

## **AC 2008-1328: CHALLENGES AND BENEFITS OF RUNNING A MULTI-INSTITUTIONAL RECRUITMENT**

### **Judy Loveless-Morris, University of Washington**

Judy Loveless-Morris is a graduate student in the Department of Sociology at the University of Washington. Her research interests include: stratification; race and ethnicity; sociology of work; inequality in work organizations; and qualitative research methods. She is also a research assistant at the Center for Workforce Development, University of Washington.

### **Priti Mody, University of Washington**

Priti Mody is Director of New & International Initiatives at the University of Washington Center for Workforce Development and lead evaluator of NW-ETEP.

### **Robert Embrey, Highline Community College**

Robert Embrey is the Project Manager for the NW Engineering Talent Expansion Partnership at Highline Community College.

### **Kali Kuwada, Seattle Central Community College**

Kali Kuwada is a Counselor for engineering at Seattle Central Community College.

### **Marisela Mendoza, Columbia Basin College**

Marisela Mendoza is the NW Engineering Talent Expansion Site Coordinator at Columbia Basin College.

### **Robert Olsen, Washington State University**

Dr. Robert Olsen is the Associate Dean for Undergraduate Programs and Student Services and Boeing Distinguished Professor of Electrical Engineering within the College of Engineering and Architecture at Washington State University. He is a principal investigator of this National Science Foundation grant.

### **Eve Riskin, University of Washington**

Dr. Eve Riskin is Associate Dean for Academic Affairs and Professor of, Electrical Engineering in the University of Washington College of Engineering. She is a principal investigator of this National Science Foundation grant.

# Challenges and Benefits of Running a Multi-institutional Recruitment and Retention Engineering Program

## I. Introduction

Low enrollment of underrepresented minority (URM) and female students in engineering is of national concern. In 2002, six colleges at the four year and community college level, along with several other key institutions collaborated to form the Northwest Engineering Talent Expansion Partnership (NW-ETEP). The main goal of the project is to increase the number of URMs and females who earn undergraduate engineering degrees, but it also provides a unique opportunity to discuss the challenges and benefits of multi-institutional research. Collaborative research and evaluation is becoming common practice amongst those interested in the underrepresentation of URMs in science and engineering<sup>1</sup>. While the concept and benefits of coalitions are well accepted, the challenges of multi-institutional analysis are often undiscussed<sup>3</sup>. This exploratory paper will discuss the challenges and rewards of participating in a multi-institutional collaboration.

The findings from this paper will add to the scant literature focusing on the challenges of multi-institutional collaborations. Moreover, this paper specifically addresses the challenges of collaborative efforts for those interested in recruitment, retention, and assessment. Since multi-institutional research and evaluation are becoming frequent, it is important to address this gap in the literature as well as provide a model and guidance for future collaborative efforts.

Coalitions are touted as best practice when it comes to redesigning how engineering education is delivered, especially to diverse student populations<sup>1</sup>. Among the benefits of multi-institutional efforts are the opportunities to synthesize knowledge, resources, and efforts for a common goal<sup>1, 3, 6, 8, 10</sup>. Coalitions have had many successes, but also present some difficulties. The literature, including a typology of collaborations is reviewed in more detail in the “Findings” section below.

NW-ETEP collaborations yielded the similar obstacles identified within the literature: dissemination, geographical challenges, and the demand of additional responsibilities<sup>1, 3, 6, 8, 10</sup>. Even though the challenges were similar, the extent is not as pervasive as previous findings. Because of study limitations, such as numbers of participants and location, our findings are not generalizable. However, our study replicates the same difficulties that other studies have found, suggesting that our findings have some merit and may provide conditions that will alleviate the challenges of multi-institutional collaborations.

