Association of Public and Land-grant Universities

The Science & Mathematics Teacher Imperative

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STEM Education Centers: A National Discussion

Donna Gerardi Riordan

Executive Summary

For more than five years, the Association of Public and Land-grant Universities – APLU – has been creating forums for its member institutions to stimulate and share improvements in science and mathematics education. As that worked progressed, APLU noticed a marked increase in the number of self-described centers, programs, or institutes focused on science, technology, engineering, and mathematics (STEM) education hosted on campuses across the nation (hereafter, STEM Education Centers, or Centers). While it seemed that these entities could have a potentially unique role in leveraging campus-level change and improvements in STEM teaching and learning, we first needed to know more about their missions, functions, or structures.

In June 2013, APLU launched a national discussion on university-based STEM Education Centers through a grant from the Alfred P. Sloan Foundation. The project's goal was to foster communication and interaction among STEM Education Centers to learn more about them and explore if and how they could be mobilized to improve undergraduate STEM education. We decided to start by understanding the functions they serve and how they relate to STEM education, whom they serve, their sizes and structures, and their challenges.

Over 70 STEM education center directors completed an online survey about their center. APLU's Planning Team invited 54 centers directors to a national discussion. From this survey and discussion, we learned that these centers are varied in their missions, functions, and structures, as noted below. Even with such diversity, STEM Education Center directors recognized that they share a common commitment to serving as a campus locus for improving STEM teaching and learning. Though they employ different strategies for programming and engaging various stakeholders and audiences, centers face many of the same challenges with sustaining successful projects past the life of a grant, engaging university leadership, and learning about best practices from centers with similar missions and audiences. Directors recognized they need opportunities to learn from one another and meet around topics of common interest; consequently, follow-on activities are now being planned.

Executive Summary: What We Learned

From this set of 54 Centers, we gained valuable insight into their roles in STEM education, audience served, organizational structure, institutional support, and missions. The following are some highlights:

Centers improve the recruitment, retention, and STEM learning experience of undergraduate students. Centers improve the education of STEM undergraduates through support for faculty, new curricula, teacher preparation, and by facilitating research on teaching and learning. Centers also broaden the impact of campus research by supporting undergraduate research programs and/or outreach programming for the public or school groups within their regions. Furthermore, they have wider-scale impact through participation in national networks, convening meetings, creating online resources, and publishing their research and findings on improving STEM education.

Centers have different structures. Centers vary in age: the oldest was established in 1959; the newest are in the planning phases and are scheduled to launch in 2014. Nearly 65 percent are less than 10 years old. Funding for centers varies widely, and includes annual state funding, institutional support, private and federal grants, and contracts for goods and services. Centers may report to the university provost, offices of research, outreach and external affairs, or act as stand-alone units, some across multiple colleges or schools.

Centers serve a wide range of audiences: principal investigators with ideas and strategies to meet "broader impacts"; faculty who wish to develop cross-unit research projects or who need evaluation services for internal and external projects; K-12 students, teachers, or local citizens through outreach programs; and teachers for preparation and professional development. Centers respond to a variety of expectations by campus leadership for either internal collaboration of faculty across colleges or external partnerships as part of a vision for public or K-12 outreach. Center staffing varies widely – from small (support for 1 FTE) to very large (400 FTE at a state-funded center that serves several local schools), with wide variations in the kinds of faculty involvement and professional staff assignments.

Centers face many challenges to maintain visibility and viability on campuses. Institutional support varies widely (annually, and from center to center), and state funding for staff, faculty lines, and programs also varies and is insecure. They rarely have sufficient and stable funding for faculty, staff, and basic infrastructure.

Centers also are challenged by the need to align their missions with the missions and objectives of other campus units. They must navigate turf battles among stakeholders on campus and within local communities, while also working to maintain continuity of mission and programming in light of faculty and staff turnover. Securing adequate space on campus to ensure the right kinds of communications and collaborations within and across units is yet another challenge.

Executive Summary Next Steps: Creating a Postsecondary STEM Education Resource Network/Coalition

Workshop participants expressed a tremendous interest in developing a national community of STEM Education Centers and saw great opportunity in fostering lasting interactions among centers with similar interests. We concluded that the **next step is to build a community that can share ideas, practices, and resources through on-line mechanisms and convene when needed to address specific topics.**

The terms "network" or "hub" convey the intent of a new entity as one that would coordinate community-building, communications, and sharing of materials. The hub could also establish links to national efforts so that centers could translate the national STEM education agenda to local contexts. Those interactions would take several forms: developing and convening a variety of special interest groups in areas such as data needs and evaluation, professional development for centers directors and staff, and strategies to merge national policy with regional and local actions. There was a sense that online resources could be organized, analyzed, and shared among centers, and that a common classification scheme, or taxonomy for centers, would be useful to identify similar kinds of programs, interests, and structures. Furthermore, participants recognized that private or public funding would be required to launch any new network.

