# Collaboration as a means to building capacity: Results and Future Directions of the National Girls Collaborative Project

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Paper presented at American Educational Researchers Association (AERA)
13 – 17 April, 2009, San Diego CA.

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## Abstract

The purpose of the National Girls Collaborative Project is to extend the capacity, impact, and sustainability of existing and evolving girl-serving STEM projects and programs. This paper describes the underpinnings and design of the National Girls Collaborative project and posits that the structured collaboration framework this organization foments may be a necessary component for our field to move beyond our current levels of representation of women in STEM. Initial results from the projects are described and related to nation-wide efforts to increase women in STEM.

## Introduction / problem statement

It is commonly recognized that the representation of women in STEM (Science Technology Engineering Mathematics) fields is too low both from a perspective of equal opportunity (Gowan & Waller, 2002; Sadker & Sadker, 1994) and for meeting the projected need of STEM professionals (Chubin, May & Babco, 2005). Studies show that the low representation of women in STEM professions begins as early as eighth grade when twice as many boys than girls show an interest in STEM careers (Commission on the Advancement of Women and Minorities in Science, Engineering, and Technology Development, 2005) and continues in college, where women received only 21% of Bachelor's degrees awarded in engineering, 27% in computer sciences, and 43% in physical sciences (National Science Board, 2006). Factors such as perceptions of careers, confidence, role models, and career advice have been noted in the literature as contributing to the lack of females in Information Technology (Bartol & Aspray, 2006). Women constitute 45% of the workforce in the U.S., but hold 25% of science and engineering jobs and 29% of computer and mathematical occupations (US Census, 2000).

Many organizations and activities are designed with the sole purpose of addressing this problem. However in spite of this investment the nation has not experienced significant gains in the representation of women in several key STEM fields, e.g., computer science, engineering, and physics. This is particularly true in engineering where, overall, women represent about 20% of undergraduate engineering students; in computer science women's representation has actually decreased (National Science Board; 2000; NCWIT, 2007) see NCWIT for numbers and citation). Many factors may contribute to the apparent inability of our many efforts to increase the representation of women in these fields to reach the "tipping point" where women's representation will be equivalent to their numbers in the overall population. Collaboration, as an interactive process, enables professionals across projects and communities to generate and carry out creative solutions and strategies that maximize benefit beyond that which entity could accomplish. The NGCP model includes a number of strategic activities that provide value and

incentives to encourage organizations and individuals to work together and to use the leverage of a network of individual girl-serving STEM programs to help create gender equity in STEM.

How can collaboration help? Increasing collaboration between girl-serving organizations has the potential to reduce duplication of effort and organizational isolation, increase efficiencies through sharing of resources (e.g. physical spaces, marketing materials), and promote sustainability of recruitment and retention efforts. The National Science Foundation (NSF) has recognized the need for collaboration and recently funded several efforts to address this need (NSF GSE Recent Awards, 2007).The National Girls Collaborative Project (NGCP, ngcproject.org) is one such effort.

The purpose of the NGCP is to extend the capacity, impact, and sustainability of existing and evolving girl-serving STEM projects and programs. The NGCP is structured to bring organizations together to compare needs and resources, share information and plan strategically to expand STEM–related opportunities for girls. This paper first examines the key elements of collaboration that provide the basis for NGCP, then describes how the NGCP model works, results to date and how the lessons learned from NGCP can be applied to women in STEM organizations nationwide.

## Background Literature

Since 1994, the National Science Foundation (NSF) and the American Association of University Women (AAUW) have invested nearly $90 million to fund projects aimed at increasing gender equity in STEM fields (AAUW, 2004). These are but two of many organizations that continue to invest in this effort, however, as we have previously argued, our efforts seemed to have stalled in their impact on the representation of women in STEM. We argue that this may in part be due to the isolation of STEM-focused girl– serving organizations. This isolation and lack of collaboration can lead to several problems including the following.

- Too few resources distributed over too many programs; including the possibility that organizations may actually be inadvertently "competing" for the same girls when they receive solicitations for multiple activities that have not been coordinated.
- Duplication of efforts – an indication of an overall lack of coordination
- Overtaxing of the same or limited group of corporate donors being solicited for resources by individual organizations when coordinated requests could be more effective.
- Increased motivation and sustainability problems – isolation of individual girl-serving organizations can lead to burn out, lack of new ideas and the furthering of ineffective practices.
- Lack of capacity –building in STEM-focused girl serving organizations; low resourced organizations must spend the bulk of time and other resources implementing individual activities leaving little time for improving activities (evaluation and assessment), girl follow-up or activities designed to create sustainable organizations (e.g. staff development).

The costs of these problems are exacerbated because many girl-serving organizations are not well-resourced to begin with – limited staff, limited budget, limited time, limited expertise. Although organizations such as the National Science Foundation (NSF) and American Association of University Women (AAUW) followed a necessary path of funding STEM-focused girl serving organizations over the past decade, the funding of so many *individual* activities may have – in some ways – contributed to the current situation.