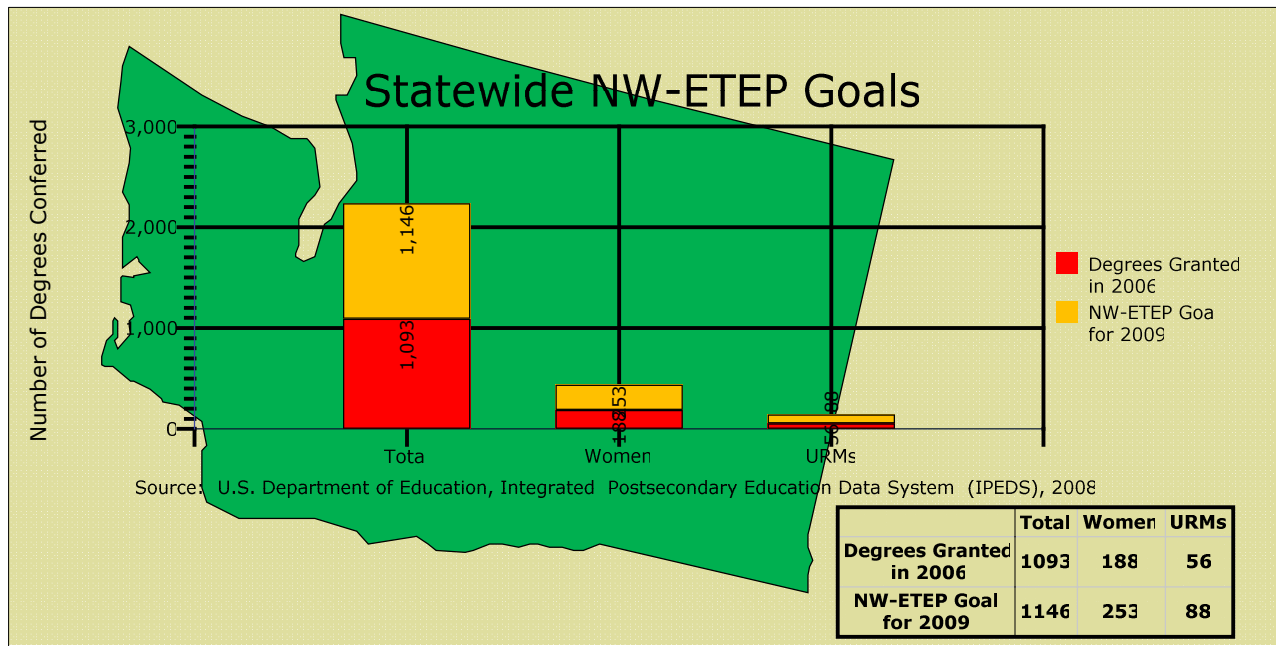
One of the significant contributions of this paper is how adapting relationship styles can reduce dissemination challenges<sup>8</sup>. Another feature of this paper is to extend our understanding of the difficulties of geographical diversity, as well as suggest how geographical distances can be closed through structured communication. The challenges of additional duties are discussed, but suggestions for future research are made. Lastly, this paper adds to the literature of collaborative research by exploring some of the challenges of the evaluation research in a collaborative environment.

## II. Northwest Engineering Talent Expansion Partnership (NW-ETEP)

Funded by a five-year grant from the National Science Foundation, NW-ETEP is a partnership among two universities and four community colleges in Washington State. Three institutions target students in eastern Washington while the other three focus on western Washington. Its goals are to:

1. Increase by 10% over the next five years the total number of students in the State of Washington that earn an undergraduate engineering degree.
2. Increase by 100% the number of underrepresented minorities (URMs) earning undergraduate engineering degrees.
3. Increase by 20% the number of women earning undergraduate engineering degrees.
4. Implement a statewide strategy to fully utilize the capacity of all the state's engineering programs (and ultimately all STEM programs).

Figure 1. Graphical Representation of Goals 1-3, from baseline year 2003-04



SOURCE: U.S. Department of Education, Integrated Postsecondary Education Data System (IPEDS), 2007

The proposal promises gains from 20% to 22% for women and 4% to 8% for under-represented minorities. To accomplish this goal, NW-ETEP is implementing a continuum of strategies on several fronts to target key student populations, involving numerous students, staff, and faculty at several institutions (listed above).

The NSF funding is used for staff at the four community colleges who work to support students interested in transferring to the four-year colleges to earn engineering degrees, with a particular focus on underrepresented students. These efforts include a comprehensive team comprised of existing faculty and student services providers, an on-site coordinator, and services ranging from

academic support to major/career exploration to transfer assistance/support. At the universities, efforts are focused on retention of women interested in engineering.