In future planning, we will develop activities around the following consensus ideas that emerged from the workshop:

Build a community: Create a network among centers to combat isolation within their own institutions and empower centers to act together in ways they could not individually.

Share ideas, practices, and resources: Develop mechanisms to share or prepare "white papers" that describe critical information such as the principles, values, and promising practices of STEM education centers. This will involve creating and maintaining a "clearinghouse" of common tools, data, metrics, and evaluation strategies; practices (successes and failures); and impacts of work on STEM education. Also needed are mechanisms to share research and information among like-minded centers (e.g., undergraduate, K-12, discipline-based education research, or outreach); or, creating an archive of common organizing documents, such as organizational charts, MOUs, funding strategies, and URLs. This planning will draw upon expertise, experience, and resources across centers to focus on specific issues.

Communicate easily: Create mechanisms for communicating and networking within the STEM education community. Initially, we would build out the existing web presence where center profiles (both existing and new) could be housed, which will enable the generation and sharing of newsletters, blogs, directories, and email lists. Additionally, we would strategically bring together like-minded individuals and centers to discuss pressing issues. Convening could occur virtually, or regionally, as part of existing conferences (e.g., discipline-based meetings), be stand-alone events focused on specific topics, or a large annual national conference with multiple strands. They could be designed to involve the diversity of centers, or specific interest groups, such as K-12, outreach, discipline based education research, or undergraduate transformation.

Overview

For more than five years, the Association of Public and Land-grant Universities – APLU – has created forums for its member institutions to stimulate, bolster, and share improvements in science and mathematics education. As that work has progressed, APLU has observed a marked increase in the number of self-described centers, programs, or institutes focused on science, technology, engineering, mathematics (STEM) education on campuses across the nation (hereafter, STEM Education Centers, or Centers). While it seemed that these entities could have a role – and potentially a unique role – in leveraging campus-level change and improvements in STEM teaching and learning, we first needed to know more about their missions, functions, or structures.

In June 2013, APLU launched a national discussion on university-based STEM Education Centers through a generous grant from the Alfred P. Sloan Foundation. Led by the STEM Education Center Planning Team, its goals were to foster communication and interaction among STEM education centers and to enhance the capacity of these centers to support effective undergraduate education.

Specifically, the project sought to:

- Better understand and document the breadth of programs that support evidence-based practices in undergraduate STEM education;
- Identify commonalities and variations among such centers; and
- Begin to build a national network among such centers.

APLU recognized that the term STEM Education Centers would not fit all entities, but as an organizing construct, it would provide a useful framework to launch a much-needed conversation. We found that centers appear to incorporate a large range of research, outreach and training functions, and activities related to the transformation of undergraduate teaching and learning of STEM disciplines. We also found that centers were emerging as a vehicle for addressing national priorities regarding STEM education. Furthermore, APLU engaged university-based centers first –rather than centers housed outside of academe – since universities (with undergraduate education at their core) could catalyze a broad national STEM education transformation, including research on multi-level teaching and learning STEM disciplines.

This report summarizes the project's work: the results of information gathering during the summer and discussions at the workshop held in St. Louis in September 2013. It also includes preliminary plans for next steps. Additional information about the project is found in the Appendixes. Appendix A describes the project's planning, process, and survey; Appendix B is the preliminary classification scheme for STEM Education Centers; Appendix C is the workshop's agenda.

Project Design

To meet our objectives, the planning team created an online process to collect detailed descriptions of STEM Education Centers, and organized a 1.5 day workshop attended by center directors entitled, "Towards a National Network of University-based STEM Education Centers." We surveyed 70+ STEM education centers in the US and invited 54 of those center directors to a national discussion. We created a technology infrastructure that showcases programs as "profiles." From this survey and discussion, we learned that these centers are varied in their missions, functions, and structures. Yet even in light of the diverse approaches, STEM Education Center directors recognized the need for opportunities to learn from one another and create a common language to describe and talk about what centers do.

Outcomes

What functions do STEM Education Centers perform?

Detailed information about 54 centers gathered in our survey during the summer of 2013 reveals a diversity of visions, missions and functions for centers. For more information about the range of approaches used among centers, visit the STEM Education Center website http://serc.carleton.edu/StemEdCenters/profiles.html.

