Networking Among VIP K–16 Participants

Authors:

Basmat Parsad
Joy Frechtling
Westat

David May
Nancy Shapiro
University System of Maryland (USM)

January 2007

Paper Prepared for the:

MSP Evaluation Summit II
October 4–5, 2006
Radison University Hotel, Minneapolis

Networking Among VIP K–16 Participants

This study employed social network analysis (SNA) to describe professional collaboration among participants of the Vertically Integrated Partnerships (VIP) K–16 program, primarily high school teachers and higher education faculty. The study focused on three qualitative measures by which to examine VIP's evolving collaborative structure—the emergence of new professional connections since VIP, the extent to which VIP networks became more connected, and leadership roles in integrating network participants. Informed by program goals and activities, VIP networks were examined in four core program-related areas—inquiry-based teaching and learning, mentoring relationships, exposing undergraduates to science teaching as a career option, and planning and managing VIP activities. While causal inferences are beyond the scope of this study, the findings provide an understanding of the capacity of VIP for promoting professional networks in activity areas that are key to achieving program goals.

Background

The Vertically Integrated Partnerships K–16 program is designed to create and sustain professional collaboration among its partners. Initiated in the 2002–03 academic year, the program is committed to five primary goals—improving high school student learning outcomes, improving science teacher pedagogical content knowledge, improving college faculty teaching skills, enhancing graduate student teaching skills, and increasing the number of undergraduate students who choose teaching as a career (VIP K–16 Year 2 Report). VIP has incorporated a wide range of activities to achieve these goals. Some of the activities target high school science teachers in the Montgomery County (MD) public school system (MCPS) or faculty or students at institutions of higher education (IHEs), while others promote "vertical" collaboration between IHE and MCPS participants. Cohorts of MCPS science teachers, for instance, have participated in conferences, workshops, and summer institutes to enhance pedagogical knowledge in science and to develop skills in best practices of pedagogy and assessment that are aligned with new inquiry-based curriculum. Among IHEs, efforts to promote faculty collaboration and increase K–16 partnerships have become intensified over the past year, with increased emphases on faculty learning communities (including collaboration with high school science teachers), undergraduate teaching internships in high school classrooms, and the redesign of parts of the undergraduate science curriculum (VIP K–16 Year 4 Report).

While anecdotal evidence suggests the emergence of many professional networks during the course of the VIP program, there are no systemic data to document the program's accomplishments in fostering professional collaboration among its partners. To address this gap, the Survey on Collaborative

Networks Within the Vertically Integrated Partnerships K–16 (VIP) Program was designed to document the emergence and structure of collaborative networks since VIP was initiated. The data from this study will establish quantitative benchmarks for future evaluations.

Study Goals and Design

The primary goal of this study was to document the level of collaboration since VIP and to identify the key connectors in VIP networks. Social Network Analysis (SNA) was identified as a methodology that could assess VIP integration in four high-priority program areas.

- Sharing or developing new teaching strategies or materials that emphasize inquiry-based teaching and learning;
- Mentoring relationships, either to mentor or be mentored, in inquiry-based teaching and learning;
- Delivering activities that expose graduate or undergraduate students to science teaching as a career option; and
- Planning, coordinating, or managing VIP activities.

The indicators of successful integration were based on VIP's goals and activities to identify a set of guidelines by which to evaluate the evolving collaborative structure. Two broad sets of guidelines provide the basis for such evaluation—the overall levels of collaboration since VIP, and the position of leadership within VIP networks.

Overall Levels of Collaboration

Successful integration is reflected by substantial increases in the overall levels of professional collaboration since VIP, and it can occur both by incorporating more members into the network and by establishing new connections among members who are already in the network. These two processes impact the overall cohesion of the network, i.e., the extent to which members are connected to each other. Because of VIP's emphasis on K–16 integration, collaboration between IHE and MCPS participants is as critical to measuring success as is the overall level of integration among VIP participants as a whole. Using SNA tools, successful integration among all VIP participants and between IHE and MCPS participants were measured as follows:

- Many of the individuals who were not connected with the other members before VIP were incorporated into the VIP network, as measured by a substantial increase in the number of network participants since the program began.

- A large number of new professional connections emerged since VIP as a result of new entrants to the network and new connections among members already in the network.

- The overall connectedness of VIP networks increased, as measured by network density (i.e., the proportion of total possible ties connecting participants in a network).[1]

- Top leadership positions in the network were occupied by individuals who clearly connect many of the participants across institutional and group boundaries.

Three individual-level centrality measures were used to identify participants who occupy key positions in the VIP networks. *Centrality degree* was used to measure network activity or popularity of individual participants within a group. This measure reflects the number of other participants who are directly linked to a person. *Centrality betweenness* was used to identify persons with the most indirect links to other participants, although these persons may not be the most popular. *Closeness* was used to identify individuals with the shortest path of connection to other participants, with smaller estimates indicating that the person is strategically located in the network (Wasserman and Faust 1999; Durland 2005).

Social network data were obtained through a survey of individuals from all institutions involved in VIP. The IHE groups consisted of VIP faculty fellows and project directors at Montgomery College (MC), Towson University, University of Maryland, Baltimore County (UMBC), University of Maryland Biotechnology Institute (UMBI), University of Maryland, College Park (UMCP), and the University System of Maryland office (USM). UMCP and USM personnel were combined into one group. The MCPS participants surveyed included two individuals at the science office, teachers in the ExPERT program at UMBI, VIP Master Science Teachers, and other MCPS teachers involved in various VIP efforts.

The survey simply asked whether respondents worked with other participants in each of four critical areas of collaboration—inquiry-based teaching and learning, mentoring, exposure of undergraduate students to teaching as a career option, and planning or coordinating VIP activities. We chose a roster format over the free recall format in order to jog respondents' memories and minimize recall problems, with each question repeating a full list of names for the 134 selected VIP participants. To separate out the confounding effects of preexisting professional relationships, respondents were asked whether they had worked with each other before and since the initiation of the project. The survey was emailed in April 2006 to the selected VIP

[1] The total number of possible ties in a 1-mode network is calculated as g(g-1)/2, where g is the total number of participants. Thus, if 4 of the participants in a 10-person group worked with each other, then the network is based on 6 out of a possible 45 ties (i.e., 13 percent of the ties). This estimate can be expressed as a proportion of 0.13 on a scale of 0 to 1, where 0 represents no relation and 1 represents a fully connected network. The total number of possible ties for 2-mode networks, such as the network between IHE and MCPS, is calculated as g(g). Density measures can be misleading if they are not reported with group size because the estimate automatically decreases with group size. For example, while a density score of 0.50 for a small group of 10 participants indicates that the network is based on 23 ties (or 50 percent of a possible 45 ties), a density score of 0.05 for a larger group of 100 participants indicates that the network is based on 2,475 ties (or 50 percent of a possible 4,950 ties).

participants for whom contact information was available, i.e., 124 of the 134 listed participants. Nonrespondent follow-up ended in June for a response rate of 80 percent (99 out of a possible 124 respondents). However, for subgroups such as UMBI, UMCP/USM, and teachers in the ExPERT program at UMBI, the response rates were as low as 51 to 64 percent.

All 134 VIP participants were included in the analyses: 99 respondents, 25 nonrespondents, and 10 participants for whom contact information was not available. The issue of whether to include missing data is a recurring problem that presents some unique challenges for network analyses that are based on relations that are dyadic and reciprocal, as in studies that examine whether individuals worked together or lived next to each other (Wasserman and Faust 1999; Durland and Fredericks 2005). We conducted several diagnostic procedures to examine the extent to which excluding missing data might affect the study findings. A decision was made to retain missing cases in the analyses for two major reasons. First, the exclusion of such data would have resulted in the loss of substantial information because the nonrespondents were identified as professional collaborators by many of the VIP participants who completed the survey. Second, differences in the overall findings were not significant enough to change the general conclusions of the study, although the estimates were somewhat higher than if the missing data had been excluded from the analyses. All analyses in this report were conducted on symmetricized data to adjust for missing data and for unresolved mismatched data.[2]

Results

For each of the four activity areas, SNA tools were applied to evaluate the successful integration within VIP networks based on the following indicators:

- To what extent did VIP activities incorporate its members into professional networks; i.e. how many participants were involved in collaborative relationships and how many were not?
- How many new collaborative relationships emerged since the implementation of VIP, both from new entrants to the network and among those already in the network?
- How connected were the VIP networks; i.e., to what extent did participants work with each other?

[2] The data were made symmetric to complete the information for a pair of actors when one member either did not respond to the survey or reported mismatched information. Thus, if respondent #10 reported working with #70 but #70 did not respond to the survey, the data were symmetricized to indicate that #70 worked with #10. This approach is common in dealing with asymmetric network data for cases where the topic of study implies reciprocity, such as "being related to each other" or "living next door." A similar approach was used to deal with unresolved mismatched data, which represented 4 percent or fewer of all dyads in the network. For example, if respondent #10 reported working with #70 but #70 did not indicate that he/she worked with #10, then the data were symmetricized to indicate that #70 worked with #10.

- Who occupied leadership positions in VIP networks and how well connected were they to other participants?

The level of collaboration that can be considered successful depends ultimately on the activity area being examined, the goal of VIP with regards to that activity area, and the extent to which the program focused on those activities.

Findings were reported for the full group of 134 selected VIP participants and for specific subgroups as defined by institutional and programmatic boundaries. To explore the extent to which VIP activities promote collaboration within these subgroups (e.g., the various IHEs and MCPS subgroups) and activities that foster K–16 interaction between the IHE and MCPS teams, the analyses focused on networks *within* IHEs and MCPS and networks *between* these groups.

Sharing or Developing New Teaching Strategies or Materials

A primary goal of the VIP K–16 program is to increase and improve inquiry-based teaching and learning in secondary and postsecondary classrooms. At the IHE level, learning communities were created to promote opportunities for faculty to share pedagogical knowledge, inquiry workshops were held to expose faculty to new teaching strategies and materials, and undergraduate courses in the STEM fields have begun to be restructured to infuse inquiry-based strategies into teaching. The approach to science as inquiry has also been emphasized in program-related activities at the secondary school level, including conferences, workshops, and summer institutes designed for various cohorts of science teachers. Some program activities were specifically designed to promote K–16 integration, including retreats and activities to expose undergraduates to teaching in high school classrooms.

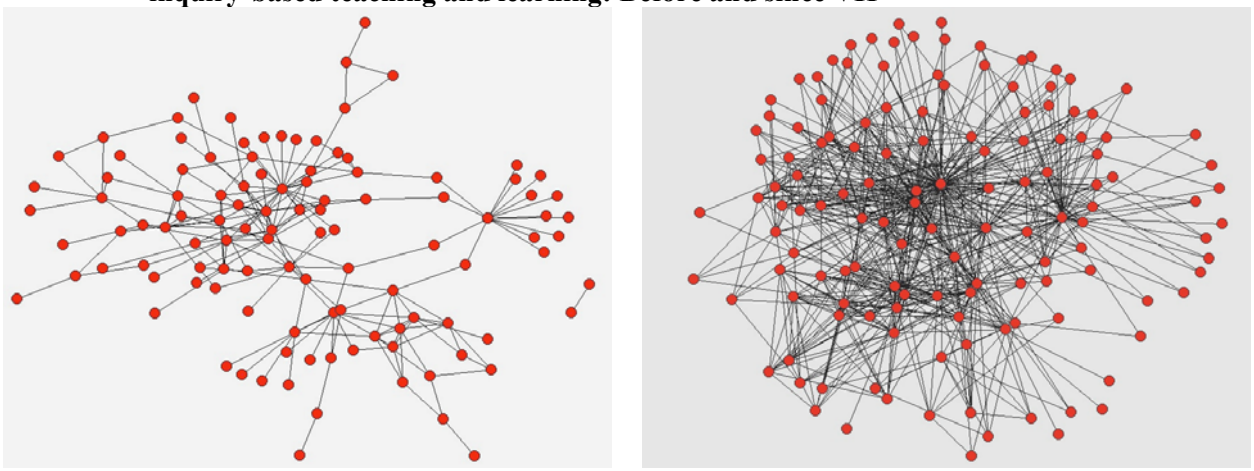
Given the wide range of program activities aimed at improving inquiry-based teaching and learning at both the secondary and postsecondary levels, successful VIP integration in this area would include (1) the involvement of most VIP members in the network, (2) a large number of new professional connections since VIP, and (3) more integrated networks since VIP. These indicators provide insights into the extent to which VIP activities served to promote networks of knowledge sharing in inquiry-based teaching.