The participating schools have targeted women and URM students with success for various recruitment, retention, and outreach activities. Of the current enrolled students at the six institutions, twenty-five percent are females, and fourteen percent are from under-represented minorities (URMs include African-Americans, Hispanics, and Native Americans).

### III. Methodology

This study used qualitative method with a semi-structured question format. The data were collected either through email or phone interview. The same structured interview schedule was used for both email and phone interviews. The purpose of the structured interviews was to investigate barriers, facilitators, and perceptions of relationship style among collaborating partners. With the exception of one institution, a representative from each of the six institutions was interviewed.

The structured interviews were mostly centered around Kanter's (1994) "Collaborative Advantage," which will be further discussed in the literature review<sup>8</sup>. Sample questions include:

- Which of the following description(s) best describes the relationships among the partners. After choosing the best description(s), please provide an example that demonstrates the relationship you chose. For example, if one chose option B, and example for why one chose this option might be: *Institution A has the ability to reach more minority students, while Institution B has the ability to connect students with real-world internships...etc.*
- Would you describe the characteristics of the collaborations as a peer relationship or more paternalistic? (b) Can you give some examples of why you picked one or the other? (c) What are the pros and cons of this type of relationship?
- As a result of this collaboration, do you think that there are obstacles that stymie efforts to build collaborative programs among institutions of higher education?
- In what ways do think the collaborations have succeeded in implementing structures and processes to bridge successful communication and efforts? In what ways have we failed?

Following the methods of grounded theory<sup>4</sup>, we attempted to focus on identifying important themes and categories related to our areas of interest. All of the interviews were coded into general themes of interest. This paper draws primarily from the inspection and organization of the following codes: dissemination, geographical challenges, primary jobs, open/closed collaborations, peer or non peer communication, and one of three relationship styles. In addition, themes such as evaluation challenges emerged from these processes that were not addressed by existing papers.

#### IV. Literature Review: Types of Collaborations

Cooperative arrangements between institutions can range along a continuum from weak and distant to strong and close<sup>8</sup>. In Rosabeth Kanter’s (1994) *Harvard Business Review* article, “Collaborative Advantage,” she examines and explores business relationships. However, her findings can be generalized to collaborations that extend beyond the business world. Here, her findings are implemented among higher education institutions. Kanter (1994) identifies three types of relationships: *mutual service consortia*, *joint ventures*, and *value-chain partnerships* (see Figure 2).<sup>8</sup>

Figure 2. Types of Collaborative Relationships

	<i>Mutual Service Consortia</i>	<i>Joint Ventures</i>	<i>Value Chain Partnerships</i>
<i>Strength of Collaboration</i>	Weak and Distant	Mid-Range	Strongest and Closest
<i>Characteristics</i>	Similar institutions with similar resources pooling resources to obtain a goal that would be more difficult to acquire alone.	Each institution brings a unique set of resources that benefits overall goals.	Institutions within differing industries with different but complementary skills that link their capabilities to create value for ultimate users.

Source: Kanter, Rosabeth Moss. 1994. “Collaborative Advantage: The Art of Alliances.” *Harvard Business Review*. Page 98.

These types of collaborations will be described here and applied to NW-ETEP in the findings section. Of the three varieties of relationships, mutual service consortia are identified as the weakest. In mutual service consortia institutions, similar institutions pool resources to effectively achieve a similar goal that would otherwise be difficult to achieve independently.

Joint ventures are neither the strongest nor the weakest of the relationship styles. Joint ventures are considered to be mid-range relationships. At the other extreme of the continuum are value-chain partnerships. Identified as the strongest and closest collaborations, value-chain partnerships are characterized as institutions in “different industries with different but complementary skills that link capabilities to create value for ultimate users”<sup>8</sup>. At the other extreme of the continuum are value-chain partnerships. Identified as the strongest and closet collaborations, value-chain partnerships are characterized as institutions in “different industries with different but complementary skills that link capabilities to create value for ultimate users”.<sup>8</sup>

#### V. Findings

##### A. Dissemination & Knowledge/Resource Sharing

According to previous research, one of the most important, yet most difficult goals of coalitions is dissemination.<sup>1, 3, 6, 8, 10</sup> When working with several institutions some of the difficulties pertaining to dissemination are ensuring that all participants have the skills and information needed to execute the goals, as well as the same understanding of the goals.<sup>9</sup> Even though dissemination is often presented as a challenge of collaborations within the literature, some of

the obvious advantages of collaborations are the leveraging of resources and knowledge sharing and creation.