STEM Education Centers:

Improve the STEM learning experience of students on campus by providing:

- a campus or STEM community focused on improved STEM teaching and learning
- faculty development opportunities including learning communities that draw from across departments, seminars, book groups, workshops, and courses
- curricular innovation including curriculum development grants
- curriculum/learning opportunities across departments
- instruction on teaching to teaching assistants
- support for student populations including those underrepresented in the sciences
- STEM-wide programming (e.g. undergraduate research programs, involvement in K-12 education)
- support for faculty to obtain external funding for education and curriculum projects
- sharing of ideas on STEM education from the external STEM education community into the campus community
- capacity to evaluate programs and assess learning on campus through research, expertise, instrument development, or coordination of campus activities
- advanced study and degrees in science education for faculty

Improve the flow of students into STEM undergraduate programs, including students from underrepresented groups by offering:

- high school to postsecondary "bridge" programs
- school year and summer programs for K-12 students
- support faculty to obtain external funding for K-12 outreach projects

Improve the preparation of students for STEM undergraduate education offering:

- teacher preparation degree programs
- teacher professional development programs
- support for faculty to obtain external funding for K-12 teacher education projects
- research on teacher preparation and K-12 student learning
- capacity to evaluate programs and assess learning on campus through research or implementation programs in collaboration with school systems
- K-12 curriculum development
- on-site research, curriculum assessment, and program evaluation
- programming for K-12 students (in and out of school)
- coordination of participation of undergraduates in K-12 programming

Expand the understanding of teaching and learning through:

- research programs including graduate programs with foci on K-12, undergraduate, and free-choice learning
- research and scholarship on teaching/learning
- support for faculty to obtain external funding for educational research projects through grant seeking and grant writing
- develop cross-unit research projects

Broaden the impact of campus research by supporting:

- outreach programming for the public or school groups
- faculty to obtain external funding for outreach projects
- activities that enhance the broader impact of campus research
- undergraduate research programs

Support national scale improvement in STEM education through:

- participation in a national community engaged in improving STEM education
- bringing research and experience from campus to a larger community engaged in improving STEM
- hosting national conferences, workshops, and events
- creating online resources
- publications
- leading or participating in state-wide or national networks or projects
- state and federal advocacy to inform education policy issues

How are STEM Education Centers structured?

STEM Centers are organized in many different ways, with varying missions and audiences. For example, centers vary in age. The oldest was established in 1959 (and is currently re-defining its mission); the newest are in the planning phases and are scheduled to launch in 2014. Nearly 65 percent have been in existence for less than ten years. Funding for centers varies widely: it includes annual state funding, institutional support, private and federal grants, and contracts for goods and services.

Centers are distributed in many locations across campus. Some report to the campus provost, offices of research, or outreach and external affairs. Some are stand-alone units while others work across multiple colleges or schools. Still others are discrete programs within single colleges of education, arts and sciences, or engineering, or they are embedded as a special focus area within campus-wide centers for teaching and learning. Center staffing varies widely – from tiny (support for 1 FTE) to very large (400 FTE at a state-funded center that serves several local schools). Centers involve professional administrators and researchers, postdocs, graduate and undergraduate student workers, and local teachers. And many units support part-time faculty positions through various kinds of affiliation agreements.

What challenges do STEM Education Centers face?

Despite all of the functions that STEM education centers perform, they face many challenges to maintain visibility and viability on campuses. Below is a summary of significant challenges as reported in the survey, grouped into four interrelated categories: funding, aligning missions, space, and culture.

Funding

Centers rarely have sufficient, secure, and ongoing funding for faculty, staff, and basic infrastructure. Institutional support varies widely by year and by center, and state funding for staff, faculty lines, and programs also varies and is insecure. Centers rarely have dedicated institutional funding and must balance a need for external funding from private and federal sources that will provide stability to run ongoing, successful models and opportunity for new ideas and innovations.

Aligning Missions

Centers are challenged by the need to align their own mission with the missions and objectives of different units. They must navigate turf battles among various stakeholders on campus and within communities, while also working to maintain continuity of mission and programming due to faculty and staff turnover. Centers must simultaneously maintain a clear purpose and transparent collaborations and partnerships within the campus community.

Space

Securing adequate space is also a challenge. This includes an appropriate physical location on campus that ensures communications and collaborations within and across units. Centers often compete with other units for valuable space. They are devising ways to advocate for space by creating and supporting incentives (e.g., funding) for ongoing commitments for faculty, professional staff, collaborators (on- and off-campus), and cross-unit (school/college) projects.

Culture Change

Centers are places where, optimally, links are forged between research about teaching and learning and faculty practice/institutional change. However, centers confront institutional and individual opposition to cultural change, along with narrow views among faculty about instructional responsibility. Changing that mindset is difficult at best and incentives to secure faculty buy-in are necessary for broad-based reform of undergraduate STEM. In addition, centers need better assessment models, student outcome baseline data, and measurement tools to provide the coordination and organization required to achieve institution-wide change.

Creating a common language to describe STEM Education Centers

In light of the diversity among STEM Education Centers, the planning committee realized the importance of developing a common language to allow this group to identify others with shared interests and to communicate effectively with each other. As a result, we discussed how that information might be gathered, organized, analyzed, and used and decided to include a discussion of common language into the workshop agenda.