The social network data collected from VIP participants support the expectations for widespread participant involvement in professional networks on sharing or developing new strategies or materials on inquiry-based teaching and learning (Figure 1). Although most participants (N=110) were already involved in a relatively loosely knit network on inquiry-based teaching when VIP started, the absence of network

isolates since VIP indicates that program activities had successfully connected all 134 participants in one or more professional relationships in this area.

The large number of new collaborative ties since VIP clearly reinforces increased networking both in terms of individuals who were pulled into the network since VIP and those who were already sharing inquiry-based teaching strategies and materials with others in the network. Of the 711 relationships that currently exist among the 134 participants since VIP, a majority (517) were new ties that emerged from program activities. The graphs in Figure 1 provide a clear visual representation of increased overall integration among VIP participants as the networks evolved from relatively loosely knit connections to a more webbed network since VIP. This shift is confirmed by a corresponding increase in network density from 2 to 8 percent of a possible 8,911 ties in the network.

Figure 1.—Networks on sharing or developing new teaching strategies or materials that emphasize inquiry-based teaching and learning: Before and since VIP



Before VIP

N=134 (Network participants= 110; Isolates = 24)
Number of possible ties = 8,911
Number of ties in network = 194
Percent of possible ties in network = 2.2%

Since VIP

N = 134 (Network participants= 134; Isolates = 0)
Number of possible ties = 8,911
Number of ties in network = 711
Percent of possible ties in network = 8.0%
Number of new ties = 517

NOTE: The percent of possible ties is rounded to the nearest decimal place.
SOURCE: Survey on Collaborative Ties Within the Vertically Integrated Partnerships K–16 (VIP) Program, 2006.

Figure 1 shows that some individuals were central to the network with regards to the number of other participants to whom they were connected, both directly and indirectly, and the extent to which they were strategically located. These individuals are listed in Table 1 as occupying leadership positions in the network and having the most influence in promoting or maintaining collaborative networks on inquiry-based teaching and learning. The high degree scores in the VIP network indicates that these individuals had the highest number of direct interactions with other participants while the high betweenness scores reflect indirect contact with many other participants.

Leadership positions in the network on inquiry-based pedagogy were occupied by both IHE and MCPS participants, with 11 of the 16 most central network players being IHE faculty (Table 1). The single most connected participant in the overall network, participant OF2, was located in the MCPS office.[3] This participant was the most central actor in the network because he or she was the most connected to other participants, both directly and indirectly, as indicated by the degree and betweenness measures (76 and 46, respectively). This finding is consistent with the expectation that VIP management personnel will occupy key roles in the network on sharing inquiry-based teaching strategies and materials.

Table 1.—Centrality measures for key players in VIP network on sharing or developing new teaching strategies or materials that emphasize inquiry-based teaching and learning: 2006

Randomized participant ID	Degree	Betweenness	Closeness
OF2	75.9	45.5	80.6
BI9	38.3	15.9	61.0
OT7	37.6	7.7	61.6
EX20	32.3	4.6	58.9
MC7	26.3	6.0	57.1
TO12	25.6	2.5	55.0
OT47	25.6	2.2	56.4
CP8	20.3	1.8	55.6
OF1	20.3	1.5	55.6
BC4	18.8	3.6	54.5
TO7	18.0	1.2	51.2
CP2	16.5	2.0	54.5
OT25	16.5	0.6	51.4
TO1	15.8	0.9	51.6
CP6	15.8	6.0	54.1
CP4	15.8	1.2	54.1

NOTE: Degree reflects the number of other participants who are directly linked to a person. Betweenness was used to identify persons with the most indirect links to other participants. Closeness was used to identify individuals with the shortest path of connection to other participants, with smaller estimates indicating that the person is strategically located in the network. For the purposes of this report, participant IDs were randomly generated after the survey data were collected, and they do not match the order of the numbers listed in the questionnaire. This was to maintain respondent anonymity.

SOURCE: Survey on Collaborative Ties Within the Vertically Integrated Partnerships K–16 (VIP) Program, 2006.

It should be noted that popularity or degree measures need to be interpreted with other centrality measures. For example, participant BI9 is a UMBI faculty member who held about the same number of direct connections as participant OT7, an MCPS teacher. However, the UMBI faculty member was more central to the network because he/she held more indirect connections in the network.

The ego nets presented in Figure 2 provide a visual representation of the overall connectedness of the single most connected participant and the top seven network connectors listed in Table 1. The ego net for participant OF2 (from the MCPS science office) suggests that the loss of this individual from the network could result in substantial fragmentation among other network members. In addition, the ego net for the top

[3] For the purposes of this report so as to maintain respondent anonymity, participant IDs were randomly generated after the survey data were collected; they do not match the order of the numbers listed in the questionnaire.

seven network connectors (see Table 1) suggests that these individuals are central to integrating a considerable proportion of the collaborative relationships in the overall network.

Figure 2.—Ego net for the most connected participant and the top seven connectors in the VIP network on sharing or developing new teaching strategies that emphasize inquiry-based teaching and learning: 2006

Ego net for most connected participant (MCPS office #2) Ego net for the top seven network connectors (listed in Table 1)
NOTE: Larger circles represent top connectors in the network.
SOURCE: Survey on Collaborative Ties Within the Vertically Integrated Partnerships K–16 (VIP) Program, 2006.

Increased Collaboration Within Subgroups

Table 2 shows the extent to which members of various VIP subgroups worked with each other *within* the group to share or develop new teaching strategies or materials on inquiry-based teaching and learning. Among the 57 IHE participants, the number of ties increased from 66 to 208, resulting in a total of 142 new ties since VIP. The network also increased in overall cohesion from 4 percent to 13 percent of all possible ties. These findings are consistent with anecdotal evidence of high levels of VIP activity among IHE participants. Increased interaction may be attributable to activities such as curriculum redesign for undergraduate courses and the creation and expansion of learning communities to facilitate knowledge-sharing networks in inquiry-based teaching.

Differences in the extent of professional networking in inquiry-based teaching and materials by type of IHE can also be examined within the contexts of specific types of program interventions to promote such collaboration. The social network data from VIP participants indicate that the faculty at Towson had the largest number of new collaborative relationships on inquiry-based teaching and materials since VIP (53 ties), and they also had more group interaction than other IHEs before the program started (24 ties; Table 2). As a result, Towson had the most densely connected VIP network, showing 85 percent of a possible 91 ties

among the 14 program participants. The closely knit network of information sharing on inquiry-based teaching strategies and materials at Towson reflects long-standing formal interactions among faculty. For example, current documentation of VIP, activities indicate that learning communities were established in the first year of VIP and the participants have made tremendous progress in redesigning their undergraduate curriculum to infuse inquiry-based teaching and learning (VIP K–16 reports for Years 2, 3, and 4).

Table 2.—Number of ties and percent of possible ties within VIP networks on sharing or developing new teaching strategies or materials that emphasize inquiry-based teaching and learning: Before and since VIP

Group	Group size	Number of possible ties	Number of ties			Percent of possible ties	
			Before VIP	Since VIP	New	Before VIP	Since VIP
All institutions of higher education	57	1,596	66	208	142	4.1	13.0
Montgomery College	10	45	5	26	21	11.1	57.8
Towson	14	91	24	77	53	26.4	84.6
University of Maryland, Baltimore County	9	36	5	17	12	13.9	47.2
University of Maryland Biotechnology Institute	14	91	13	13	0	14.3	14.3
University of Maryland, College Park and USM	10	45	6	18	12	13.6	39.4
Montgomery County Public School System	77	2,926	109	322	213	3.7	11.0

NOTE: The number of possible ties within an institution of higher education is based on the number of VIP participants in that institution. The number of possible ties for all institutions is based on the number of possible ties within each institution and among all institutions.

SOURCE: Survey on Collaborative Ties Within the Vertically Integrated Partnerships K–16 (VIP) Program, 2006

Anecdotal evidence from VIP partners also indicate that the learning communities model at Towson was extended to MC and UMBC, and that several IHEs have been working collaboratively on redesigning their undergraduate science curriculum (VIP K–16 annual reports). Thus, it is not surprising that the data for this study indicated substantial increases in partnerships on inquiry-based teaching among faculty at MC and, to a lesser extent, among faculty at UMBC and UMCP/USM (Table 2). For example, 21 new professional relations emerged among the 10 MC participants since VIP, and the network density increased from 11 to 58 percent of a possible 45 ties among the group.

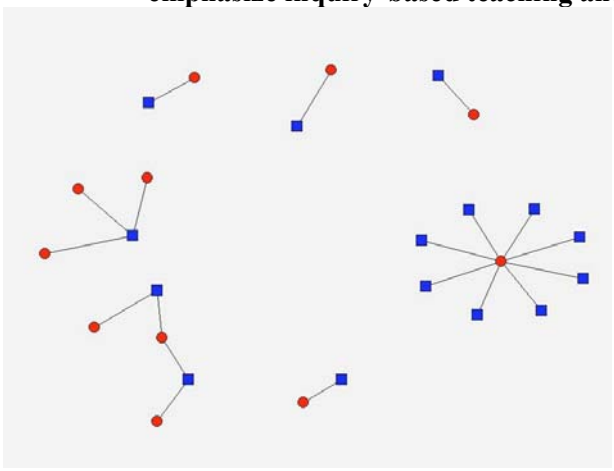
Professional relationships in inquiry-based pedagogy and materials increased and expanded among MCPS participants (Table 2). Among all MCPS participants, including two individuals from the science office, the number of professional relations increased from 109 ties in the pre-VIP period to 322 ties since VIP, for a total of 213 new connections in this area. This finding is expected, based on the wide range of program activities aimed at improving teaching strategies and enhancing content knowledge among the various cohorts of MCPS science teachers. MCPS offers numerous professional development opportunities through summer institutes, quarterly conferences, monthly seminars, and K–12 curriculum guide workshops. In these activities, the Master Science Teachers play an important role in professional development activities and in the development of instructional supports for MCPS teachers.

Increased Vertical Collaboration between IHE and MCPS Participants

Vertical collaboration between the IHE and MCPS teams is key to promoting a K–16 education structure. Although much of the professional interactions on inquiry-based teaching may have occurred along parallel paths for IHE and MCPS participants, several VIP activities were specifically designed to promote vertical collaboration between the two groups. For example, in addition to facilitating vertical interactions through retreats, VIP has promoted K–16 interactions through the ExPERT teacher program at UMBI and the internship program for science, technology, engineering, and mathematics (STEM) undergraduates to teach in high school classrooms (VIP K–16 Year 4 Report).