Although NW-EETEP partners did not identify mutual service consortia as the dominant relationship type, some participants felt that mutual service consortia described some characteristics of the NW-EETEP collaboration. Because all of the institutions within NW-EETEP are higher education institutions, all of the institutions share similar features. For example, all institutions have multiple student services and staff dedicated to recruiting science and engineering students. Having some features of the mutual service consortia relationship reduces some of the confusion of the goals, and as a result, the overall goals of NW-EETEP are well understood among its partners. However, this relationship style also challenges NW-EETEP in executing the goals, which will be further discussed later.

NW EETEP collaborations were not characterized as a value-chain partnership. NW-EETEP collaborators have contact with the students in a higher education setting and in a capacity that promotes the declaration of engineering as a major by students, with an intentional focus on URMs. As a result, the overall goal of NW-EETEP is well understood with little confusion. On one hand, not having value-chain collaborations may create inertia. All participants work in higher education and thus are bounded by similar structures which may bound participants in the way that we attempt to achieve our goals.

If we apply Kanter's characterization of value-chain partnerships to NW-EETEP, the collaboration may yield better results in terms of increasing the number of URM science and engineering students because joint activities would be developed, operations would overlap, and a substantial change would occur within each partner's organization as a result of institutions from differing "industries" collaborating. For example if NW-EETEP collaborators were to include partners that were outside higher education, such as one of the state's largest science and engineering employers, a goal would be shared but the differing operating structures would create changes both within higher education and work organizations that could not be envisioned among partners in an insular institution.

All NW-EETEP partners agreed that the foremost benefit of working with one another is that each institution brings a unique set of resources that benefits the overall goals of NW-EETEP. NW-EETEP collaborations are unanimously described by our partners as Kanter's (1994) joint ventures. NW-EETEP partners have similar resources, as well as some distinct resources that assist in the overall goal of increasing URM science and engineering students. One of the shared advantages of NW-EETEP is ability to capitalize on market differences.

The diverse locations of the participating institutions provide access to larger and more diverse minority populations. For example, some of the colleges within NW-EETEP are able to draw from a larger number of Hispanic populations, while others are better able to draw from African-American and female populations.<sup>2</sup> In general, each institution attempts to increase URM recruitment from all minority populations. However, each institution also finds strength in drawing from particular minority applicants that are reflective of geographic location. This enables NW-EETEP to make progress toward increasing overall minority recruitment without competing for the same pool of URM students. If, for example, NW-EETEP was not a

collaborative effort, the end result might be an increase in Hispanic science and engineering students, but no other minority populations. Collaborative efforts afford the program to have a state-wide impact on diverse URM populations.

An additional advantage of this collaboration is the ability to provide students with better services and outcomes. Students are asked to complete an annual student experience survey which gives site coordinators a sense of which programmatic offerings are best utilized by their students. Additionally, the partnership is better situated to connect with other state-wide initiatives such as MESA. Furthermore, the relationship gives each institution a better understanding of what programs and degrees are offered within the state, rather than by region. Therefore, community colleges are able to advise students based on interest and not regional availability.

The joint venture relationship style serves NW-EETEP goals in another way as well. Stein and Short (2001) point out that even minimal collaboration can be valuable in higher education. Differing higher education institutions are often viewed as competitors for students (for more detailed discussion see Stein and Short 2001). However, NW-EETEP's shared goals among the participants diffuse the competition as noted by many of our participants. Instead of competing for students, these collaborations focus more on the sharing and placement of students. The end result is better placement and successful transfer of URM students. Although joint venture relationships among NW-EETEP collaborators are fruitful, adopting the value-chain partnership could further benefit students by adding resources and experiences that extend beyond the scope of higher education.