We also realized that many challenges exist, including the dynamic nature of centers' creation and evolution and the need to maintain a balance between complete and consistent data. The tension between the desire for a sophisticated coding system that would increase consistency but which also could fail to capture innovations became apparent. Furthermore, we wondered about the ultimate utility of such a scheme. Would it really be important to know the structures and functions of centers in great detail?

While planning the workshop, we tested these ideas by using survey data to explore what should or could be included in a classification scheme or taxonomy, and how key data would be captured and represented. Appendix B details the initial classification scheme discussed during the workshop. Key elements of the classification scheme include:

Section 1: Institution/Center Identification

Section 2: Institutional Characteristics (from IPEDS)

Section 3: Center Structure

Section 4: Audiences Addressed

Section 5: Vision or Goals of Center

Section 6: Center Mechanisms

Section 7: Center Successes and Metrics

Section 8: Challenges

Section 9: Funding

Workshop attendees were of two minds about the utility of such a taxonomy. Some argued common descriptions and characterizations of work would enable center directors and staff to identify resources and colleagues and provide a sense of where one's center fits within the larger network. Others felt that current centers were already a loose network of campus hubs involved in related activities across projects from research to implementation in addition to various kinds of internal and external collaborations. Therefore, a taxonomy would enable the capture of descriptions of the full spectrum of activities.

The group also acknowledged an important absence of clear definitions or core principles for what is meant by STEM Center, STEM education, STEM learning, and STEM literacy, thus creating a barrier to more communication and collaboration among campuses and programs. We recognized that there was little alignment between a center's

work and national goals (e.g., those identified by the President's Council of Advisors on Science and Technology) and a lack of inclusion of two-year colleges or workforce development concerns.

Furthermore, the term "STEM Education Center" may not define the locus of interest that brings a group of faculty or staff together and provides coherence around a common vision or mission. In some institutions, STEM education-related work, especially around teaching and learning, is situated in non-STEM centers such as centers for teaching and learning or learning excellence or in advanced technology education units for technology activities. Those that are in the colleges of education have a different approach or outlook on teaching and learning and delivery models than those in colleges of arts and sciences. Moreover, the concept of diversity would need to be expanded beyond the traditional connotation (i.e., minorities and non-traditional) to include physical and learning challenges.

While no definitive decision about a future taxonomy was made, there was broad agreement about the need to document and explore the wide range of approaches centers use to design new centers and to build community and collaborations.

Next Steps: Creating a "Postsecondary STEM Education Resource Network/Coalition"

At the workshop, the group brainstormed about possible next steps that include creating a mechanism for university-based STEM education centers to communicate and collaborate and identifying what would need to be done and by whom. After a wide-ranging discussion, there was convergence around an idea for future action: **Create a mechanism to build a community that can share ideas, practices, and resources; communicate easily and regularly around topics of common interest; and convene when needed to address specific topics.**

Workshop participants recognized that common communications may be difficult due to the diversity of approaches to STEM education centers and their differing priorities and approaches to STEM education. However, there is tremendous opportunity in sharing information and thus a strong interest in enabling ongoing interactions among those with similar interests. Those interactions could take several forms depending on needs and special interests. The terms "network" or "hub" were used often to describe the intent of the entity as one that would coordinate community building, communications, sharing of materials, establish links to national efforts, and translate the national agenda to local contexts. Any organizational structure would need to include a way to ensure that common (or special) interest groups could be convened around issues such as data needs and evaluation, professional development for center directors and staff, strategies to merge national policy with regional and local action, urban K-12 issues, K-12 and undergraduate engineering education, or integrated STEM education. Furthermore, participants recognized that private or public funding would be required to launch any new network.

The consensus of the workshop's discussions revealed that:

Building a community means…

- **Create a network** among centers to combat their isolation within their own institutions. This network could include professional development of center leaders and staff, such as exchange programs of "visiting scholars" between centers that would focus on collaboration and learning.
- **Work together** to build on what others (including other groups) have done, are doing, or are planning to do.
- **Identify others** with whom to explore ways to instigate, motivate, and support change within higher education institutions.
- **Mobilize collective action** around issues such as requesting institutional leadership and support and faculty engagement in STEM educational transformation. (In the

interim, APLU can play this role, as it has with SMTI and the MTE-Partnership.)

- **Empower centers to act together** in ways they could not individually, and thus increase the value of centers in their own institutions and regions. For example, a community of centers or programs could mobilize around national and state-level policy changes in education and advocacy within professional associations such as APLU and AAU and regionally for local/regional impacts on STEM education.
- **Integrate a policy component** to enable two-way sharing of information and concerns between the local/regional and state/national arenas.