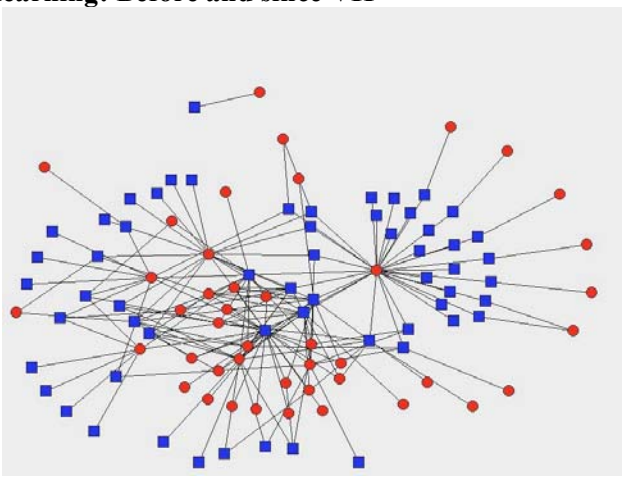
Figure 3 shows that a total of 162 new collaborative ties on inquiry-based teaching and learning emerged *between* the IHE and MCPS groups since VIP.[4] Professional collaboration in this area evolved from a scattered connection of 19 ties that involved only 23 of the participants to a larger and more connected network of 184 ties that included most of the IHE participants (represented by circles) and MCPS participants (represented by boxes).

Figure 3.—Vertical networks on sharing or developing new teaching strategies or materials that emphasize inquiry-based teaching and learning: Before and since VIP



Before VIP

N=134 (57 IHEs and 77 MCPS)
Network participants = 26; Isolates = 108
Number of possible ties across groups = (57x77) = 4,389
Number of ties across groups = 19
Percent of possible ties across groups = 0.4%



Since VIP

N=134 (57 IHEs and 77 MCPS)
Network participants = 101; Isolates = 33
Number of possible ties across groups = (57x77) = 4,389
Number of ties across groups = 181
Percent of possible ties across groups = 4.1%
Number of new ties = 162

NOTE: The percent of possible ties is rounded to the nearest decimal place. All analyses were run on 2-mode networks with IHEs as row data (represented by circles in the network and MCPS as column data (represented by boxes in the network). Thus, the networks focus only on ties *between* IHE and MCPS participants, and they do not include ties within each of the two groups.
SOURCE: Survey on Collaborative Ties Within the Vertically Integrated Partnerships K–16 (VIP) Program, 2006.

[4] This does not include collaborative ties among IHE participants as a whole or among MCPS participants as a whole.

Increased participation in vertical networking, paralleled by increased network density from less than 1 percent to 4 percent of a possible 4,389 ties, indicates that more college faculty and MCPS participants were moving across educational levels to collaborate on inquiry-based teaching since the VIP program started (Figure 3).

Vertical collaboration in inquiry-based teaching between MCPS participants and faculty at each of the IHEs increased substantially since VIP, with the largest increases occurring between UMBI and MCPS (from 4 to 47 ties) and for the network between Towson and MCPS (from 0 to 45 ties) (Table 3). Vertical collaboration also increased between other IHE and MCPS participants. For example, 32 new ties emerged between UMBC and MCPS participants, and 24 new ties emerged between UMCP/USM and MCPS participants.

Table 3.—Number of ties between MCPS and subgroups of IHE participants and percent of possible ties in VIP networks on sharing or developing new teaching strategies or materials that emphasize inquiry-based teaching and learning: Before and since VIP

MCPS and subgroups of IHE participants	Group size	Number of possible ties	Number of ties			Percent of possible ties	
			Before VIP	Since VIP	New	Before VIP	Since VIP
Montgomery College and MCPS	10+77	770	9	27	18	1.2	3.5
Towson and MCPS	14+77	1,078	0	45	45	0	4.2
University of Maryland, Baltimore County and MCPS	9+77	693	2	34	32	0.3	4.9
University of Maryland, Biotechnology Institute and MCPS	14+77	1,078	4	47	43	0.4	4.4
University of Maryland, College Park/USM and MCPS	10+77	770	4	28	24	0.5	3.6

NOTE: The percent of possible ties is rounded to the nearest decimal place. All analyses were run on 2-mode networks with IHEs as row data and MCPS as column data. Thus, the networks focus only on ties *between* IHE and MCPS participants, and they do not include ties within each of the two groups.

SOURCE: Survey on Collaborative Ties Within the Vertically Integrated Partnerships K–16 (VIP) Program, 2006.

Summary: Networks on Inquiry-based Teaching and Learning

The VIP network on inquiry-based teaching and learning reflects a relatively high level of professional collaboration among all partners and between IHE and MCPS partners. Although most VIP participants had worked with one or more other participants on inquiry-based teaching prior to the start of the program, VIP activities appeared to have successfully integrated all 134 program participants into a relatively dense network. Thus, the number of ties increased exponentially from 194 to 711, accounting for a total of 517 new connections in this area. This increased collaboration, resulting primarily from new connections among those already in the network, is reflected in a corresponding increase in network cohesion from 2 to 8 percent of all possible ties.

Vertical integration between the IHE and MCPS participants is critical to the long-term program goal of fostering K–16 partnerships in inquiry-based teaching and learning. While such collaboration was almost nonexistent before VIP, and while it continued to occur at lower levels than did collaboration among all VIP participants, the IHE and MCPS teams had become fairly integrated since VIP. The number of network participants increased from 23 to 101 and the number of connections increased from 19 to 181, for a total of 162 new relationships since VIP.

Leadership positions in the overall network were occupied by both IHE and MCPS participants, although the most influential individual came from the MCPS science office. Individuals in the top 13 leadership positions were most central on multiple centrality measures, and 3 persons held power consistently no matter how it was defined.

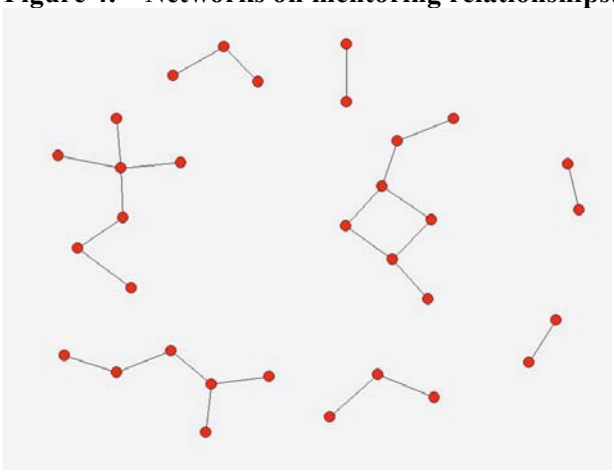
Mentoring Relationships

Mentoring is an important mechanism for career enhancement and knowledge sharing in pedagogy and content. Participants were asked to indicate whether they participated in a mentoring relationship with other participants, either as a mentor or as being mentored, before and since VIP was initiated. Mentoring relationships may emerge from many of the VIP activities discussed earlier, including IHE learning communities, undergraduate STEM course reform, undergraduate internships in K–12 classrooms, and MCPS cohort conferences and workshops.

Mentoring networks are based on one-to-one relationships and on fewer interactions per participant than can be expected from activities that are designed to produce larger networks such as collaborative networks that evolve from participation in learning communities and conferences. The focus in analyzing mentoring networks, therefore, is on whether VIP participants were connected to another member of VIP, either as a mentor or as being mentored. Thus, successful VIP integration in this area would include (1) the involvement of a majority of the VIP members in at least one mentoring relationship, and (2) the emergence of many new one-to-one mentoring ties since VIP.

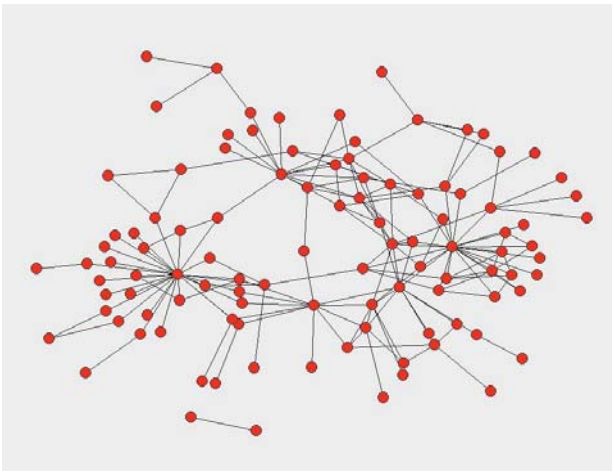
Figure 4 shows that VIP activities had integrated a large proportion of participants into the mentoring network. The number of participants involved in mentoring relationships increased from 32 to 105 since VIP. As expected, the total number of mentoring ties (175) was considerably lower than the 711 ties that existed in the network on inquiry-based teaching (Figures 1 and 4). It is important to note, however, that 150 of the mentoring relationships among participants were new ties that emerged since VIP. Consequently, network cohesion increased from a density of less than 1 percent to 2 percent of a possible 8,911 ties since program implementation.

Figure 4.—Networks on mentoring relationships: Before and since VIP



Before VIP

N=134 (Network participants= 32; Isolates = 102)
Number of possible ties = 8,911
Number of ties in network = 25
Percent of possible ties in network = 0.3%



Since VIP

N=134 (Network participants= 105; Isolates = 29)
Number of possible ties = 8,911
Number of ties in network = 175
Percent of possible ties in network = 2.0%
Number of new ties = 150

NOTE: The percent of possible ties is rounded to the nearest decimal place.

SOURCE: Survey on Collaborative Ties Within the Vertically Integrated Partnerships K–16 (VIP) Program, 2006.

The visual representation of the VIP mentoring network clearly suggests the predominance of one-to-one collaborative relations (Figure 4). Although a majority of the 134 VIP participants were involved in the mentoring relationships since VIP, the network structure is stringy and not well-integrated, which suggests that many of the individuals were linked in this way only to one other participant.

Table 4 lists the eight most connected participants in the VIP mentoring network since the program started. The UMBI faculty (participant BI9) is clearly connected, both directly and indirectly, to more VIP participants than other key players in the network.

Table 4.—Centrality measures for key players in VIP network on mentoring relationships: 2006

Randomized participant ID	Degree	Betweenness	Closeness
BI9	20.3	24.4	3.0
TO12	16.5	16.9	3.0
MC7	9.8	14.4	3.0
BC4	8.3	11.3	3.0
CP8	8.3	7.1	3.0
OT7	8.3	10.4	3.0
BC5	6.0	3.2	3.0
OT27	6.0	3.6	3.0

NOTE: Degree reflects the number of other participants who are directly linked to a person. Betweenness was used to identify persons with the most indirect links to other participants. Closeness was used to identify individuals with the shortest path of connection to other participants, with smaller estimates indicating that the person is strategically located in the network. For the purposes of this report, participant IDS were randomly after the survey data were collected, and they do not match the order of the numbers listed in the questionnaire. This was to maintain respondent anonymity.

SOURCE: Survey on Collaborative Ties Within the Vertically Integrated Partnerships K–16 (VIP) Program, 2006.

It is interesting to note that the most central network players came primarily from IHEs, with the top two leadership positions being held by faculty from UMBI and Towson (Table 4).

Increased Collaboration within Subgroups

The data presented in Table 5 reinforce the pattern of relatively high levels of faculty involvement in mentoring relationships. The number of mentoring ties among IHE participants increased from 11 to 64, for a total of 53 new ties since VIP. This was higher than the 35 new mentoring relationships that emerged among MCPS participants. Most of the mentoring activities among IHEs appeared to be concentrated at Towson, with the emergence of 18 new ties, and at MC, with a total of 10 new ties since VIP. These findings may reflect high levels of faculty involvement in learning communities and curriculum redesign at these institutions.