A recent report also points to the issues that isolated funding and girl-serving efforts can produce. AAUW's Under the Microscope researched the STEM-focused girl serving projects funded by AAUW and NSF and concludes that there have been an impressive collection of gender equity projects, however they are discrete in nature and the gender equity movement would benefit from more strategic approaches to addressing gender equity in STEM fields (AAUW, 2004).

Funding organizations are recognizing the need to focus their investments more systemically and their current RFPs (requests for proposals) reflect this need. For instance, NSF's Program for Research on Gender in Science and Engineering (GSE) is not currently funding girl serving activities but rather focusing on funding high quality research of STEM activity implementations as well as on-ongoing funding of dissemination projects.

While definitions vary, collaboration can be defined as an interactive process intended to enable professionals across projects and communities that share goals to generate and carry out creative solutions and strategies that maximize benefit beyond that which one project or community could accomplish. Collaborative models include a number of strategic activities – potentially including jointly developed structures and shared resources -- that provide value and incentives to help organizations and individuals to maximize benefits beyond that which one project or community could accomplish (Mattessich, Murray-Close & Monsey, 2001; NGCP, 2007).

Collaboration has the potential to provide for easier and coherent access to services, resources and the possibility of greater and longer lasting impact on targeted systems; Loan-Clarke & Preston (2002, as cited in Caniglia, nd) describe several other diverse benefits of collaboration.

- *Collaboration can ensure more effective use of individual talents* and resources. In general, collaboration offers the possibility of multiple entities coming together to work towards a common goal. It is often the case that no single organization possesses all the knowledge, skills, and techniques required to most effectively accomplish that common goal. The current representation of girls engaged in STEM activities may be an indicator that such a talent and / or resource deficit exists in individual STEM-focused girl serving organizations. While it is possible that an organization might be able to learn or acquire all the techniques and resources needed to solve a particular problem, it seems both unlikely and also very costly in terms of time and other resources. In contrast, when organizations collaborate, it is more likely that when they combine their resources and skills they will possess what is needed to effectively address the problem.

- *Collaboration may be a source of stimulation and creativity*. When individuals and organizations with similar goals work together, there are natural opportunities for the discussion of ideas and for these ideas to cross-fertilize and be adapted for improvement, or for the spin-off of new ideas that grow from the old. Individual organizations may or may not be staffed sufficiently to promote this sort of creativity – yet combining multiple organizations may help to achieve this outcome.
- *Collaboration extends the individual organization's networks.* An implicit outcome of the above is that by connecting previously unconnected organizations, all organizations have a broader network from which to draw upon for future needs. An individual organization may have contacts with 10 other like-minded who can be contacted for information or advice. By collaborating with others, the network can be extended and further productivity enabled.
- *Collaboration enhances dissemination of results*. With this extended network, the opportunities for disseminating results are increased. In the area of girls in STEM this is particularly important as the need to know both what activities are currently available, and what is working is necessary if we are to further increase the representation of girls in STEM fields.
- *Collaboration can build organizational empowerment* (Wolff, 2001). A last, but very important potential benefit of collaboration is the possibility for individuals to be more empowered, or more confident overall due to their increased connectivity with like-minded organizations. This sense of empowerment can improve the organization's ability to respond to new challenges, and to new opportunities. (Wolff, 2001).

Many coalitions and collaborative projects have accomplished these types of outcomes when addressing complex societal issues (Jackson & Clark, 1996). Research suggests that coalition building assists in carrying out the educational plan: broadening the development of new audiences, reporting the results of member activities through media, and improving the educator's capacity for providing information to citizens, interest groups, and policy-makers.

Mattessich, Murray-Close, & Monsey (2001) conducted a review of research on collaboration in order to identify factors commonly identified as being critical to the success of collaborative ventures. They grouped their findings into six categories and then subdivided each category further. Figure 1 shows the six categories and a sampling of the sub-categories most often cited in their literature review.

Insert Figure 1 approximately here.

Borden and Perkins' (1999) summary of common factors and characteristics influencing the collaborative process provides a similar set to those identified by Mattessich, et al's work (2001). For instance, Borden and Perkins cite work from the National Network for Collaboration (Hogue, Parkins, Clark, Bergstrum, and Slinski, 1995) that identified factors such as leadership, communication, community development, and sustainability, and a study by author Borden (1997) that identified four factors: internal communication, external communication, membership, and goal setting.

Jackson and Clark (1996) conducted a study of 58 agricultural extension sites to examine the relationship between selected situational factors and structural characteristics of collaborative organizations and perceived effectiveness of collaborations. Structural characteristics were aspects of the collaborative organizations that seemed to capture their "structural essence" (p. 2) such as resource flows, communication frequency and communication quality. The situational factors used were the size of the collaborative organization, the type of organizations involved in the collaboration, the amount of resource dependency that existed between collaborative partners, the degree of consensus among collaborative partners. The researchers found that the degree of consensus amongst collaborative partners followed by the formalization of agreements between partners and the flow of resources between partners were the best predictors of the perceived effectiveness of the collaboration.