Sharing ideas, practices and resources means…

- **Develop** a mechanism to share or prepare white papers that describe critical information such as the principles, values, and promising practices of STEM education centers, and common data, metrics, and evaluation strategies, tools and resources.
- **Organize** a way to share tools, practices (successes and failures), and impacts of work on STEM education, perhaps through a clearinghouse.
- **Share** research and information among like-minded or similar focused centers. (e.g., undergraduate, K-12, discipline-based education research (DBER) or outreach)
- **Create** an archive of common organizing documents, such as organizational charts, MOUs, funding strategies, and URLs.
- **Draw** on expertise, experience, and resources across centers, focus on specific issues. (e.g., working with faculty on undergraduate teaching; implementing multi-dimensional programs to recruit and combat barriers to students staying in STEM and being successful; and college and career readiness)
- **Put together** a model workshop for experienced people to come together to collect tips/knowledge from others.
- **Offer** professional development, consultation services, and mentoring for directors starting new centers.

Communicating easily and readily means…

- Create an online presence that would enable the generation and sharing of newsletters, blogs, directories, and email lists.
- Create a web presence where center profiles could be housed, and thus build on the current set of 54 profiles.
- Build an online tool for communication and networking within the STEM education community that includes a paid time commitment to maintain it and ensure its timeliness, relevance, and usefulness.
- Develop a speakers' bureau of innovators who could be invited to visit and speak at centers and invite regional centers to attend. Such a strategy could be used to promote friendly competition among different groups.

Convening means…

- Strategically convene like-minded individuals and centers around pressing issues. Such convening could occur regionally, as part of existing conferences (for example, discipline-based meetings), be stand-alone events focused on specific topics, or a large annual national conference with multiple strands. They could be designed to involve the diversity of centers, or specific interest groups, such as K-12, outreach, DBER, or transforming undergraduate STEM education.
- Organize face-to-face or virtual conferences and meetings of various special interest groups that could take various forms. For example, a group of visiting faculty, supported through a collaborative grant involving multiple institutions, could meet

for a period of time (say 3-14 days) to work on specific issues, and develop new ideas, programs, and grant proposals. Or, building on the model developed in the biology community through the "Vision and Change" program, STEM centers could link initiatives and perspectives, and convene a group of faculty in another discipline. Each model project could produce 10-minute videos of the project with a written summary. "Visiting scholars" share reflections to be coupled with videos, to be hosted on a virtual library site to help further spread the models. The videos can help share the vision with colleagues from the home campus to help convey the ideas and promote participation in implementation.

During the next several months, APLU will build on the findings of this project and plan next steps to continue the national discussion and seek ways to build a Postsecondary STEM Education Resource Network/Coalition. In the meantime, profiles of STEM Education Centers and other project work can be found online at http://serc.carleton.edu/StemEdCenters/index.html.

Appendix A
Project Planning, Process, Survey

In June 2013, the Association of Public and Land-grant Universities (APLU) launched a national discussion on university-based STEM Education Centers through a grant from the Alfred P. Sloan Foundation. The project's goal was to foster communication and interaction among STEM Education Centers to enhance their capacity to support effective undergraduate science, technology, engineering, and mathematics education.

The project ran from May through October 2013. We convened a planning committee, created a robust process that involved a survey and online content management system to gather and organize information about a set of STEM education centers, and organized a 1.5 day workshop in September attended by center directors entitled, "Towards a National Network of University-based STEM Education Centers."

More than 150 "centers" in STEM education with various structures and functions exist today. This project initially intended to focus on centers that are discrete campus units with research and faculty activities that focus on the transformation of undergraduate teaching and learning of STEM disciplines. APLU believes that this subset of centers is a critically important group to engage initially, since universities (with undergraduate education at their core) will potentially serve as the catalysts for broader national educational transformation in STEM, including research on teaching and learning STEM disciplines at all levels. As we began to actively collect information, we realized that this narrow focus would limit our ability to learn from a wider range of centers, so we broadened the types of university-based centers invited to participate.

Specifically, our project sought to survey the landscape of STEM education centers in order to:

- better understand and document the breadth of programs that support evidence-based practices in undergraduate STEM education;
- identify commonalities and variations among such centers; and
- begin to build a national network among such centers.

We launched our project by inviting STEM Education Centers to participate in this national discussion by joining our online list for future communications, hosted by Carleton College's Science Education Resource Center, or SERC. We had an overwhelmingly positive response to our initial invitation to approximately 150 centers.

Next, we invited centers to take a survey to gather information to create a preliminary taxonomy of center functions (e.g., the problems or issues the centers were established to address and how they are being addressed) and structures (e.g., how they were established; their mechanisms for working across campus and other organizations). The survey questions are included in Box 1.

Simultaneously we created a technology infrastructure to showcase programs as "profiles." Seventy-eight centers responded by starting to fill out surveys, and a total of 54 centers completed the survey. That information was used to showcase them on a STEM Education Centers website at http://serc.carleton.edu/StemEdCenters/profiles.html.