Table 5.—Number of ties and percent of possible ties within VIP networks on mentoring relationships: Before and since VIP

Group	Group size	Number of possible ties	Number of ties			Percent of possible ties	
			Before VIP	Since VIP	New	Before VIP	Since VIP
All institutions of higher education (IHE)	57	1,596	11	64	53	0.7	4.0
Montgomery College	10	45	0	10	10	0.0	22.2
Towson	14	91	8	26	18	8.8	28.6
University of Maryland, Baltimore County	9	36	2	9	7	5.6	25.0
University of Maryland Biotechnology Institute	14	91	1	2	1	1.1	2.2
University of Maryland, College Park and USM	10	45	0	5	5	0.0	10.6
Montgomery Public School System	77	2,926	7	42	35	0.2	1.4

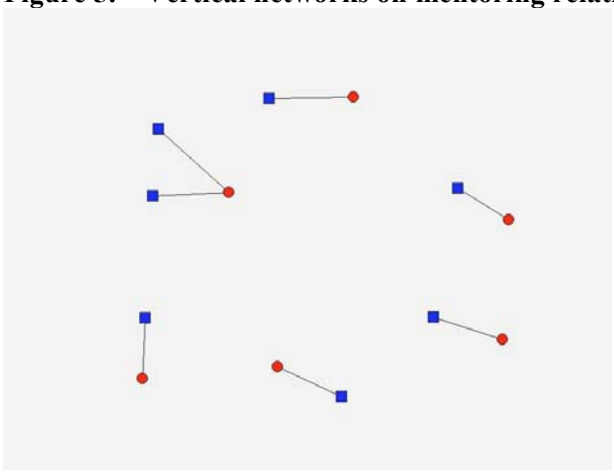
NOTE: The number of possible ties within an institution of higher education is based on the number of VIP participants in that institution. The number of possible ties for all institutions is based on the number of possible ties within each institution and among all institutions.

SOURCE: Survey on Collaborative Ties Within the Vertically Integrated Partnerships K–16 (VIP) Program, 2006

Increased Vertical Collaboration Between IHE and MCPS Participants

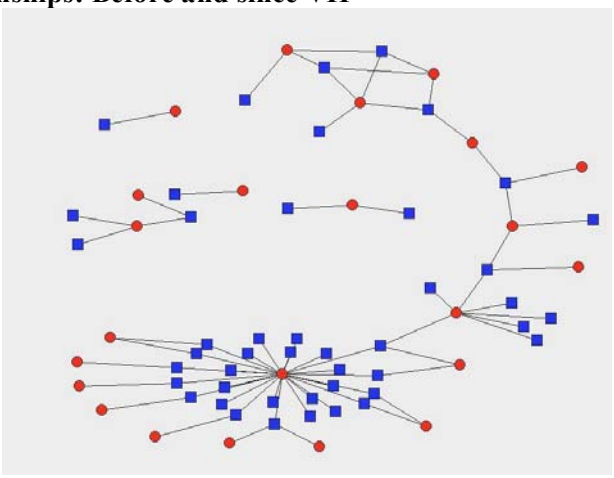
A majority of IHE and MCPS participants had crossed over educational levels to establish mentoring relationships since VIP (Figure 5). This vertical network evolved from a few scattered connections to a network of 69 mentoring ties since VIP, accounting for a total of 62 new mentoring relationships emerged between college faculty and MCPS participants. As can be expected for networks based on one-to-one relationships, there was a small increase in network cohesion since VIP, from less than 1 percent to 2 percent of a possible 4,389 ties

Figure 5.—Vertical networks on mentoring relationships: Before and since VIP



Before VIP

N=134 (57 IHEs and 77 MCPS)
Network participants = 13; Isolates = 121
Number of possible ties across groups (57x77) = 4,389
Number of ties across groups = 7
Percent of possible ties across groups= 0.2%



Since VIP

N=134 (57 IHEs and 77 MCPS)
Network participants = 68; Isolates = 66
Number of possible ties across groups (57x77) = 4,389
Number of ties across groups = 69
Percent of possible ties across groups = 1.6%
Number of new ties = 62

NOTE: The percent of possible ties is rounded to the nearest decimal place. All analyses were run on 2-mode networks with IHEs as row data (represented by circles in the network and MCPS as column data (represented by boxes in the network). Thus, the networks focus only on ties *between* IHE and MCPS participants, and they do not include ties within each of the two groups.

SOURCE: Survey on Collaborative Ties Within the Vertically Integrated Partnerships K–16 (VIP) Program, 2006.

Vertical mentoring also increased between college faculty at each of the IHEs and MCPS participants (Table 6). UMBI reported the largest number of mentoring ties with MCPS and the largest increase in such ties (from 5 to 36 ties). Network cohesion also increased from less that 1 percent to 3 percent of all possible ties in the network.

Table 6.—Number of ties between MCPS and subgroups of IHE participants and percent of possible ties in VIP mentoring networks: Before and since VIP

MCPS and subgroups of IHE participants	Group size	Number of possible ties	Number of ties			Percent of possible ties	
			Before VIP	Since VIP	New	Before VIP	Since VIP
Montgomery College and MCPS	10+77	770	2	8	6	0.3	1.0
Towson and MCPS	14+77	1,078	0	4	4	0	0.4
University of Maryland, Baltimore County and MCPS	9+77	693	0	14	14	0	2.0
University of Maryland Biotechnology Institute and MCPS	14+77	1,078	5	36	31	0.5	3.3
University of Maryland, College Park/USM and MCPS	10+77	770	0	7	7	0	0.9

NOTE: The percent of possible ties is rounded to the nearest decimal place. All analyses were run on 2-mode networks with IHEs as row data and MCPS as column data. Thus, the networks focus only on ties *between* IHE and MCPS participants, and they do not include ties within each of the two groups.

SOURCE: Survey on Collaborative Ties Within the Vertically Integrated Partnerships K–16 (VIP) Program, 2006.

Summary: Mentoring Networks

In the case of one-to-one relationships as in VIP mentoring networks, the important questions to address are whether many program participants are involved in such relationships and whether this number represents a substantial increase since VIP was initiated. While the total amount of networking remains modest, data collected from VIP participants indicate increased and more widespread participation in mentoring networks. The number of involved participants increased from 32 to 105 since VIP, and a total of 150 new mentoring connections emerged since the program started.

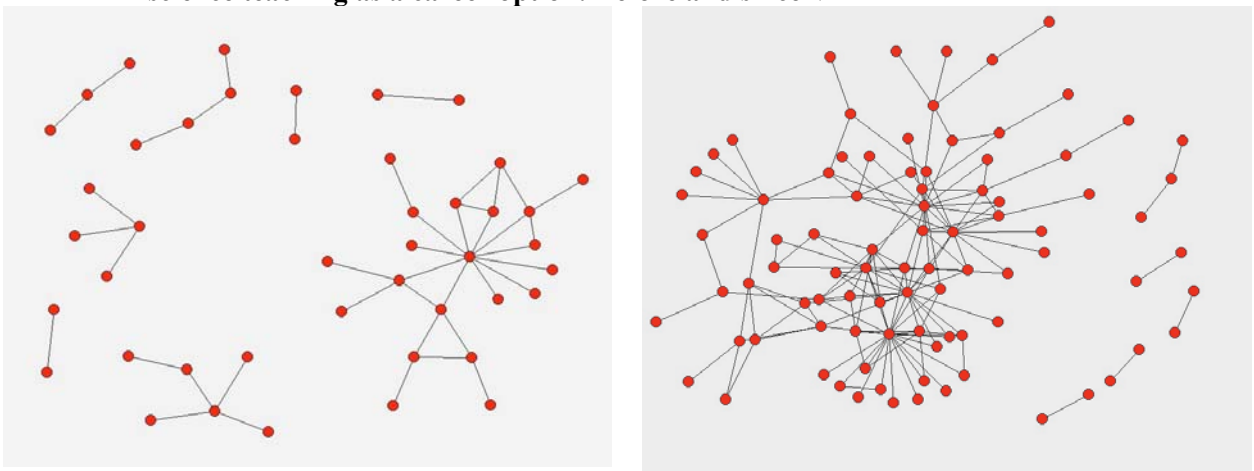
Vertical connections between the IHE and MCPS teams evolved from a few scattered relationships among 13 individuals before VIP to a somewhat disjointed but larger network of 68 participants. Faculty at UMBI and UMCP/USM were more likely than those at other IHEs to move across educational levels to establish mentoring relationships with MCPS partners.

Exposure of Undergraduates and Graduates to Teaching in Classrooms

An important program outcome of VIP is to increase the number of STEM undergraduates and graduates who choose teaching as a career option. Although IHEs have always been involved in assigning students to classroom teaching at the K–12 level, the VIP internship program for undergraduates was designed to provide opportunities specifically for science majors to learn about teaching in K–12 classrooms and to develop a realistic understanding of science teaching as a career option. IHEs hold primary responsibility for these activities, but MCPS participants may also work with IHE partners to assign and guide the classroom interns. As in the case of mentoring networks, successful VIP integration among VIP partners in exposing college students to science teaching would focus primarily on whether increases have occurred in the number of participants involved in exposing college students to teaching and in the number of new connections in this area.

Figure 6 shows that the VIP network for exposing college students to classroom teaching benefited from a preexisting but scattered connections among 44 participants and a total of 42 ties. Since VIP, many more participants were incorporated into the network and the number of professional ties increased to 154, accounting for 112 new ties since the program started. This increased participation is reflected in a corresponding increase in network cohesion from less than 1 percent to 2 percent of a possible 8,911 ties since VIP.

Figure 6.—Networks on delivering activities that expose graduate or undergraduate students to science teaching as a career option: Before and since VIP



Before VIP

N=134 (Network participants = 44; Isolates =90)
Number of possible ties = 8,911
Number of ties in network = 42
Percent of possible ties in network = 0.5%

Since VIP

N = 134 (Network participants = 88; Isolates = 46)
Number of possible ties = 8,911
Number of ties in network = 154
Percent of possible ties in network = 1.7%
Number of new ties = 112

NOTE: The percent of possible ties is rounded to the nearest decimal place.

SOURCE: Survey on Collaborative Ties Within the Vertically Integrated Partnerships K–16 (VIP) Program, 2006.

VIP participants who occupied top leadership positions in the network on exposing college students to classroom teaching are listed in Table 7. IHE participants were the most connected in this network, with most of the top 11 players being faculty members, and 7 of the 11 participants coming from UMCP/USM and UMBC. The singe most connected participant (TO12) was a faculty member from Towson.

Table 7.—Centrality measures for key players in VIP network on delivering activities that expose graduate or undergraduate students to science teaching as a career option: 2006

Randomized participant ID	Degree	Betweenness	Closeness
TO12	17.3	9.8	1.7
CP8	13.5	7.4	1.7
BC2	11.3	7.8	1.7
BC5	10.5	5.3	1.7
CP6	9.0	4.6	1.7
OF2	6.8	1.9	1.7
OT38	6.0	4.5	1.7
TO5	5.3	0.4	1.7
BC7	5.3	1.5	1.7
BC4	5.3	2.1	1.7
BI1	5.3	1.3	1.7

NOTE: Degree reflects the number of other participants who are directly linked to a person. Betweenness was used to identify persons with the most indirect links to other participants. Closeness was used to identify individuals with the shortest path of connection to other participants, with smaller estimates indicating that the person is strategically located in the network. For the purposes of this report, participant IDS were randomly after the survey data were collected, and they do not match the order of the numbers listed in the questionnaire. This was to maintain respondent anonymity.