## NGCP – Collaboration in Action

The NGCP exemplifies the essential elements of collaboration and brings together organizations throughout the United States that are committed to informing and encouraging girls to pursue careers in science, technology, engineering, and mathematics (STEM). The project focuses on three main goals:

- Maximize access to shared resources within projects and with public and private sector organizations and institutions interested in expanding girls' participation in STEM.
- Strengthen capacity of existing and evolving projects by sharing promising practice research and program models, outcomes and products.
- Use the leverage of a network or collaboration of individual STEM-focused girl serving programs to create the tipping point for gender equity in STEM.

### Project Origins

In 2002, the Puget Sound Center for Teaching, Learning and Technology (PSCTLT) implemented the Northwest Girls Collaborative Project (NWGCP) in Washington and Oregon. This "regional collaborative" organization was designed to promote institutional and resource collaboration to help girl-serving STEM-focused girl serving organizations more effectively address the complex issue of gender equity in STEM fields. As our results section below describes, the NWGCP was successful in its geographic area and resulted in a model of collaboration that could be applied more broadly.

In 2004, NSF funded the National Girls Collaborative Project (NGCP). The purpose of the NGCP was to increase the capacity, impact, and sustainability of existing and evolving girl-serving STEM projects and programs by replication of the Northwest Girls Collaborative Project Model in three states: California, Massachusetts, and Wisconsin. Recently, the National Science Foundation funded a process for extending and focusing of the NGCP model across the United

States and Puerto Rico. Implementation of the growing NGCP involves the creating of regional collaboratives across the U.S. that will assist existing and evolving girl-serving STEM projects to take advantage of shared idea and resources. Using the American Association of University Women (AAUW) regional framework to organize oversight and support, this project implements and disseminates the strategies from the successful collaboration structure previously developed via the NWGCP and NGCP. The expanded National Girls Collaborative Project utilizes the leadership and expertise of additional partners, Assessing Women and Men in Engineering (www.Aweonline.org), and the Educational Development Center (EDC), to disseminate research-based promising practices to further advance the work of existing and evolving girl-serving projects and also to provide a forum to share results among practitioners and researchers.

## Key Elements of the model:

The NGCP model – as illustrated in Figure 2 -- includes a number of key players / organizations and design elements that exemplify collaboration and strive to reduce the previously stated problems associated with many relatively isolated organizations working to achieve the same goal. The key players operate as follows to achieve the project goals.

- National leadership team: Senior project team members with experience from previous replications of the model who can insure model fidelity.
- National champions board: Key individuals from higher education, national K-12 organizations, corporations, and professional organizations to advise and support the project throughout their various networks.
- AAUW regional liaisons: Local AAUW members charged with supporting and promoting local regional collaborative organizations.
- Collaborative leadership teams: Individuals from the two or three lead regional organizations managing local activities.

- Collaborative champions boards: Key individuals from local companies, professional organization chapters, higher education, and local K-12 organizations to support and advise the regional implementation of the project.
- Participants (girl-serving organizations, education, business, professional organizations – e.g. SWE): Local girl-serving STEM organizations motivated to collaborate to extend and enhance programming.

<insert Figure 2 about here>

The model implements the following design elements that bring the players together into a collaborative network.

1. Implementation of Collaborative Model: The National Leadership works to create the individual "regional collaboratives" by identifying organizations that demonstrate "collaboration readiness". These organizations must have a history of local collaboration and be able to integrate participation in NGCP into existing organization activities and utilize existing organization staff. Typically, these organizations are seeking a leadership role in their communities and welcome the resources and tools the NGCP provides to further this goal. Once identified, the national leadership provide training and mentoring of these regional collaborative participants in how to create STEM-related collaborations and assist these collaborative networks in creating action plans which utilize research-based promising practices in the areas of informal learning and evaluation and assessment. AAUW regional liaisons provide support to regional collaboratives through a connection to AAUW and other regional efforts to improve opportunities for girls in STEM. Currently the project has thirteen regional collaboratives operating and will continue to expand to cover all states in the U.S. by 2011.
2. Dissemination and Outreach: In partnership with regional and professional organizations, the NGCP leadership team works to document and promote coordination and collaboration among girl-serving STEM programs throughout the United States and Puerto Rico by implementing an on-going communication system linking these

organizations. There are several tools used to promote this communication including webinars, and the NGCP newsletter. However a key tool for this activity is the NGCP Program Directory. The Program Directory lists organizations and programs that focus on motivating girls to pursue careers in science, technology, engineering and mathematics (STEM) and is designed to help organizations and individuals network, share resources, and collaborate on STEM-related projects for girls.

3. Collaboration Support: Regional collaboratives offer mini-grants of $1000 or less to girl-serving STEM-focused programs as an incentive to collaborate and to assist in informal STEM-focused learning projects as well as assessment and evaluation activities.
4. Research Evaluation: Conduct evaluation of the NGCP to determine effectiveness of collaboration and the impact of collaboration and implementation of STEM research-based promising practices at national, regional, and local levels.