## *B. Organizational & Functional Challenges*

### *B1. Geographical Challenges*

The advantages of diverse geographical locations were discussed as a positive feature of collaborations. Geographical locations can present a challenge to the coalition as well. One of the challenges of geographical distance is communication. The distance limits how frequently the partners can convene in person. In addition, geographical locations can produce compartmentalized collaborations. As a result, information may not be shared evenly across the entire group, or the sharing of information is sometimes delayed. Furthermore, some relationships are developed better than others (due to geographical restraints) and although a system is set up where ideas can be shared, follow up action is often slow or forgotten.

Compartmental collaborations can often present a challenge to a cohesive relationship of the larger partnership. Not being in the same building also presents a challenge to the overall communication style of the partnership. Being in varying institutions challenges follow-up discussions that occur more organically when members work within a single institution. Thus, follow-up comments are not always heard. Although members have the opportunity to put forth challenging ideas during conference calls, sometimes partners do not want to disrupt the flow of the phone call. Other times, challenging ideas may occur after a phone call, when members are not together, reducing the chance that these ideas will be heard. In a single institution, these ideas may be easily shared in passing, at lunch, etc, even after a meeting ends. While input is

actively sought, and discussion encouraged, geographical distance between partners presents a challenge to fruitful dialogue.

Although communication may not be as frequent or intensive as collaborators in a single campus, the benefits are still numerous. Despite geographical distance the partners contend that the scope for collaboration is still mostly open. Communication is conducted regularly via email listserv, monthly teleconference, and biannual meetings. Each partner felt that their ideas were respected and invited. Furthermore, communication occurs frequent enough that members valued the knowledge sharing and creation process. The exchange of existing and new knowledge was identified as beneficial, particularly for participants that had demanding duties unrelated to NW-EETEP.

## *B2. Primary Jobs*

For participants with primary job duties other than NW-EETEP, being part of a coalition that facilitates knowledge-sharing allows for successful ventures to be easily replicated. Otherwise, participants with primary job duties other than NW-EETEP would find themselves extended beyond the ability of being able to efficiently contribute to NW-EETEP goals. Often times, collaborators have to commit additional time to the coalition when they already have demanding primary job responsibilities.<sup>1,10</sup> Some of participants are fully funded by NW-EETEP, while others have to share these responsibilities with other job duties. Not being fully funded can understandably undermine focus and commitment to Partnership goals.<sup>10</sup> Of the participants not fully funded by NW-EETEP, many have primary jobs with tasks and goals that overlap with the goals of NW-EETEP. These scenarios present less of a problem for participants.

On the other hand, other partners have primary jobs in which the duties are unrelated to NW-EETEP and their time has to be expended to many areas, without the luxury of having a single focus. These participants may be evaluated on the performance of their primary responsibility and cannot devote attention to the alliance (Stein and Short 2001). If collaboration members have the tension of choosing between their own institutional goals and those of the collaboration, efforts can become stymied, especially when the goals differ. Furthermore, since the collaboration is between existing institutions, staff changes often ensue. Naturally, new staff members are first trained to execute institutional duties. As a result, new staff members may not be brought up to speed quickly or accurately according to NW-EETEP goals, which may cause a breakdown in the partnership and its goals. These challenges will likely occur for all higher education collaborations. To ensure optimal collaborations, administrators should anticipate how to minimize this obstacle.

## *C. Evaluation*

### *C1. Collaborative arrangements between institutions*

The collaboration among the partners offer substantial research advantages far beyond what each institution could independently produce.<sup>12</sup> NW-EETEP produces invaluable data that would be difficult to generate through a single institution. Some of the smaller institutions do not have the



manpower or the money to generate state-wide data. In contrast, the larger institutions might not be able to obtain such rich, detailed data without the smaller institutions. Moreover, the collaborations reduce the amount of manpower needed to collect the data since the effort is collective. In the end the collaboration allows for data collection that will be generalizable to state trends. However, statewide evaluations require balancing a rigorous assessment protocol and ensuring that the site coordinators are not overwhelmed with data collection and entry tasks. Because staff time is limited, the time for data collection and entry pull coordinators away from serving students which is the core of the program.