Also as part of the survey, we asked if center directors would be interested in attending a 1.5-day workshop on September 15-16 in St. Louis. Again, the response was overwhelming, with more than 45 centers wanting to attend this exploratory workshop. (We originally planned for 20-25.)

Box 1: STEM Education Center Profile Survey

Responding to this survey should take approximately 1 hour, and we predict that most of the requested information can be derived from existing materials. There is no save button for this form. However, you can submit your answers at any point, even if they are incomplete and they will be turned into a webpage that you will be able to edit and add to later on. The webpage will not be made public without permission.

Responding to this survey will result in a direct, near-term benefit to your center: the information you provide will be used to create a public profile page for your center and to inform the development of a taxonomy of STEM centers. So far, center directors have commented that filling out this survey has been a useful exercise that supplements their existing documentation.

We appreciate your participation, and look forward to exploring with you the creation of networked community of STEM Education Centers with you.

Public Information: Information gathered in this section will be included in your Center's public profile page.

1. Center/Program Director Name
2. Center/Program Director Email
3. Name of person responding to survey (if different than above).
4. Email of person responding to survey (if different than above)
5. Center/Program Name
6. Center URL (please include the http://)
7. Institution
8. Department or Administrative Unit (if applicable)
9. Year the Center/Program was established
10. Vision or Goals Statement for the Center/Program
11. Please provide a one sentence summary of your Center and its vision or primary mission.
12. Briefly (1-2 paragraphs) describe your Center's structure and size. For example, is it an independent unit or is it a unit within another center? Is internal and/or external collaboration expected? Is it run by faculty or administrators? What is the size of the staff in FTE? What kinds of faculty, staff, and research positions exist?

13. Describe your programming in 1-2 paragraphs, emphasizing your most successful or wide reaching programs. Please include information on the audience you work with directly and the size of that audience (faculty, STEM faculty, a particular curricular initiative, students, K-12 teachers etc.).

14. Describe in a paragraph your biggest success(es) including information on the nature of the impact, the scope of the impact (who, how many were impacted). Please provide some information on how the impact was documented.

15. What structural or programmatic elements have contributed to your center's success? (e.g., location on campus or within program, administrative support in form of W, campus culture that values X, funding for Y, long history with time to establish Z).

Private Information

1. The responses to these questions will not be made part of your Center's public profile. They will only be used internally as we work towards creating a national STEM Education Center network.

2. What are the biggest challenges to the success of your programming?

3. What are the Center/Program's primary sources of funding (institutional funds, federal and/or private grants or contracts, user fees)?

Appendix B

Preliminary Classification Scheme for STEM Education Centers

The planning committee drafted a common classification scheme to describe centers based on the survey questions outlined in Appendix A.

Sec. 1: Institution/Center Identification

- Institution
- Center/Program Name
- Center URL
- Center/Program Director Name
- Center/Program Director Email

Sec.2: Institutional Characteristics*

- Carnegie Classification 2010: Basic
- Sector of institution
- Historically Black College or University
- Institution size
- Percent admitted - total
- Grand total STEM degrees
- Percent of total enrollment that are American Indian or Alaska Native
- Percent of total enrollment that are Black or African American
- Percent of total enrollment that are Hispanic/Latino
- Percent of total enrollment that are Asian/Native Hawaiian/Pacific Islander
- Percent of total enrollment that are Asian
- Percent of total enrollment that are White
- Total enrollment
- Geographic region
- Degree of urbanization (Urban-centric locale)

Sec. 3: Center Structure

- Department or Administrative Unit (if applicable)
- Year the Center/Program was established
- Center's structure and size
- Is it an independent unit or is it a unit within another center?
- Is internal and/or external collaboration expected?
- Is it run by faculty or administrators?
- What is the size of the staff in FTE?
- What kinds of faculty, staff, and research positions exist?

Sec. 4: Audiences Addressed

- Undergrad (transformation)
- K-12 partnerships/prep
- Outreach
- Faculty development
- Research
- Other

Sec. 5: Vision or Goals of Center

- Course Transformation
- Student support for undergraduate and graduate students (Direct student services; Recruitment, retention; Diversity, Access)
- Faculty/Teacher support (Recruitment/ housing; Professional development)
- Program support
- Network establishment (internal/ external to campus)
- Program evaluation
- Research on teaching and learning
- Communication (internal/external)
- Policy (internal/external) (local/state/ national)
- Coordination of STEM-related NSF and other grants

- Specific curricular initiatives (K-12, undergraduate, educational technology)