The combination of these key players and design elements produces a model that addresses the need to reduce isolation and increase collaboration by bringing people together in person and online, providing professional development and incentives (mini-grants) for collaboration, providing and creating an online 'community' for those doing this work, and connecting girl-serving organizations with each other, education and business to have a greater impact on services and possibly policy ('a bigger voice'). We also note that the NGCP model is in alignment with the factors that influence collaboration identified by Mattessich et al. (2001). Figure 3 shows how the NGCP model aligns with these factors.

Insert Figure 3 approximately here

## *Results, Lessons Learned and Implications*

The NGCP extension project has completed year two of five at this writing; however evidence of the effectiveness of the collaborative model can be garnered from the pre-cursors of the NGCP (e.g. NWGCP, and the previous NGCP Regional Collaboratives), These results are germane to the current extension project (and provide evidence of our current projects' potential impact) as these prior collaborative instantiations had the same essential objectives as the

current project – that is they were designed to increase collaboration among STEM-focus girl serving organizations in order to make these organizations more effective in their mission to increase the numbers of girls preparing themselves and the pursuing STEM careers. Lastly, we also present initial results from years one and two of the NGCP extension services project. The reader will note that even though our broader goals are concerned with increasing the representation of girls in STEM, all of the NGCP projects are focused on collaboration-building among organizations that either directly serve or provide resources to these girl-serving organizations. Thus all results are discussed in terms of collaboration capacity-building.

Metrics from the combined projects also provide evidence of the models ability and accomplishments in reaching a significant number of not only girl-serving STEM organizations but also their potential and actual collaborative partners. Table 1 summarizes these metrics.

Insert Table 1 approximately here.

*Mini-Grant Collaboration Results*

We are currently systematically gathering outcomes results data for all new mini-grantees for the NGCP extension services grant, however results from mini-grants funded in the earlier instantiations of NGCP – namely the Northwest Girls Collaborative project (NWGCP), and the South Central Girls Collaborative project (SCGCP) provide evidence of their impact on collaboration. The NWGCP awarded 25 mini-grants of a maximum of $1000 each to organizations that collaborated on a project serving girls in STEM. The mini-grant projects varied in size and scope, including a summer Lego Robotics camp for underserved girls, an inquiry-based science class for underachieving high school girls, a trip for rural girls to visit Boeing and the Museum of Flight, and an after-school program for middle school girls focused on marine science.

Ten mini-grant recipients completed a pre-report and thirteen recipients completed the post-report. The pre-survey was completed before projects began and asked mini-grantees about their collaborations and project goals. The post-survey asked mini-grantees about the projects, their experiences with the collaborations and the projects, and project outcomes. Our results

summary here focuses on the mini-grant recipients' reports of impact on collaboration.

- Many mini-grantees started a *new* collaboration because of their funding from NWGCP. For those who did not previously know each other, the NWGCP provided the opportunity to meet each other and guidance to develop a mini-grant application and project.
- As evidenced by the following quotation, for collaborators who already knew each other, the NWGCP mini-grant provided the momentum to develop a specific project together.

> "The NWGCP got me moving forward on the project and collaborating with others. Without the grant my project wouldn't have gone past the idea stage and I wouldn't have thought about collaborating."

- Mini-grants exemplified the benefit of shared collaborative resources. Grantees reported consistently that they were able to provide more and/or higher quality programming or services as a result of the collaboration. Many mentioned the benefits of two organizations with different skills and resources working together.
- The sustainability of the collaborations varied. Nine mini-grantees reported that their collaborations will continue, and five of these stated that the collaboration would be expanding. For example, one program developed a working relationship with a female engineer at Boeing that will continue in the future. Three recipients were hopeful that their collaboration would continue, but were not sure and one recipient stated that the collaboration would not really continue, but the relationship would.
- The mini-grantees recognized the value of the collaborations. Mini-grantees expressed that the mini-grant really motivated them to collaborate in a new way or with a new organization. The mini-grants also motivated organizations to put into action an idea that they had not acted on previously. Mini-grantees also stated that the grants provided support (both financial and other) to carry out the project. An additional benefit for some organizations was that the mini-grantees motivated and

allowed them to leverage resources for a larger project.

A recent report from the South Central Girls Collaborative project (SCGCP) – an NSF funded regional replication of the NGCP – also provides support for the effectiveness of mini-grants in supporting and growing collaboration. Although the SCGCP mini-grantees reported some challenges due to the distance between collaborative partners, almost all of the mini-grant participants that reported evaluation data indicated that the collaboration between the mini-grant partners would continue, in some form -- whether it was with the same mini-grant project, or starting something new.

Ten mini-grant projects from the current NGCP, reaching a total of 282 girls, have completed all of their activities and submitted a final report. Projects rated the success of their collaborations very highly—all indicated the highest level on a 5-point scale (from 1=Poor to 5=Excellent). Ratings of the projects' success were also high, with a mean of 4.6 on the same 5-point scale.

