needed. In exchange, they are providing funding opportunities that signal to both the educators and researchers where they would like to place emphasis. In this manner, the netway model provides an ecology with the **incentive** for local agents to participate in global networks.

We can see this even more clearly when we look at the specific incentives that might motivate an educator to use the web-based system. Rather than a simple reporting tool in which local users send off data and rarely see results or benefit, the Netway© uses incentive-based strategies to provide the local-user with something immediately useful to them. For example, the user could walk away from a session with any of the following:

- a netway mapping of their activities and outcomes autogenerated in various formats according to local-user preferences (e.g., Logic Model, Pathway Model)
- an Evaluation Plan that includes a logic or pathway model and indicates the evaluation questions, samples, measures, design, analysis and reporting.
- a network analysis of where the local user is situated within a larger global network (e.g., other programs that address similar elements)
- key indicators and markers that are "near" or part of the local-user's netway

- examples of other "Pathways" that other local-users are taking to get to the same or similar outcomes
- a network analysis of outcomes, indicators, pathways and markers that similar local-users have in their pathway that the user does not have in theirs (akin to Amazon's "people who bought this book also bought")
- links to existing research that local-agents can use to link direct outcomes of their interventions to indirect outcomes such as national or global socio-economic factors

These reports would be generated automatically in visual and data form and would be easy to read and use. At the same time, and in exchange for the local-user's effort, the global-agent is receiving data about the local-global network that can be used to better manage the network (influence decisions, future RFPs, etc.) This use of agent incentive is a very important aspect of the Netway© Software and the netway idea.

Our supplemental request includes a small amount of funding to accomplish the adaptation and enhancement of the existing Netway© software. We are able to do this at relatively low cost and with a short timeline because we are the developers of the original software, we have the programming team already in place, and we are familiar with the existing data structures. Approval of this supplemental funding will enable us to adapt the software in time to incorporate it into the three proposed pilot tests for this research beginning January 2007. The software will provide an important tool that will help make the pilot tests both more efficient and effective. Furthermore, by tying into this existing system, even the initial STEM pilots will be able to take advantage of the data already entered for the existing cooperative extension programs, many of which are both NSF funded and classifiable as STEM education. For example, several of the existing programs in the database explicitly teach science (hydroponics, aquaponics, science and technology high school internships, Garden Mosaics) and have outcomes related to young people’s interest in and attitudes about science. This supplemental request would provide a timely and inexpensive way to enhance the current research grant and significantly extend the potential that it will have profound effects for STEM education more broadly.

Supplementary Documents

- Letter of Support, Cornell Center for Materials Research
- Letter of Support, NSF MRSEC
- Letter of Support, Santa Fe Institute