Sec. 6: Center Mechanisms/Approaches to Support Goals

- Scholarly programs: (Seminar series; Graduate/undergraduate tracks in STEM education; Professional development workshops of students, staff, faculty)
- Incentives: (Fellowships/awards; Funding; Promotion/tenure; Public showcasing)
- Resources/services: (Funding/people for programmatic work; Evaluation of course, programs etc.; Advising/PD; Staff support; Data management/showcasing; Publicity, communication)
- Identity, space, language around STEM education: (Newsletters; Annual events)
- Networking: (Among existing people and programs doing work; Among levels of system (individual, department, campus administration); Between system and extramural stakeholders)

Sec. 7: Center Successes and Metrics

- Successful outcomes:
- Tied to Goals/Vision (Section 4)
- Audiences (Section 5)
- Mechanisms (Section 6)
- What metrics were used

Sec. 8: Challenges

- Private answers for challenges, e.g.,

Funding, Aligning Missions, Structure, Culture

Sec. 9: Funding

- Private answers for funding

* U.S. Department of Education. Institute of Education Sciences, National Center for Education Statistics (2013). IPEDS Institutional Characteristics Survey. Retrieved from http://nces.ed.gov/ipeds/datacenter/InstitutionByName.aspx.

Appendix C
Workshop Agenda

Towards a National Network of University-based STEM Education Centers

September 15-16, 2013 | Drury Hotel at the Arch, St. Louis, MO

Sunday, September 15

4:00 - 6:00 pm	Check in and registration in the hotel lobby
5:00 pm	Reception and Icebreaker at Carmine's Restaurant
6 :00- 8:00 pm	Dinner at Carmine's Restaurant
	Workshop Goals and Objectives - Noah Finkelstein and Cathryn Manduca, STEM Education Center Project Co-chairs
	Dinner Address - Linda Slakey, Former Director of NSF's Division on Undergraduate Education; Senior Advisor to AAU's Undergraduate STEM Education Initiative

Monday, September 16

8:15 am	Setting the stage: Review of the day's plans and the web-based content management system. Noah Finkelstein and Cathy Manduca
8:30 - 10:00 am	*Session A:* Summary of Surveys/Profiles of STEM Education Centers
	Plenary session with summary presentation by Noah Finkelstein about survey data and profiles and introduction of the idea of a classification scheme for STEM Education Centers, followed by small group discussions and Q&A.
	Part A -- 30 minutes
	Purpose: To create common ground among workshop participants about STEM Education Centers.
	Part B -- 60 minutes
	Purpose: Small group discussions followed by Q&A to reach agreement/ consensus as to whether or not a detailed classification scheme of STEM Education Centers would be needed, useful, or possible.
10:30-11:45 am	*Session B:* Striking Innovations and Approaches to Working Within Institutions
	Purpose: While recognizing that all institutions face challenges in today's economic climate, this session aims to identify novel ideas and approaches to meeting STEM Education Centers' stated missions. The goal is to have a set of examples of innovations in STEM Education Centers that align with various missions and audiences.
	Groups self assigned (approx. 10 persons per group) based on their interest in the innovations/approaches identified in the Center profiles:

	Group A: Programming, e.g., scholarly programs, seminar series, graduate/undergraduate tracks in STEM education, professional development workshops of students, staff, and/or faculty. *Group B:* Incentives , e.g., fellowships/awards; funding; promotion/tenure, public showcasing of projects/programs/center. *Group C:* Resources/services, e.g., funding/people for programmatic work; evaluation of course/programs, etc.; advising/PD: staff support; data management/showcasing/publicity, and communications. *Group D:* Identity/space, creating and disseminating language and information about STEM education, e.g., newsletters, websites, blogs, annual events. *Group E:* Networking among existing people and programs doing work; among levels of system (individual, department, campus administration); and between system and extramural stakeholders. Three-minute group reports in plenary session
11:45 - 12:45 pm	Lunch
12:45 - 1:45 pm	*Session C:* Addressing the Challenges of Building Sustained Institutional Support for STEM Education Centers Purpose: Survey results identify challenges and concerns that STEM Education Centers face to reach greater understanding of strategies used to build and sustain institutional support for STEM Education Centers. Groups self-selected based on challenges of interest to them and capacity to address those challenges. Group A -- Funding; Group B -- Aligning Missions; Group C -- Structure; Group D -- Culture; Group E -- Miscellaneous
1:45 - 2:00 pm	Three-minute group reports in plenary session
2:15 - 4:15 pm	*Session D:* Moving forward: Creating a National Network of STEM Education Centers? Purpose: If the consensus view is that STEM Education Centers do add value both on campuses and as a network, we will discuss what needs to be done and by whom. For example, is there a role for national organizations like APLU, and if so, what should it be? The goal is to reach consensus as to whether or not to proceed with follow-on projects and preliminary plans and commitments to achieve them.
2:15 - 2:30 pm	Brainstorm in plenary group to identify up to five big ideas
2:30 - 3:30 pm	Break out into five groups, each focusing on one detailed idea
3:30 pm	Five-minute reports from Group Discussions in Session D Purpose: Five-minute summaries from each group in Session D to ensure that all ideas are shared with the full group.
4:15 pm	Closing Remarks by Noah Finkelstein and Cathryn Manduca
4:30 pm	Adjourn