Six respondents indicated that work with their partner(s) had extended to other projects beyond the mini-grant project. Nine out of ten indicated they would continue to collaborate to offer the project started with a mini-grant. Comments from the final reports indicated that the funding was sufficient to enable a project and provide motivation to work with another program, *"The mini-grant we received enabled us to do a project we wouldn't have been able to do without some financial support. It also gave us the opportunity to collaborate with a group we had been wanted to collaborate with."*

*Organizational Collaboration*

NGCP gathered data from the early NGCP instantiations on the effectiveness of the project in promoting collaboration through the use of a "collaboration rubric". Figure 4 shows an excerpt from this rubric (Borden & Perkins, 1998, 1999; Frey, 2004; Hogue, 1993). Respondents from each of the regional collaboratives were asked to rate the extent of their collaboration with

the STEM organizations listed. The five Levels of collaboration are 1) Networking, 2) Cooperation, 3) Coordination, 4) Coalition, and 5) Collaboration. At the low end “networking” means there is an awareness of another organization but no defined roles or established communication and – at the high end - “collaboration” indicates the members of each organization operate as if belonging to one system, there is frequent communication and consensus is reached on all decisions.

Insert Figure 4 approximately here.

To measure NGCP’s impact on collaborative relationships, representatives from individual STEM-focused girl serving organizations, corporations, professional organizations in each regional collaborative completed the rubric at the beginning and again at the end of the project. The national leadership team collected these results for three of the four collaborative regions. Results showed an increase in collaboration with all organization types. Increases were significant in two categories: collaboration with STEM professionals and with higher education STEM programs.

The Wisconsin organizations showed the most positive changes in collaboration as measured by this rubric. Overall pre /post data indicating the degree to which the reporting organization collaborated with a certain type of group indicated an average of Pre: (N=32) 1.72 and Post (N=17) 2.58. A t-test showed this difference to be significant at the .05 level. In addition to Wisconsin, the mean level of collaboration across all individual organizations surveyed increased significantly ($p < .01$) from 1.84 to 2.81.The California organizations’ collaborative data also showed positive change in level of collaboration with each type of organization as well as an increased overall mean level of collaboration of each organization, however no changes were significant at the $p<.05$ data.

Pre and post project collaboration rubric data from the SCGCP also provide some support the effectiveness of the model. Results showed a slight increase in the mean amount of collaboration between respondents and other organizations from the beginning of the project to the end. The level of collaboration increased in 6 out of 11 organization types, however none of

the changes were statistically significant. Results also showed that the highest levels of collaboration were with K-12 teachers, corporate partners, and professional organizations. Lowest levels of collaboration were with higher education STEM programs and academic counselors.

*NGCP Extension Services Evaluation – Early Results and Plans*

Specific data on project outcomes is being gathered via the NGCP extension services grant evaluationors to examine project implementation at regional and national levels in order to understand the impact of the project and guide project improvement efforts. Even as we begin year three, we are working to answer the following evaluation questions regarding the effectiveness of the collaboration: how much (and how) does the NGCP model impact collaboration between STEM programs and/or other organizations? And, how are the STEM-focused girl serving programs affected by access to shared resources of the NGCP? (E.g. are their programs more effective?)

The NGCP national team works with the regional Collaborative Leaders to simultaneously build-capacity to conduct the assessment and evaluation activities necessary to answer these questions and to pass these skills and tools on to the STEM-focused girl serving organizations in each collaborative. Standardized evaluation and assessment tools are providing the basis for both valid and reliable data and include the collaboration rubric, the tested and validated AWE surveys for assessing the impact of mini-grant activities, formative evaluation tools for all collaborative events, online database for collecting participant data, and in-depth evaluation forms for each mini-grant activity. Additionally, as the project progresses, we will be able to do longitudinal tracking of impact of participation in NGCP of the STEM-focused girl serving organizations. We expect the latter data source to yield valuable information on NGCP's impact on recruitment and retention of girls in STEM.

The following preliminary results regarding collaboration for the regional collaborative organizations and their impact on STEM-focused girl serving organizations show some early signs of effectiveness and are also being used to inform project revisions.

- An important part of collaboration building is providing appropriate resources (Mattessich, et al., 2001). Regional collaborative leadership report that they frequently use the resources provided by the NGCP leadership team. The NGCP website is most commonly used tool; print materials (brochures, etc.) were also frequently used along with the guide documenting the collaboration implementation model.
- Data from the regional collaborative leadership teams indicates that each region is making varying progress towards required outcomes for fully participating as a collaborative. As of January 2009, all regional collaboratives have hosted a kick-off conference and a champions' board meeting (which is to occur before the project kick off). # regional collaboratives have administered mini-grants and three regional collaboratives have hosted forum events. The data indicate overall that all collaboratives are making progress on their required activities but at different rates.

Our most extensive results to date for the extension services grant are from our continuing use of the collaboration rubric survey (see Figure 4) for assessing the degree of collaboration in the NGCP Extension services grant. Baseline data collected in 2008 indicated that the level of collaboration of the Extension services collaboratives with various types of STEM-related programs and organizations varied between the regional collaboratives. Overall, the mean level of collaboration was 1.80 on a six-point scale where 0=No Interaction and 5=Collaboration . The highest mean levels of collaboration were with higher education STEM faculty (2.24) and non-profit organizations (2.22). Respondents were most likely to have no interactions with higher education academic counselors (56%). Future administrations of the annual survey will provide comparison data to help measure the impact of the NGCP on participating programs and users listed in the Program Directory over time. We are also con

Twenty-three percent of annual survey respondents indicated that participating in the NGCP had a moderate or high impact on their level of collaboration with other programs. They specified that they are more aware of other programs, share their resources more, feel that the

project was a catalyst for developing a project with another organization, and increased their opportunities to interact with other programs. Other respondents stated they had not been involved in the project long enough for it to have an impact on their collaboration, or that they lived in a region that was not served by a regional collaborative site at the time of the survey administration.