Collaborative efforts allow the partnership to access large scale data. However, both the greatest benefit and challenge of the collaboration is the data. For example, one of the challenges of data collection is uniformity of the data collected. As stated above, each institution collects its data independently. Although data is requested in a standardized manner, due to individual site limitations, such as registration process, or software available, data often have to be recoded which contribute to reliability and validity issues, besides being time-consuming. An additional challenge for the collaborations' community colleges is that many students who intend to transfer to engineering baccalaureate programs may not have this information coded properly in institutional databases or may not formally participate in an engineering transfer curriculum in order to be tracked.

Another positive feature of the partnership's data is that it allows the partnership to study recruitment and retention beyond one point in time. Longitudinal data collection and evaluation are not without challenges, however. An inherent challenge of evaluating long term research is that it does not usually produce short term outcomes. External funding usually allows multiple institutions to work together on a common goal. External funding, such as, grant foundations, often have timelines and measureable outcomes attached to their funding. Although, the collaboration among partners provides rich data that will produce positive future impact, this impact cannot always be demonstrated in the time allotted by the external agency. Failure to demonstrate immediate impact threatens the ability for partners to establish a long-term relationship. Many of the best ideas may come at the "end" of the collaboration, making changes difficult to institute if continuing funding is not granted to partnerships. These are some challenges that may be overcome in a single institution.

With a broad-based intervention such as NW-EETEP, several more general evaluation challenges also are critical to mention. First, since the partnership goals are expressed in targets for statewide degrees granted, it may be difficult to parse out which effects the intervention has contributed to when compared to other exogenous factors. A set of intermediate indicators focusing on the six partnering institutions was developed to mitigate these effects. Secondly, the process of requesting, collecting, re-coding, "cleaning", and analyzing data may take several months. This time constraint must be balanced against making timely recommendation to inform programmatic efforts to ensure that NW-EETEP is on track to reach its goals. The purpose of ongoing data collection is to constantly provide progress reports so program staff are able to make changes to their work to improve the services offered to students.

In true collaborative style, the principal investigators have included the evaluator from the initial development phase of NW-EETEP in order to determine the most appropriate evaluation strategies and to explore the most productive ways to embed these activities into the work plan from the beginning. This long term involvement has helped build relationships between the site coordinators and evaluation team which makes the assessment process operate smoothly with less suspicion and distrust. Additionally, keeping the evaluator informed of changes in program direction helps to make the assessment more effective since the recommendations can be more targeted to current programming elements. A challenge to this process, however, is that the evaluator should still remain objective in order not to interpret data too creatively in favor of positive outcomes. The evaluator should not be too invested in the program in order to look critically at indicators to see if progress is being made.

Multi-institutional collaborations may produce many evaluation challenges, but when challenges are anticipated or addressed the advantages of the data far outweigh any of the challenges.

## *C2. Accountability*

In addition to standardized data collection and the presence of an evaluation group which is independent from the programmatic elements of the partnership, the participating institutions receive periodic feedback on the collaborative progress toward grant goals – a tool which helps keep the partnership focused on outcomes.

Despite resource and contextual similarities, the ultimate goal of the project is to increase the number of bachelor in engineering degrees. In addition, the principal investigators of the grants are associate deans at the university-level. Thus, four year institutions may dictate the relationship a little more than community colleges do. This might explain why some of the community colleges, and one of the four year institutions, viewed the relationship as both a peer and paternalistic relationship. This was cited perception, but also not completely negative. Whether perceived or real, power differentials in relationships may inhibit the free flow of ideas desired in a true partnership. Partners expressed that the dynamic of this partnership allowed for open contribution, as well as a productive structure since someone must “steer the ship”.

## **VI. Discussion, Conclusion and Future Directions**

One of the weaknesses of qualitative findings is that they are not generalizable.<sup>4</sup> However, since challenges in this paper are replicated in other studies, the findings suggest that there is some validity. Furthermore one of the strengths of qualitative methods is to offer thick or rich descriptions. The findings from this paper add to the existing literature by suggesting conditions that might produce outcome differences.

As mentioned in the “Findings” section above, this partnership has been able to capitalize on the strengths of the participating institution through a collaborative format that roughly resembles a joint venture relationship. This collaboration ensures that each institution has a strong commitment to and understanding of the goals of the project and is also able to leverage each others’ strengths. While communication and geography can be barriers to effective collaborations, NW-EETEP has been able to turn these elements into strengths; regular

communication is used to facilitate knowledge transfer while geography is used to maximize recruitment of diverse student populations. The sharing of resources and centralized assessment has also helped make this higher education collaboration data-driven and focused on outcomes.