SOURCE: Survey on Collaborative Ties Within the Vertically Integrated Partnerships K–16 (VIP) Program, 2006

Increased Collaboration Within Subgroups

The network data collected from VIP participants reinforce the notion of long-standing IHE involvement in exposing postsecondary students to science teaching (Table 8). Overall, 46 new relationships emerged among IHE participants since VIP to complement the 30 ties that were already in place before VIP. Among MCPS participants, however, most of the partnerships to expose students to teaching had emerged since VIP (22 out of 29). These differences were also reflected in network densities, which increased from 2 to 5 percent for IHEs and from less than 1 percent to 1 percent for MCPS.

Table 8.—Number of ties and percent of possible ties within VIP networks on delivering activities that expose graduate and undergraduate students to science teaching as a career option: Before and since VIP

Group	Group size	Number of possible ties	Number of ties			Percent of possible ties	
			Before VIP	Since VIP	New	Before VIP	Since VIP
All institutions of higher education (IHE)	57	1,596	30	76	46	1.9	4.8
Montgomery College	10	45	3	12	9	6.7	26.7
Towson	14	91	16	18	2	17.6	19.8
University of Maryland, Baltimore County	9	36	4	14	10	11.1	38.9
University of Maryland Biotechnology Institute	14	91	1	1	0	1.1	1.1
University of Maryland, College Park and USM	10	45	1	12	11	3.0	25.8
Montgomery Public School System	77	2,926	7	29	22	0.2	1.0

NOTE: The number of possible ties within an institution of higher education is based on the number of VIP participants in that institution. The number of possible ties for all institutions is based on the number of possible ties within each institution and among all institutions.

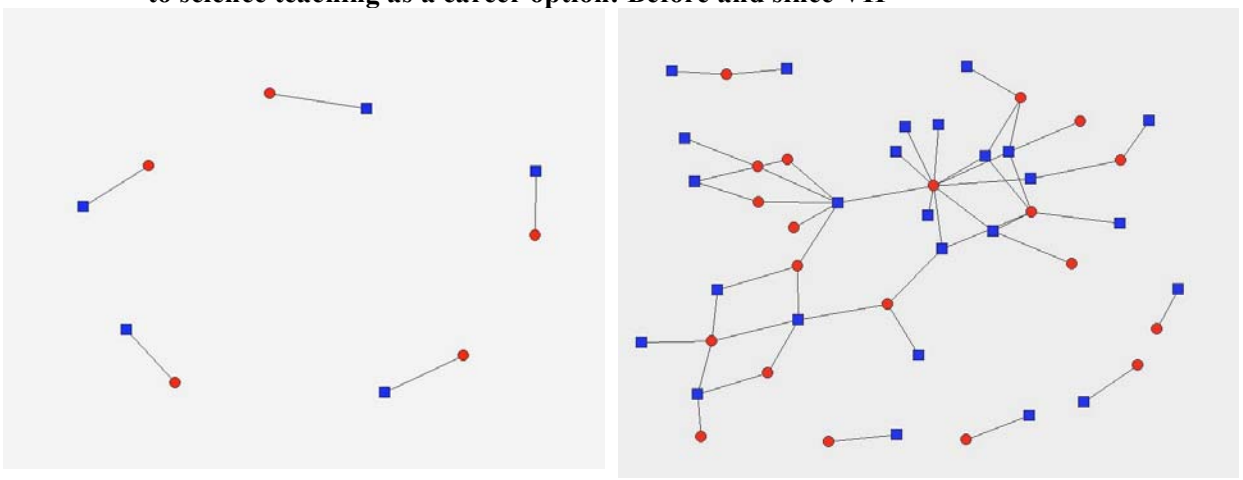
SOURCE: Survey on Collaborative Ties Within the Vertically Integrated Partnerships K–16 (VIP) Program, 2006

Among IHEs, the faculty at Towson clearly took a lead role in working collaboratively, before and since VIP, to provide opportunities for undergraduates to learn about classroom teaching. Most of the 18 professional ties on exposing postsecondary students to science teaching were in place at Towson prior to VIP. Substantial collaboration also occurred among faculty at the other IHEs except UMBI, which is not an undergraduate teaching institution.

Increased Vertical Collaboration Between IHE and MCPS Participants

Collaborative experiences in exposing students to teaching, although based on relatively small networks, seem from the data to represent a relatively new area of professional relationships between this group of college faculty and MCPS participants. Figure 7 shows that almost all of the collaborative ties between IHEs and MCPS in exposing undergraduate and graduate students to teaching emerged as a result of VIP activities; of the 49 ties since VIP, 44 were new partnerships. In addition, the number of participants involved in exposing college students to teaching remained relatively low since VIP (46).

Figure 7.—Vertical networks on delivering activities that expose graduate or undergraduate students to science teaching as a career option: Before and since VIP



Before VIP

N=134 (57 IHEs and 77 MCPS)
Network participants = 10; Isolates = 124
Number of possible ties across groups (57x77) = 4,389
Number of ties across groups = 5
Percent of possible ties across groups= 0.5%

Since VIP

N=134 (57 IHEs and 77 MCPS)
Network participants = 46; Isolates = 88
Number of possible ties across groups (57x77) = 4,389
Number of ties across groups = 49
Percent of possible ties across groups = 1.1%
Number of new ties = 44

NOTE: The percent of possible ties is rounded to the nearest decimal place. All analyses were run on 2-mode networks with IHEs as row data (represented by circles in the network and MCPS as column data (represented by boxes in the network). Thus, the networks focus only on ties *between* IHE and MCPS participants, and they do not include ties within each of the two groups.

SOURCE: Survey on Collaborative Ties Within the Vertically Integrated Partnerships K–16 (VIP) Program, 2006.

Vertical networking between each IHE and MCPS also occurred at relatively low levels (Table 9). Since VIP, the number of vertical connections between UMBC and MCPS participants increased from 1 to 19 ties, and it increased from 1 to 12 ties for the network between UMCP/USM and MCPS participants.

Table 9.—Number of ties between MCPS and subgroups of IHE participants and percent of possible ties in VIP networks on delivering activities that expose graduate or undergraduate students to science teaching as a career option: Before and since VIP

Group of IHE and MCPS participants	Group size	Number of possible ties	Number of ties			Percent of possible ties	
			Before VIP	Since VIP	New	Before VIP	Since VIP
Montgomery College and MCPS	10+77	770	1	1	0	0.1	0.1
Towson and MCPS	14+77	1,078	0	7	7	0	0.7
University of Maryland, Baltimore County and MCPS	9+77	693	1	19	18	0.1	2.7
University of Maryland, College Park/USM and MCPS	14+77	1,078	2	10	8	0.2	0.9
University of Maryland, College Park/USM and MCPS	10+77	770	1	12	11	0.1	1.6

NOTE: The percent of possible ties is rounded to the nearest decimal place. All analyses were run on 2-mode networks with IHEs as row data and MCPS as column data. Thus, the networks focus only on ties *between* IHE and MCPS participants, and they do not include ties within each of the two groups.

SOURCE: Survey on Collaborative Ties Within the Vertically Integrated Partnerships K–16 (VIP) Program, 2006.

Summary: Networks on Exposing College Students to Teaching

As in mentoring networks, the targeted nature of exposing students to teaching is expected to yield smaller and less integrated networks than those that emerge from more large-scale activities such as learning communities and conferences on inquiry-based teaching and learning. Visual representation and network statistics from the survey data reinforce this expectation. Since VIP, the number of participants involved in exposing college students to science teaching doubled (from 44 to 88 participants) and the number of ties increased from 42 to 154 ties, accounting a total of 112 new connections.

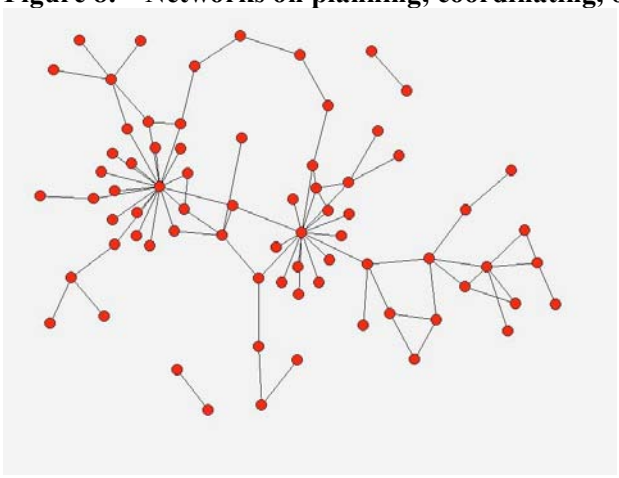
Vertical collaboration between IHE and MCPS participants remained relatively low since VIP, with the network increasing from 5 ties among 10 participants to 49 ties among 46 participants. Thus, collaborative relationships in exposing college students to science teaching seemed to be concentrated at either the IHE or MCPS level and did not involve much networking across educational levels. This finding is reinforced by the concentration of leadership roles among IHE participants. In the overall network, a majority of the top leadership positions were held by IHE participants and by college faculty at UMCP/USM and UMBC, in particular.

Planning, Coordinating, and Managing VIP Activities

VIP activities must be planned and implemented to effectively reach and influence program participants and to realize program goals. Because of the wide range of activities and the large number of institutions involved at different educational levels, effective coordination may require coordinated efforts from many persons within VIP's administrative arms and within IHEs and MCPS. Indeed, VIP leadership was deliberately made as democratic as possible, involving teachers and faculty in planning and delivering most VIP projects. Thus, indicators of successful integration would include widespread involvement in these activities and substantial increases in the number of new ties since the program started.

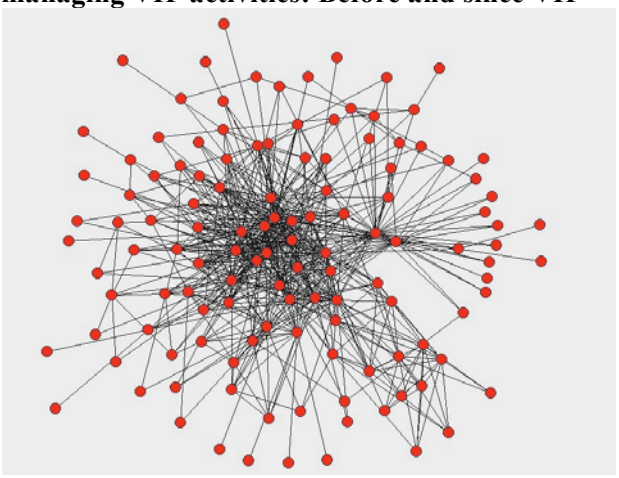
Figure 8 shows that a total of 538 new connections emerged since VIP to plan, coordinate, or manage professional activities among the 134 VIP participants. Many of the VIP participants were already involved in planning and coordinating such activities among faculty and MCPS teachers, although the network was relatively loosely connected with 85 ties among 73 of the participants. Since VIP, however, almost all of the participants were incorporated into collaborative relationships to plan, coordinate, or manage VIP activities, and the overall network cohesion increased from 1 percent to 7 percent of a possible 8,911 ties.

Figure 8.—Networks on planning, coordinating, or managing VIP activities: Before and since VIP



Before VIP

N=134 (Network participants = 73; Isolates = 61)
Number of possible ties = 8,911
Number of ties in network = 85
Percent of possible ties in network = 1.0%



Since VIP

N = 134 (Network participants = 125; Isolates = 9)
Number of possible ties = 8,911
Number of ties in network = 623
Percent of possible ties in network = 7.0%
Number of new ties = 538

NOTE: The percent of possible ties is rounded to the nearest decimal place.

SOURCE: Survey on Collaborative Ties Within the Vertically Integrated Partnerships K–16 (VIP) Program, 2006.

Key players in the network of planning, coordinating, or managing VIP activities were spread across IHEs and MCPS, with 11 of the top 13 players coming from IHEs (Table 10). As expected, the most connected person was located at the MPCS science office, followed by an MCPS participant and a UMBI participant.