When asked whether they believed the NGCP had the potential to create the tipping point for gender equity in STEM, a large majority of annual survey respondents indicated yes. One stated, *"Yes, NGCP has the potential to create awareness for the need for increased gender equity and to increase knowledge of efforts already in place. Existing organizations will be better acquainted with each other; networks will be developed that can have long-term benefits."* Many believed it would be a gradual change, and that progress was already being made, especially with the benefit of other similar projects to increase girls' participation in STEM. Others commented that it was too early to predict and they were interested to see how the NGCP would continue to grow to create such a movement. The mix of these results for levels of collaboration argues for the need for collecting further data – perhaps interview data – to ascertain how the implementation of each collaborative varies and how those differences are related to the collaboration metric results.

*Lessons learned and implications*

A key aspect of any long term project such as NGCP is continually reflecting on project directions, activities and results with the intention of continuous improvement. The model pictured in Figure 2 was not the first model NGCP used; it has evolved as the result of lessons learned and the need to make the model work at a national level. For instance, the inclusion of AAUW liaisons in the current project; the increased focus on identifying partners with collaboration readiness characteristics, and increasing expectations of collaborative partners (e.g. do assessment and evaluation from the beginning) are all examples of how the project has evolved. From these reflections and changes, we feel there are important lessons that we have learned. The following summarizes these lessons and how they may apply to girl-serving STEM organizations.

Set expectations clearly and from the outset. A key strength of NGCP is the collaboration implementation model. This model defines the elements, steps and required activities of participating as a regional collaborative. Even though somewhat prescriptive, the model itself allows for a great deal of variation in implementation details so individual organizations can operate effectively in many different ways and still be following the collaborative model. Any problems that have occurred have largely stemmed from straying from the implementation model. We have learned that early reference and ongoing reinforcement of the model is the most effective way to implement successful collaborations. The lesson that can be applied beyond NGCP is that setting expectations clearly up front for the pending collaboration can reduce confusion, help to identify collaborative partners that are able to participate fully and ultimately enable a successful collaboration.

Use the project resources as intended right from the beginning. This lesson is related to the prior one. In the case of NGCP, we have experiences in both doing this well and ones where we could do better. The use of the program directory is a positive example from NGCP. At the onset of the NGCP extension grant, all collaboratives were required to complete their program directory entries. Further, completion of program directory entries is also required for all mini-grant applicants. This use of the program directory both served to familiarize participants with its use and value as well as helped to more fully populate the directory – making it more useful to all.

Both of these lessons point to the need to be well-prepared to execute and support collaborative relationships before one begins to solicit and build these collaborations. This again points to the need to both be ready to collaborate and implement a proven NGCP model, but also to identify organizations that are collaboration-ready. This may sound obvious, but it is easy to be anxious to begin and perhaps do so before all the resources and tools are fully ready to support the identified collaborations. . By using these resources from the get go, you get the most from your investment and have the greatest likelihood of sustainability in the long run.

Look for collaboration readiness from the onset. In our experience, collaboration readiness in an organization is indicated when the organization has a history of local collaboration, has already established potential partners for networking during the project and can

integrate participation in NGCP into existing organization activities and utilize existing organization staff. For instance – as a non-example -- an organization of strictly volunteers may not provide a stable and ongoing network to sustain the project as volunteers come and go. Thus collaboration readiness requires that the organization have a strong organizational structure with some permanence; so even if individuals transition, there is enough of a core organization and staff remaining to carry on with organizational commitments. Such organizations may take varying forms; for instance NGCP has found that strong Girl Scout councils, as well as University based diversity outreach organizations (e.g. Women in Science or Engineering programs) may have the characteristics needed to successfully implement the NGCP model. We note that these aspects of collaboration-readiness are supported by their similarity to Mattessich et al.'s list of key factors for collaboration (2001). One of those factors is shared purpose; our experience support this in that we see collaboration readiness as requiring that the mission of the potential collaborator must have some match with NGCP's mission – but interestingly enough that match does not have to be discipline specific. For instance, an organization having a mission of collaboration or informal education (as with many Girl Scout Councils) may be sufficient; they don't necessarily have to be STEM focused.

## Conclusions

When explaining the NGCP to prospective collaborative partners, author Peterson is known to say "the National Girls Collaborative Project doesn't work directly with girls. Now this may seem counter-intuitive and somewhat ironic, but the NGCP is not alone in understanding that supporting and increasing capacity for successful girl-serving organizations as well as providing access to resources via collaboration does ultimately impact our overall ability to attract and retain more girls in STEM disciplines

To be more effective in our overall goal of achieving gender equity in STEM disciplines, we may need to – what appears to be – distance ourselves from actual girl serving activities and

concentrate on reforms / organizations that can build capacity and ultimately make the girl – serving organizations more effective.