Additionally, value chain partnerships are considered the strongest of the relationship styles. In order for this collaboration to move to this style of relationship and to truly impact the number and diversity of engineering students, our partnership will need to implement better communication procedures. Effective communication could be construed as a challenge, with roots in geographical distance and possible perceived power differences, which suggests that organizational structure and communication should be scrutinized carefully in a multi-institutional collaboration, perhaps to the point of building in training to ensure problems of this nature don't arise. Moreover, to alleviate funding issues discussed in the "Evaluation" section, and for greater state-wide impact, this partnership should seek partners not bounded by the higher education structure.

Due to limitations in the semi-structured interview format, the interviews generated additional areas for inquiry to be probed in more detail, particularly regarding communication and structure of the partnership. First, some of the data suggest that positive spillover effects have occurred. Spillovers are unintended consequences of a partnership.<sup>11</sup> Spillover areas to be explored include: increased motivation of staff, cross-fertilization of ideas, increased information-sharing in terms of knowledge of relevant activities statewide, and leveraging of resources of other groups. Another area for future research includes the exploration of potential tension between leadership and paternalism given the grant leadership is based at the university-level while many of the partners are community colleges.

Another potential challenge for this collaboration, and many in higher education, is sustainability. As the original five-year grant comes to a close, the partners are brainstorming avenues of continued funding, looking towards other funding agencies, corporations, and state government. Particularly since many of the staff associated with this partnership are funded completely or in part through this grant, the partnership is in jeopardy if additional funds are not secured. The collaboration is using a group strategy to brainstorm new directions as well as data to substantiate its progress.

## **Bibliography**

1. Bogue, Barbara, Brenda Hart, Marie Elena Reyes, Barbara Ruel (2005). "Meeting the Challenges of Cross-Institution Initiatives: An Inside View of a Successful Multi-Institution Collaboration." *Proceedings of the 2005 WEPAN/NAMEPA Joint Conference*.
2. Center for Workforce Development (2007). *Northwest Engineering Talent Expansion Partnership Evaluation Report 2007*. University of Washington, Seattle, WA.
3. Coward, H. Roberts, Catherine P. Ailes, and Roland Bardon (2000). *Progress of the Engineering Education Coalitions (NSF 00-116)*. Final Report. Engineering Education and Centers Division, National Science Foundation, Arlington, VA.

4. Glaser, Barney G & Strauss, Anselm L., 1967. *The Discovery of Grounded Theory: Strategies for Qualitative Research*, Chicago, Aldine Publishing Company.
5. Hardy, Cynthia, Nelson Phillips, Thomas B. Lawrence (2003). "Resources, Knowledge, and Influence: The Organizational Effects of Interorganizational Collaboration." *Journal of Management Studies*. 40:2 2003 (321-346). Blackwell Publishing, Oxford, UK.
6. Henry Tyson R, Hilary Holz, Clarke Steinback, Catherine Reed, and Akanksha Baid (2004). *Work in Progress- Student Retention and Recruitment in Computer Science Programs*. ASEE/IEEE Frontiers in Education Conference. Savannah, Georgia.
7. Horgan, Barbara (1997). *Cooperation and Competition: Case Studies of Academic Partnerships Using Information Technology*. Case Studies, March 1998.
8. Kanter, Rosabeth (1994). "Collaborative Advantage". *Harvard Business Review*, July-August 1994 96-108. Boston: Presidents and Fellows of Harvard College.
9. Katz, J. Sylvan, Ben R. Martin (1997). What is Research Collaboration? *Research Policy* 26 1997 (1-18).
10. Stein, R.B. & Short, P.M. (2001). "Collaboration in Delivering Higher Education Programs: Barriers and Challenges." *Review of Higher Education*, 24(4) 417-435.
11. Usselman, M., G. Kingsley, Donna Llewellyn, Brecca Berman (2005). "STEM Partnerships that Spillover." *Proceedings of the 2005 ASEE Annual Conference & Exposition, ASEE*.
12. Wildavsky, A. (1986). On collaboration. *PS*, 19, 237-248.