Table 10.—Centrality measures for key players in VIP network on planning, coordinating, or managing VIP activities: 2006

Randomized participant ID	Degree	Betweenness	Closeness
OF2	40.6	11.9	9.4
OT7	33.8	9.8	9.4
BI9	30.8	16.7	9.3
MC7	28.6	6.2	9.3
OT46	27.1	4.8	9.2
TO12	27.0	8.8	9.3
MC5	26.3	7.7	9.3
OT47	26.3	4.4	9.2
OT17	26.3	5.0	9.3
CP8	23.3	3.6	9.3
OT11	21.8	2.5	9.2
OF1	20.3	1.0	9.2
OT48	20.3	1.7	9.1

NOTE: Degree reflects the number of other participants who are directly linked to a person. Betweenness was used to identify persons with the most indirect links to other participants. Closeness was used to identify individuals with the shortest path of connection to other participants, with smaller estimates indicating that the person is strategically located in the network. For the purposes of this report, participant IDS were randomly after the survey data were collected, and they do not match the order of the numbers listed in the questionnaire. This was to maintain respondent anonymity.

SOURCE: Survey on Collaborative Ties Within the Vertically Integrated Partnerships K–16 (VIP) Program, 2006

Increased Collaboration Within Subgroups

Prior to VIP, the faculty at IHEs were connected in a network of 41 partnerships to plan, coordinate, and manage professional activities for participants (Table 11). However, a total of 146 new ties emerged among faculty, and the network cohesion increased from 3 percent to 12 percent of a possible 8,911 ties. Although MCPS participants had fewer collaborative networks than IHEs prior to VIP, professional networking since VIP produced 223 new ties within this group. This finding is consistent with the need to plan and coordinate many VIP activities among MCPS participants, including conferences, summer institutes, and workshops, and the intentional inclusion of Master Science Teachers in this process.

Table 11.—Number of ties and percent of possible ties within VIP networks on planning, coordinating, or managing VIP activities: Before and since VIP

Group	Group size	Number of possible ties	Number of ties			Percent of possible ties	
			Before VIP	Since VIP	New	Before VIP	Since VIP
All institutions of higher education (IHE)	57	1,596	41	187	146	2.6	11.7
Montgomery College	10	45	5	21	16	11.1	46.7
Towson	14	91	12	50	38	13.2	55.0
University of Maryland, Baltimore County	9	36	3	17	14	8.3	47.2
University of Maryland Biotechnology Institute	14	91	16	25	9	17.6	27.5
University of Maryland, College Park and USM	10	45	1	14	13	1.5	30.3
Montgomery Public School System	77	2,926	18	241	223	0.6	8.2

NOTE: The number of possible ties within an institution of higher education is based on the number of VIP participants in that institution. The number of possible ties for all institutions is based on the number of possible ties within each institution and among all institutions.

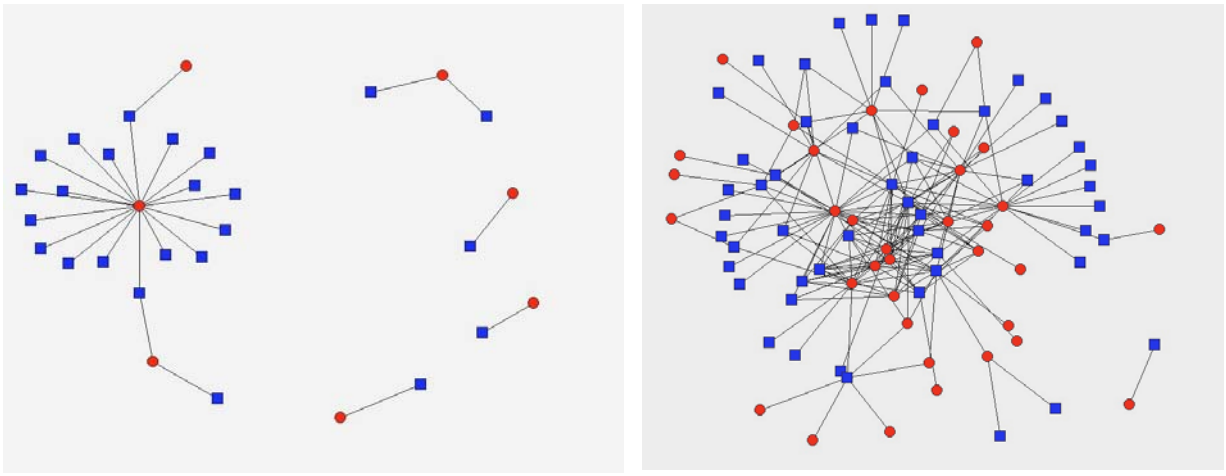
SOURCE: Survey on Collaborative Ties Within the Vertically Integrated Partnerships K–16 (VIP) Program, 2006:

Among IHEs, Towson reported the highest activity levels for planning, coordinating, and managing VIP activities, with a total of 38 new ties being established since the program started (Table 11). This finding is tied to the establishment of key VIP activities at Towson in the early stages of the program. Substantial networking also occurred within MC, UMBC, and UMCP/USM, ranging from 13 to 16 new ties.

Increased Vertical Collaboration Between IHE and MCPS Participants

Figure 9 illustrates vertical networks on planning, coordinating, and managing VIP activities. Prior to VIP, 31 of the IHE and MCPS participants had worked in K–16 relationships on these kinds of activities. Since VIP, many new vertical relationships emerged among participants who had not worked with each other before, resulting in a total of 169 new ties. Thus, the number of ties across the two groups increased from 26 to 195 and the network cohesion increased from less than 1 percent to 4 percent of a possible 8,911 ties in the network.

Figure 9.—Vertical networks on planning, coordinating, or managing VIP activities: Before and since VIP



Before VIP

N=134 (57 IHEs and 77 MCPS)
Network participants= 31; Isolates = 103
Number of possible ties across groups (57x77) = 4,389
Number of ties across groups = 26
Percent of possible ties across groups= 0.6%

Since VIP

N=134 (57 IHEs and 77 MCPS)
Network participants= 86; Isolates = 48)
Number of possible ties across groups (57x77) = 4,389
Number of ties across groups = 195
Percent of possible ties across groups = 4.4%
Number of new ties = 169

NOTE: The percent of possible ties is rounded to the nearest decimal place. All analyses were run on 2-mode networks with IHEs as row data (represented by circles in the network and MCPS as column data (represented by boxes in the network). Thus, the networks focus only on ties *between* IHE and MCPS participants, and they do not include ties within each of the two groups.

SOURCE: Survey on Collaborative Ties Within the Vertically Integrated Partnerships K–16 (VIP) Program, 2006.

There was substantial collaboration between faculty at each IHE and MCPS participants to plan, coordinate, and manage VIP activities (Table 12). The total number of ties between these groups ranged from 32 ties between UMBI and MCPS participants to 44 ties each between MC and MCPS participants and between UMCP/USM and MCPS participants.

Table 12.—Number of ties between MCPS and subgroups of IHE participants and percent of possible ties in VIP networks on planning, coordinating, or managing VIP activities: Before and since VIP

MCPS and subgroups of IHE participants	Group size	Number of possible ties	Number of ties			Percent of possible ties	
			Before VIP	Since VIP	New	Before VIP	Since VIP
Montgomery College and MCPS	10+77	770	19	44	25	2.5	5.7
Towson and MCPS	14+77	1,078	0	37	37	0	3.4
University of Maryland, Baltimore County and MCPS	9+77	693	2	37	35	0.3	5.4
University of Maryland, Biotechnology Institute and MCPS	14+77	1,078	5	32	27	0.5	3.0
University of Maryland, College Park/USM and MCPS	10+77	770	0	44	44	0	5.7

NOTE: The percent of possible ties is rounded to the nearest decimal place. All analyses were run on 2-mode networks with IHEs as row data and MCPS as column data. Thus, the networks focus only on ties *between* IHE and MCPS participants, and they do not include ties within each of the two groups.

SOURCE: Survey on Collaborative Ties Within the Vertically Integrated Partnerships K–16 (VIP) Program, 2006.

Summary: Networks on Planning, Coordinating, and Managing VIP Activities

Planning, coordinating, and managing the wide range of VIP activities over the years is expected to involve coordinated efforts of many of the participants, both at the secondary and postsecondary levels. Thus, the data collected from participants show that most of the participants were incorporated into the overall network of planners, coordinators, and managers of various VIP activities. In addition, the number of professional relationships increased from 85 to 623, for a total of 538 new connections, and network cohesion increased from 1 to 7 percent of all possible ties.

Conclusion

The primary goal of this study was to document VIP's progress toward establishing new connections and building integrated collaborative groups in four program-relevant activity areas—inquiry-based teaching and learning, mentoring relationships, exposing undergraduates to science teaching as a career option, and planning and managing VIP activities. Because this study is a first attempt to describe VIP collaborative networks, there are no quantitative benchmarks by which to assess successes or failures. However, VIP program goals and activities provided a set of guidelines that were used as diagnostic tool to measure and understand VIP networks. Based on these qualitative indicators, we would expect (1) increased participation in professional networks since VIP, (2) the emergence of many new professional relationships since VIP, (3) more integrated networks, as a result of new entrants to the network and increased interaction among existing members, and (4) key leadership to be spread across subgroups in the overall network.

The graphical representation of collaborative relationships and key network measures all indicate considerable progress toward establishing new relationships and building integrated professional partnerships in each of the four program-relevant activity areas. VIP project activities appeared to have successfully integrated all or most of the 134 participants into professional networks, as in the case of networks that evolved from large-scale project activities such as information sharing on inquiry-based teaching and the planning and management of VIP activities. Networks that involve more one-to-one relationships, such as mentoring relationships and exposing college students to science teaching in classrooms, reflected lower levels of collaborative activity. For example, all 134 VIP participants were involved in sharing information on inquiry-based teaching, while only a large majority (105) were involved in mentoring relationships.

Professional networks also became more integrated since VIP, due to the emergence of many new connections initiated by new entrants and existing network members. Consistent with program goals of

infusing inquiry-based teaching into K–16 classrooms through widespread program activities, the number of new professional ties was higher for networks on inquiry-based teaching (517) and networks on planning and coordinating VIP activities (538) than it was for mentoring networks (150) and networks on exposing college students to science teaching (112). These differences were also reinforced in the graphical representations and network densities that highlight the shifts from scattered connections before VIP to larger and more densely connected networks since VIP.

Vertical networks between the IHE and MCPS teams grew at a slower pace and were generally less integrated than overall VIP networks. These networks were also less likely to benefit from preexisting professional relationships among participants. Nevertheless, a large number of IHE and MCPS participants crossed over education levels to form K–16 partnerships, and these connections evolved from small or nonexistent networks to larger and more connected networks since VIP.

While causal inferences cannot be made, the study findings demonstrate significant progress in creating new partnerships among VIP participants. The sociograms and network statistics illustrate the usefulness of applying SNA to document the levels and patterns of professional collaboration and to detect areas of strong or weak integration. The findings from this study could be used as a benchmarking tool for longitudinal studies that describe how social relations change over time and to explore how changes in those relationships are associated with changes in other program outcomes, such as increased use of inquiry-based teaching in K–16 classrooms.

SNA made visible the unseen connections among VIP participants who come from different institutions. However, the results from this study should be used discreetly and with caution, especially in areas where the data are not fully explored. For example, this study is limited to a focus on whether or not professional relations existed in four specific program-relevant activity areas. It does not examine the strength of the relationships, such as the number of interactions that occurred over the past year. In addition, while individual-level network measures help to identify the central network connectors, and while network isolates may highlight specific areas of program weaknesses and areas for future consideration, the study did not explore these network structures and their implications for program effectiveness.