The NGCP represents a new model for creating sustainable collaborative partnerships between STEM promoting girl-serving organizations and the organizations that work with them to provide resources, ideas and access to future girls and women in STEM. This paper has described how the NGCP model works, and how by building collaborative relationships it can address the relative isolation of these organizations and the resulting duplication of efforts.

Although results are preliminary and are limited by the initial small sample size of evaluation data from such targeted organizations as the mini-grantees, our early data suggests that such collaboration and cooperation has the possibility to become vehicles for sustainable outcomes by affecting the "tipping point" -- the point at which small, targeted strategies or activities that happen unsystematically become widespread, causing a cultural shift that drives systemic and inherent change (Gladwell, 2000). The key is knowing how to apply the appropriate leverage and influence to make a bigger difference. The same analysis can be applied to gender equity in STEM. Although there have been hundreds of girl-serving STEM projects and targeted strategies to close the gender gap in STEM, we may have not yet reached the tipping point that transforms these individual efforts into systemic change, resulting in our relative plateauing of approximately 20% representation of women studying engineering at the undergraduate level (Engineering Workforce Commission, 2005). NGCP strives to use the leverage of a collaboration of girl-serving STEM programs to create the tipping point for gender equity in STEM.

Although we are still refining it, the NGCP collaborative model has shown its effectiveness through increased collaboration and mini-grant projects with sustained results. As we have described, the success to date of the NGCP in developing collaborations has been demonstrated via data from the collaboration rubric, mini-grant reports and metrics that show how collaborative activities have increased over the duration of the NGCP projects. As NGCP expands over the next few years to provide regional collaboratives across the entire United States, we will continue our assessment of its impact and hope to be able to report its influence on building capacity to attract and retain girls in STEM.

Paper presented at American Educational Researchers Association (AERA)
13 – 17 April, 2009, San Diego CA.

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## Acknowledgements

The National Girls Collaborative Project is partially funded via a grant from the National Science Foundation (NSF), Human Resource Development, and Research on Gender in Science and Engineering. National Girls Collaborative Project: Advancing the Agenda in Gender Equity for Science, Technology, Engineering and Mathematics, Grant No. HRD-0631789.

| Accomplishment | Description |
|---|---|
| Mini-grantees | 172 mini-grants awarded since 2004[1], involving 375 organizations |
| Replicated Collaborative projects | Two additional projects funded by NSF that followed the NGCP model; the South Central Girls Collaborative Project (SCGCP) and the Midwest Rural Urban Girls Collaborative Project (MRU). Both projects are completed and will be Texas Girls Collaborative Project and Midwest Girls Collaborative Project in current NGCP extension project. |
| Regional collaborative established | Fourteen regional collaboratives have been established since the beginning of the NWGCP. All of these are still operating. |
| Monthly newsletter subscriptions | NGCP sends a monthly newsletter to a list of 7,283 individuals highlighting not only the current news from each regional collaborative The newsletter serves as portal to announcements from related projects such as funding opportunities, updates to resources such as the Assessing Women and Men in Engineering project (AWE), and conference and workshop announcements of value for STEM-related programs. |
| NGCP online program directory | This directory is fundamental to the success of regional collaborative and individual mini grants' ability to find collaborative partners and sustain them. It lists organizations/ programs that focus on motivating girls to pursue STEM careers. In 2001 it began with approximately 185 entries; it has grown both in functionality and size with over 1000 girl serving entries and increased administrative functions. |
| Webcasts | NGCP offers monthly webcasts focusing on the research-based strategy components or information about collaboration and other |

[1] Includes mini-grants from all collaborative projects beginning with the NWGCP.

| | |
|---|---|
| | resources for programs. These webcasts are recorded and archived on the NGCP site for ongoing access and use; to date 1,249 users have registered for webcasts and there have been over 12,000 requests for webcast archives. |

Table 1. Metrics from combined NGCP projects.

Figure 1. Factors that influence success of collaborations (adapted from Mattessich, et al., 2001)

| |
|---|
| Environment<br><br>• History of collaboration or cooperation in the community<br>• Collaborative group is seen as respected leader in community. |
| Membership Characteristics<br><br>• Mutual respect, understanding and trust<br>• Members see collaboration as in their self interest |
| Purpose<br><br>• Concrete and attainable goals and objectives<br>• Shared vision amongst collaborating organizations. |
| Communications<br><br>• Open and frequent communication<br>• Established informal and formal communication links |
| Process / Structure<br><br>• Members share investment in processes and outcomes<br>• Multiple layers of decision making within the organizations<br>• Flexibility and Adaptability<br>• Developing clear roles and policy guidelines |
| Resources<br><br>• Sufficient funds<br>• Skilled convener – individual who convenes has organizational and interpersonal skills to execute collaboration with fairness |