Appendix D
Workshop Participant Directory

Paul Adams
Fort Hays State University

Mary Besterfield-Sacre
University of Pittsburgh

Wilella Burgess
Purdue University

Steven Case
University of Kansas

Angelo Collins
East Carolina University

Ana Corbacho
University of California, Davis

Dabney Dixon
Georgia State University

Bonnie Dunbar
University of Houston

Arthur Eisenkraft
University of Massachusetts Boston

Noah Finkelstein
University of Colorado Boulder

Scott Franklin
Rochester Institute of Technology

Regina Frey
Washington University in St. Louis

Laura Frost
Florida Gulf Coast University

Emily Gaines
University of Utah

Ed Geary
Western Washington University

Howard Gobstein
APLU

Katherine Hazelrigg
APLU

Lynne Hehr
University of Arkansas

Charles Henderson
Western Michigan University

Eric Hsu
San Francisco State University

Carla Johnson
Purdue University

Paul Kennedy
Colorado State University

Karen Kinsman
University of New Mexico

Susan Kirkland Newsom
University of Tennessee, Knoxville

Laird Kramer
Florida International University

Jacqueline Leonard
University of Wyoming

Jim Lewis
University of Nebraska-Lincoln

Susan Magliaro
Virginia Tech University

Cathy Manduca
Carleton College

Gili Marbach-Ad
University of Maryland College Park

W. Gary Martin
Auburn University

Robert Mathieu
University of Wisconsin

John McDaris
Carleton College

Bob Midden
Bowling Green State University

Michael Odell
University of Texas at Tyler

Mark Pauley
University of Nebraska Omaha

Tershia Pinder-Grover
University of Michigan

Amy Pratt
Northwestern University

Patricia Pyke
Boise State University

Bryan Rebar
University of Oregon

Kacy Redd
APLU

Julie Reinhart
Saint Xavier University

Susan Renoe
University of Missouri

Donna Gerardi Riordan
DGR Strategies

Julie Risien
Oregon State University

Gillian Roehrig
University of Minnesota

David Slykhuis
James Madison University

Jacqueline Spears
Kansas State University

Marion Usselman
Georgia Institute of Technology

Ann Marie VanDerZanden
Iowa State University

Gabriela Weaver
Purdue University

About the Author:

Donna Gerardi Riordan is the founder of DGR Strategies, a consultancy focused on the teaching and learning of science and mathematics.

For inquiries about this work, please contact Kacy Redd, kredd@aplu.org.

Acknowledgments:

STEM Education Center Planning Team

Planning Committee Co-Chairs
Noah Finkelstein, PhD, Director, Center for STEM Learning, University of Colorado Boulder
Cathryn A. Manduca, PhD, Director, Science Education Resource Center, Carleton College
Planning Committee
Steven Case, PhD, Director, Center for STEM Learning, University of Kansas
Laird Kramer, PhD, Director, STEM Transformational Institute, Florida International University
Robert Mathieu, PhD, Director, CIRTL Network, University of Wisconsin - Madison
Nalini Nadkarni, PhD, Director, Center for Science and Mathematics Education, University of Utah
Ann Marie VanDerZanden, PhD, Director, Center for Excellence in Learning and Teaching, Iowa State University
Project Director
Donna Gerardi Riordan, DGR Strategies
APLU Staff
Howard Gobstein, Executive Vice President
Katherine Hazelrigg, Program Assistant and Communications Coordinator
Kacy Redd, PhD, Director, Science and Mathematics Education Policy
Carleton College, Science Education Resource Center (SERC)
Molly Kent, Geoscience Education and Evaluation Associate
John McDaris, Geoscience Education Associate
Other assistance
Emily Gaines-Crockett, Informal Science Education Program Manager, Center for Science and Mathematics Education, University of Utah

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This project is a component of APLU's Science and Mathematics Teacher Imperative, a consortium of 132 of APLU's public research universities, and 13 university systems that is working to transform middle and high school science, technology, engineering, and mathematics (STEM) education by preparing a new generation of world-class science and mathematics teachers. Collectively, SMTI members prepare more than 8,000 science and mathematics teachers annually – making it the largest STEM new teacher initiative in the country. For more information about SMTI, visit **http://www.APLU.org/SMTI**, or contact Kacy Redd, director, science and mathematics education policy, kredd@aplu.org.

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1307 New York Avenue, N.W. | Suite 400
Washington, D.C. 20005-4722
www.aplu.org