In summary, the study findings are most useful in providing an understanding of the capacity of VIP for promoting professional relationships. The network structures tell an important story about how well VIP partners are connected. Understanding these structures and deriving insights on where problems might be located provide a useful starting point for exploring and addressing those problems in appropriate ways. For example, areas of relatively low connection (e.g., vertical collaboration on inquiry-based teaching) may indicate the need for increased program focus on K–16 activities between IHE and MCPS participants. A

potential next step is to further explore the nature of the relationships that have emerged and the meaning of the conclusions drawn from the data.

References

Durland, M. (2005). Exploring and Understanding Relationships. In B. Durland and K. Fredericks (eds.), *Social Network Analysis in Program Evaluation: New Directions for Evaluation*, No. 107. Jossey-Bass.

Evaluation of the Vertically Integrated Partnerships (VIP) VIP K–16 reports for Years 2, 3, and 4 are available online at http://vipk16.mspnet.org/index.cfm/highlights.

Fredericks, K., and Durland, M. (2005). The Historical Evolution and Basic Concepts of Social Network Analysis. In B. Durland and K. Fredericks (eds.), *Social Network Analysis in Program Evaluation: New Directions for Evaluation*, No. 107. Jossey-Bass

APPENDIX A: QUESTIONNAIRE

Survey on Collaborative Ties Within the Vertically Integrated Partnership (VIP) Program

Institution/School: _____

Name of person completing form: _____ **Telephone:** _____

Email (If different from our records) _____

Please return the completed survey using ONE of the following options:

(1) **Return the completed paper questionnaire by MAIL to**:

WESTAT
VIP survey
Room TA 2096
1650 Research Boulevard
Rockville, Maryland 20850

(2) **Return the completed paper questionnaire by FedEx**. If you prefer this option, please e-mail us the postal address of your school or institution, and we will mail you a prepaid FedEx envelope

(3) **Return a completed electronic questionnaire by E-MAIL**. Please enter your responses directly into the attached questionnaire, **save the file**, and return the saved file to us by e-mail. To guard against typing errors, please print and review a copy of the completed questionnaire before e-mailing it to us.

If you have any questions, contact: Dr. Basmat Parsad at 800-937-8281, ext. 8222 or by email at basmatparsad@westat.com.

THE SURVEY CONTINUES ON THE NEXT WORKSHEET.

Your cooperation is needed to make the results of this survey comprehensive, accurate, and timely. All information you provide will be treated as confidential and used only for research or statistical purposes. Any information publicly released, such as statistical summaries, will be in a format that does not personally identify you.

1. Which of the VIP participants did you work with in sharing or developing new teaching strategies or materials that emphasize inquiry-based teaching and learning? Consider substantive or ongoing collaboration, including collaborative activities during workshops or formal professional development. *Place an X in the first column if you worked with the person before the VIP program and an X in the second column if you worked with the person during the program.*

Before VIP program	During VIP program	Participants	
		Montgomery College	
		Jessica Baack	1
		Jeff Chyatte	2
		Donald Day	3
		Terry Dyroff	4
		Hal Hultman	5
		Bill Krayer	6
		Ijeoma Otigbuo	7
		Deb Poese	8
		Carolyn Schick	9
		Nevart Tahmazian	10
		Towson	
		Carol Berkower	11
		Larry Boucher	12
		Sarah Bruce	13
		Rachel Burks	14
		Brian Fath	15
		Sarah Haines	16
		Steven Lev	17
		Luz Mangurian	18
		Brian Masters	19
		Roland Roberts	20
		Lev Ryzhkov	21
		Cody Sandifer	22
		Joseph Topping	23
		Leon Ukens	24
		UMBC	
		Alesia Hovatter	25
		Diane Lee	26
		Eric Anderson	27
		Gale Seiler	28
		John Zweck	29
		Mark Perks	30
		Marko Bulmer	31
		Michele Wolff	32
		Phil Sokolove	33
		UMBI	
		Gary Coleman	34
		Allen Place	35
		Anwar Huq	36
		Feng Chen	37
		Frank Robb	38
		Gerardo Vasta	39
		Jim (Chao-Jin) Du	40
		Kevin Sowers	41
		M. Robert Belas	42
		Rosemary Jagus	43
		Russell Hill	44
		Sandy Honda	45
		Shiladittya Dassarma	46
		Yonathan Zohar	47
		UMCP	
		Spencer Benson	48
		Phil Deshong	49
		Mary-Ann McDermit-Jones	50
		Mateo Munzo	51
		Joelle Presson	52
		Steve Prince	53
		Anne Smith	54
		UMS	
		David May	55
		Nancy Shapiro	56
		Donald Langenberg	57
		MCPS Central Office	
		Gary Hedges	58
		Mike Szesze	59

VIP Participant List (Continued)

Before VIP program	During VIP program	Participants	Name of School (alphabetically ordered)	
		Teachers in ExPERT Program at COMB		
		Ken Halperin	Bethesda-Chevy Chase	60
		Vadella Ellis-Pope	Blake	61
		David McGaffin	Damascus	62
		Jack Hathaway	Damascus	63
		Jodi Hathaway	Damascus	64
		Lisa Voketitis	Damascus	65
		Jason Gvazdauskas	Damascus	66
		Christina Schwalm	Kennedy	67
		John Hendrix	Kennedy	68
		Katherine Sander	Kennedy	69
		Jennifer Petering	Kennedy, Magruder	70
		Rosetta Jordan	Magruder	71
		Lance Scott	McKenney Hills Alternative	72
		Edward Singleton	McKenney Hills Alternative	73
		Todd Malkoff	McKenney Hills Alternative	74
		Meghan Milanchus	Northwest, Lakelands Park	75
		Catherine Ulicny	Paint Branch	76
		Jeneen Stewart	Paint Branch	77
		Sana Pasha	Paint Branch, Springbrook	78
		Howard Putterman	Quince Orchard	79
		Carrie Dischiave	Rockville	80
		Clarie Lefebvre	Senca Valley	81
		Nicole Holmes	Seneca Valley, Sherwood	82
		Seth Kenton	Sherwood	83
		Christina Baldwin	Sherwood	84
		Steve Shifflett	Walter Johnson	85
		Other MCPS Teachers		
		Janet Kovach	Alternative Program	86
		Chris Kennedy	B-CC	87
		Mike McGarry	B-CC	88
		Rachel Sears	Bethesda-Chevey Chase	89
		Dan Levin	Blair	90
		Jennifer Kempf	Blair	91
		Paul Kroeger	Blake	92
		Mike Myers	Blake	93
		Daxel Tarner	Blake	94
		Clinton Brown	Churchill	95
		Kim Ferlick	Churchill	96
		Elena Pisciotta	Damascus HS	97
		David Culpepper	Damascus HS	98
		Bettie Jo Chronister	Damascus HS	99
		Jill Steinberg	Damascus	100
		Beth Daniels	Einstein	101
		Joelle Miller	Einstein	102
		Gloria Hearne	Gaithersburg	103
		Patrick O'Connor	Gaithersburg	104
		Wayne Breslyn	Gaithersburg	105
		Kathryn Sander	Kennedy	106
		Donna Considine	Magruder	107
		Meredith Zanni	Magruder	108
		Joseph Thomas	Mark Twain	109
		Richard Menendez	Northwest HS	110
		Erol Miller	Northwood	111
		Jill Coutts	Northwood HS	112
		Niambi Wills	Northwood HS	113
		Toya Jones	Northwood HS	114
		David Gillespie	Poolesville	115
		Kathy Bettinger	Poolesville	116
		Dorothy Harris	Quince Orchard	117
		Lori Martioski	Richard Montgomery	118
		Kevin Martz	Richard Montgomery	119
		Gregg Gochnour	Rockville	120
		Natasha Ezerski	Seneca Valley	121
		Cathy Cross	Sherwood HS	122
		Linda Loomis	Sherwood HS	123
		Diane Niedzialkowski	Springbrook	124
		Serenity Bush	Springbrook	125
		Vickie Kroeger	Springbrook	126
		Jeffrey Charuhas	Thomas S. Wooton HS	127
		Bill Morris	Walter Johnson	128
		Monica Crimino	Watkins Mill	129
		Greg Letterman	Watkins Mill	130
		Dedra Jones-Mattox	Wheaton	131
		Lisa Taschenberger (Gerhardt)	Wheaton	132
		Marie Paul	Wheaton HS	133
		Don Demember	Whitman	134
		Stuart Shifrin	Whitman	135
		Chris Canham	Wootton	136
		Susan Phillips	Wootton	137

2. Which of the VIP participants did you work with in a mentoring relationship (either to mentor or be mentored) in inquiry-based teaching or learning? Consider substantive or ongoing collaboration, including collaborative activities during workshops or formal professional development. *Place an X in the first column if you worked with the person before the VIP program and an X in the second column if you worked with the person during the program.*

Before VIP program	During VIP program	Participants	
		Montgomery College	
		Jessica Baack	1
		Jeff Chyatte	2
		Donald Day	3
		Terry Dyroff	4
		Hal Hultman	5
		Bill Krayer	6
		Ijeoma Otigbuo	7
		Deb Poese	8
		Carolyn Schick	9
		Nevart Tahmazian	10
		Towson	
		Carol Berkower	11
		Larry Boucher	12
		Sarah Bruce	13
		Rachel Burks	14
		Brian Fath	15
		Sarah Haines	16
		Steven Lev	17
		Luz Mangurian	18
		Brian Masters	19
		Roland Roberts	20
		Lev Ryzhkov	21
		Cody Sandifer	22
		Joseph Topping	23
		Leon Ukens	24
		UMBC	
		Alesia Hovatter	25
		Diane Lee	26
		Eric Anderson	27
		Gale Seiler	28
		John Zweck	29
		Mark Perks	30
		Marko Bulmer	31
		Michele Wolff	32
		Phil Sokolove	33
		UMBI	
		Gary Coleman	34
		Allen Place	35
		Anwar Huq	36
		Feng Chen	37
		Frank Robb	38
		Gerardo Vasta	39
		Jim (Chao-Jin) Du	40
		Kevin Sowers	41
		M. Robert Belas	42
		Rosemary Jagus	43
		Russell Hill	44
		Sandy Honda	45
		Shiladittya Dassarma	46
		Yonathan Zohar	47
		UMCP	
		Spencer Benson	48
		Phil Deshong	49
		Mary-Ann McDermit-Jones	50
		Mateo Munzo	51
		Joelle Presson	52
		Steve Prince	53
		Anne Smith	54
		UMS	
		David May	55
		Nancy Shapiro	56
		Donald Langenberg	57
		MCPS Central Office	
		Gary Hedges	58
		Mike Szesze	59

VIP Participant List (Continued)