Figure 2. National Girls Collaborative Project Model

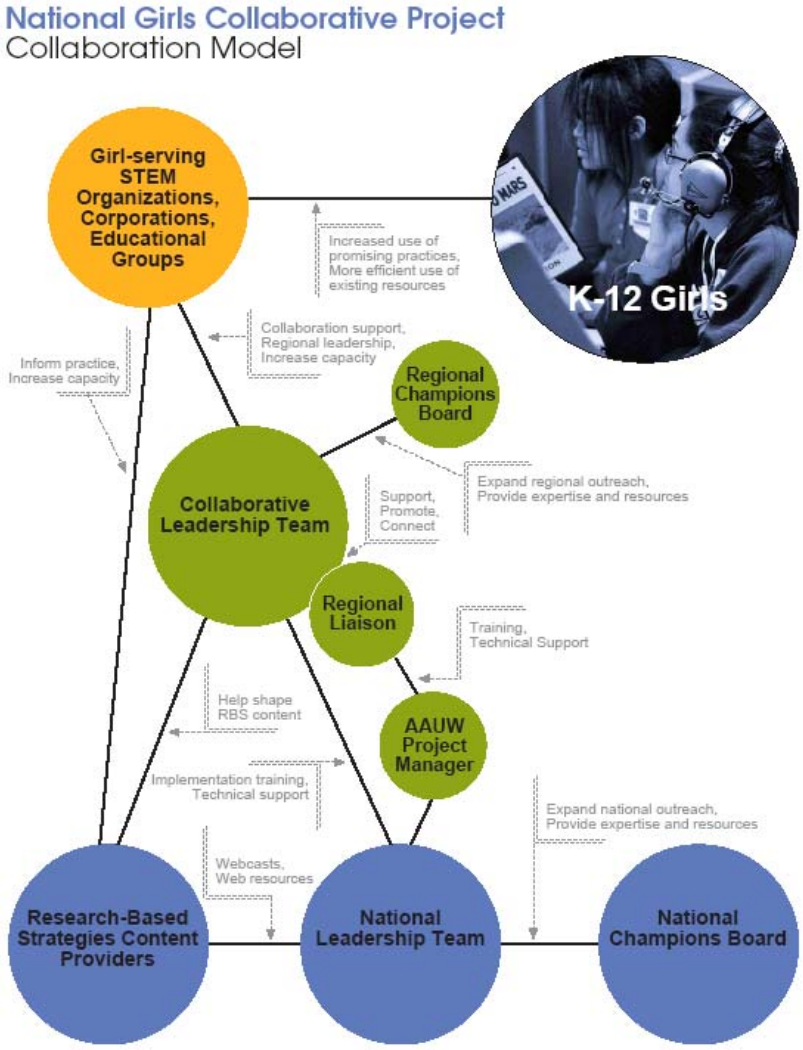

Figure 3. Key collaboration factors as implemented in NGCP

| Mattessich, et al (2001) Factors | NGCP Design Elements That Address Factor |
|---|---|
| Environment | Determine that potential regional collaborative organizations are “collaboration” ready. |
| Membership Characteristics | Regional collaboratives must “propose” their membership and plan for working with the NGCP model and express how collaboration will benefit them. |
| Purpose | Works with organizations with like goals (e.g. organizations that work in some way with K-12 girl to promote STEM). |
| Communications | Frequent communication via multiple methods: AAUW Liaisons, newsletters, listservs, conference calls. |
| Process / Structure | Implementation guide establishes a clear process to guide regional collaborative. |
| Resources | Resources made available both to regional collaboratives plus to girl-serving organizations through mini-grants. |

**Five Levels of Collaboration and their Characteristics**

| | Networking (1) | Cooperation (2) | Coordination (3) | Coalition (4) | Collaboration (5) |
|---|---|---|---|---|---|
| **Relationship Characteristics** | • *Aware of organization*<br>• *Loosely defined roles*<br>• *Little communication*<br>• *All decisions are made independently* | • *Provide information to each other*<br>• *Somewhat defined roles*<br>• *Formal communication*<br>• *All decisions are made independently* | • *Share information*<br>• *Share resources*<br>• *Defined roles*<br>• *Frequent communication*<br>• *Some shared decision making* | • *Share ideas*<br>• *Share resources*<br>• *Frequent and prioritized communication*<br>• *All members have a vote in decision making* | • *Members belong to one system*<br>• *Frequent communication characterized by mutual trust*<br>• *Consensus is reached on all decisions* |

| **STEM Organizations** | **No Interaction** | **Networking** | **Cooperation** | **Coordination** | **Coalition** | **Collaboration** |
|---|---|---|---|---|---|---|
| K-12 teachers | 0 | 1 | 2 | 3 | 4 | 5 |
| K-12 counselors | 0 | 1 | 2 | 3 | 4 | 5 |
| Higher ed STEM faculty | 0 | 1 | 2 | 3 | 4 | 5 |
| Higher ed academic counselors | 0 | 1 | 2 | 3 | 4 | 5 |
| Higher ed STEM program | 0 | 1 | 2 | 3 | 4 | 5 |

Figure 4. Collaboration Rubric Excerpt (*scale adapted from the work of Hogue, 1993; and Borden and Perkins, 1998, 1999, Frey, 2004)*

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