Before VIP program	During VIP program	Participants at Schools	Name of School (alphabetically ordered)	
		Teachers in ExPERT Program at COMB		
		Ken Halperin	Bethesda-Chevy Chase	60
		Vadella Ellis-Pope	Blake	61
		David McGaffin	Damascus	62
		Jack Hathaway	Damascus	63
		Jodi Hathaway	Damascus	64
		Lisa Voketitis	Damascus	65
		Jason Gvazdauskas	Damascus	66
		Christina Schwalm	Kennedy	67
		John Hendrix	Kennedy	68
		Katherine Sander	Kennedy	69
		Jennifer Petering	Kennedy, Magruder	70
		Rosetta Jordan	Magruder	71
		Lance Scott	McKenney Hills Alternative	72
		Edward Singleton	McKenney Hills Alternative	73
		Todd Malkoff	McKenney Hills Alternative	74
		Meghan Milanchus	Northwest, Lakelands Park	75
		Catherine Ulicny	Paint Branch	76
		Jeneen Stewart	Paint Branch	77
		Sana Pasha	Paint Branch, Springbrook	78
		Howard Putterman	Quince Orchard	79
		Carrie Dischiave	Rockville	80
		Clarie Lefebvre	Senca Valley	81
		Nicole Holmes	Seneca Valley, Sherwood	82
		Seth Kenton	Sherwood	83
		Christina Baldwin	Sherwood	84
		Steve Shifflett	Walter Johnson	85
		Other MCPS Teachers		
		Janet Kovach	Alternative Program	86
		Chris Kennedy	B-CC	87
		Mike McGarry	B-CC	88
		Rachel Sears	Bethesda-Chevey Chase	89
		Dan Levin	Blair	90
		Jennifer Kempt	Blair	91
		Paul Kroeger	Blake	92
		Mike Myers	Blake	93
		Daxel Tarner	Blake	94
		Clinton Brown	Churchill	95
		Kim Ferlick	Churchill	96
		Elena Pisciotta	Damascus HS	97
		David Culpepper	Damascus HS	98
		Bettie Jo Chronister	Damascus HS	99
		Jill Steinberg	Damascus	100
		Beth Daniels	Einstein	101
		Joelle Miller	Einstein	102
		Gloria Hearne	Gaithersburg	103
		Patrick O'Connor	Gaithersburg	104
		Wayne Breslyn	Gaithersburg	105
		Kathryn Sander	Kennedy	106
		Donna Considine	Magruder	107
		Meredith Zanni	Magruder	108
		Joseph Thomas	Mark Twain	109
		Richard Menendez	Northwest HS	110
		Erol Miller	Northwood	111
		Jill Coutts	Northwood HS	112
		Niambi Wills	Northwood HS	113
		Toya Jones	Northwood HS	114
		David Gillespie	Poolesville	115
		Kathy Bettinger	Poolesville	116
		Dorothy Harris	Quince Orchard	117
		Lori Martioski	Richard Montgomery	118
		Kevin Martz	Richard Montgomery	119
		Gregg Gochnour	Rockville	120
		Natasha Ezerski	Seneca Valley	121
		Cathy Cross	Sherwood HS	122
		Linda Loomis	Sherwood HS	123
		Diane Niedzialkowski	Springbrook	124
		Serenity Bush	Springbrook	125
		Vickie Kroeger	Springbrook	126
		Jeffrey Charuhas	Thomas S. Wooton HS	127
		Bill Morris	Walter Johnson	128
		Monica Crimino	Watkins Mill	129
		Greg Letterman	Watkins Mill	130
		Dedra Jones-Mattox	Wheaton	131
		Lisa Taschenberger (Gerhardt)	Wheaton	132
		Marie Paul	Wheaton HS	133
		Don Demember	Whitman	134
		Stuart Shifrin	Whitman	135
		Chris Canham	Wootton	136
		Susan Phillips	Wootton	137

3. Which of the VIP participants did you work with on delivering activities that expose graduate or undergraduate students to science teaching as a career option? Consider substantive or ongoing collaboration, including collaborative activities during workshops or formal professional development. *Place an X in the first column if you worked with the person before the VIP program and an X in the second column if you worked with the person during the program.*

Before VIP program	During VIP program	Participants	
		Montgomery College	
		Jessica Baack	1
		Jeff Chyatte	2
		Donald Day	3
		Terry Dyroff	4
		Hal Hultman	5
		Bill Krayer	6
		Ijeoma Otigbuo	7
		Deb Poese	8
		Carolyn Schick	9
		Nevart Tahmazian	10
		Towson	
		Carol Berkower	11
		Larry Boucher	12
		Sarah Bruce	13
		Rachel Burks	14
		Brian Fath	15
		Sarah Haines	16
		Steven Lev	17
		Luz Mangurian	18
		Brian Masters	19
		Roland Roberts	20
		Lev Ryzhkov	21
		Cody Sandifer	22
		Joseph Topping	23
		Leon Ukens	24
		UMBC	
		Alesia Hovatter	25
		Diane Lee	26
		Eric Anderson	27
		Gale Seiler	28
		John Zweck	29
		Mark Perks	30
		Marko Bulmer	31
		Michele Wolff	32
		Phil Sokolove	33
		UMBI	
		Gary Coleman	34
		Allen Place	35
		Anwar Huq	36
		Feng Chen	37
		Frank Robb	38
		Gerardo Vasta	39
		Jim (Chao-Jin) Du	40
		Kevin Sowers	41
		M. Robert Belas	42
		Rosemary Jagus	43
		Russell Hill	44
		Sandy Honda	45
		Shiladittya Dassarma	46
		Yonathan Zohar	47
		UMCP	
		Spencer Benson	48
		Phil Deshong	49
		Mary-Ann McDermit-Jones	50
		Mateo Munzo	51
		Joelle Presson	52
		Steve Prince	53
		Anne Smith	54
		UMS	
		David May	55
		Nancy Shapiro	56
		Donald Langenberg	57
		MCPS Central Office	
		Gary Hedges	58
		Mike Szesze	59

VIP Participant List (Continued)

Before VIP program	During VIP program	Participants at Schools	Name of School (alphabetically ordered)	
		Teachers in ExPERT Program at COMB		
		Ken Halperin	Bethesda-Chevy Chase	60
		Vadella Ellis-Pope	Blake	61
		David McGaffin	Damascus	62
		Jack Hathaway	Damascus	63
		Jodi Hathaway	Damascus	64
		Lisa Voketitis	Damascus	65
		Jason Gvazdauskas	Damascus	66
		Christina Schwalm	Kennedy	67
		John Hendrix	Kennedy	68
		Katherine Sander	Kennedy	69
		Jennifer Petering	Kennedy, Magruder	70
		Rosetta Jordan	Magruder	71
		Lance Scott	McKenney Hills Alternative	72
		Edward Singleton	McKenney Hills Alternative	73
		Todd Malkoff	McKenney Hills Alternative	74
		Meghan Milanchus	Northwest, Lakelands Park	75
		Catherine Ulicny	Paint Branch	76
		Jeneen Stewart	Paint Branch	77
		Sana Pasha	Paint Branch, Springbrook	78
		Howard Putterman	Quince Orchard	79
		Carrie Dischiave	Rockville	80
		Clarie Lefebvre	Senca Valley	81
		Nicole Holmes	Seneca Valley, Sherwood	82
		Seth Kenton	Sherwood	83
		Christina Baldwin	Sherwood	84
		Steve Shifflett	Walter Johnson	85
		Other MCPS Teachers		
		Janet Kovach	Alternative Program	86
		Chris Kennedy	B-CC	87
		Mike McGarry	B-CC	88
		Rachel Sears	Bethesda-Chevey Chase	89
		Dan Levin	Blair	90
		Jennifer Kempt	Blair	91
		Paul Kroeger	Blake	92
		Mike Myers	Blake	93
		Daxel Tarner	Blake	94
		Clinton Brown	Churchill	95
		Kim Ferlick	Churchill	96
		Elena Pisciotta	Damascus HS	97
		David Culpepper	Damascus HS	98
		Bettie Jo Chronister	Damascus HS	99
		Jill Steinberg	Damascus	100
		Beth Daniels	Einstein	101
		Joelle Miller	Einstein	102
		Gloria Hearne	Gaithersburg	103
		Patrick O'Connor	Gaithersburg	104
		Wayne Breslyn	Gaithersburg	105
		Kathryn Sander	Kennedy	106
		Donna Considine	Magruder	107
		Meredith Zanni	Magruder	108
		Joseph Thomas	Mark Twain	109
		Richard Menendez	Northwest HS	110
		Erol Miller	Northwood	111
		Jill Coutts	Northwood HS	112
		Niambi Wills	Northwood HS	113
		Toya Jones	Northwood HS	114
		David Gillespie	Poolesville	115
		Kathy Bettinger	Poolesville	116
		Dorothy Harris	Quince Orchard	117
		Lori Martioski	Richard Montgomery	118
		Kevin Martz	Richard Montgomery	119
		Gregg Gochnour	Rockville	120
		Natasha Ezerski	Seneca Valley	121
		Cathy Cross	Sherwood HS	122
		Linda Loomis	Sherwood HS	123
		Diane Niedzialkowski	Springbrook	124
		Serenity Bush	Springbrook	125
		Vickie Kroeger	Springbrook	126
		Jeffrey Charuhas	Thomas S. Wooton HS	127
		Bill Morris	Walter Johnson	128
		Monica Crimino	Watkins Mill	129
		Greg Letterman	Watkins Mill	130
		Dedra Jones-Mattox	Wheaton	131
		Lisa Taschenberger (Gerhardt)	Wheaton	132
		Marie Paul	Wheaton HS	133
		Don Demember	Whitman	134
		Stuart Shifrin	Whitman	135
		Chris Canham	Wootton	136
		Susan Phillips	Wootton	137

4. Which of the VIP participants did you work with to plan, coordinate, or manage VIP activities? Consider substantive or ongoing collaboration, including collaborative activities during workshops or formal professional development. *Place an X in the first column if you worked with the person before the VIP program and an X in the second column if you worked with the person during the program.*

Before VIP program	During VIP program	Participants	
		Montgomery College	
		Jessica Baack	1
		Jeff Chyatte	2
		Donald Day	3
		Terry Dyroff	4
		Hal Hultman	5
		Bill Krayer	6
		Ijeoma Otigbuo	7
		Deb Poese	8
		Carolyn Schick	9
		Nevart Tahmazian	10
		Towson	
		Carol Berkower	11
		Larry Boucher	12
		Sarah Bruce	13
		Rachel Burks	14
		Brian Fath	15
		Sarah Haines	16
		Steven Lev	17
		Luz Mangurian	18
		Brian Masters	19
		Roland Roberts	20
		Lev Ryzhkov	21
		Cody Sandifer	22
		Joseph Topping	23
		Leon Ukens	24
		UMBC	
		Alesia Hovatter	25
		Diane Lee	26
		Eric Anderson	27
		Gale Seiler	28
		John Zweck	29
		Mark Perks	30
		Marko Bulmer	31
		Michele Wolff	32
		Phil Sokolove	33
		UMBI	
		Gary Coleman	34
		Allen Place	35
		Anwar Huq	36
		Feng Chen	37
		Frank Robb	38
		Gerardo Vasta	39
		Jim (Chao-Jin) Du	40
		Kevin Sowers	41
		M. Robert Belas	42
		Rosemary Jagus	43
		Russell Hill	44
		Sandy Honda	45
		Shiladittya Dassarma	46
		Yonathan Zohar	47
		UMCP	
		Spencer Benson	48
		Phil Deshong	49
		Mary-Ann McDermit-Jones	50
		Mateo Munzo	51
		Joelle Presson	52
		Steve Prince	53
		Anne Smith	54
		UMS	
		David May	55
		Nancy Shapiro	56
		Donald Langenberg	57
		MCPS Central Office	
		Gary Hedges	58
		Mike Szesze	59

VIP Participant List (Continued)

Before VIP program	During VIP program	Participants at Schools	Name of School (alphabetically ordered)	
		Teachers in ExPERT Program at COMB		
		Ken Halperin	Bethesda-Chevy Chase	60
		Vadella Ellis-Pope	Blake	61
		David McGaffin	Damascus	62
		Jack Hathaway	Damascus	63
		Jodi Hathaway	Damascus	64
		Lisa Voketitis	Damascus	65
		Jason Gvazdauskas	Damascus	66
		Christina Schwalm	Kennedy	67
		John Hendrix	Kennedy	68
		Katherine Sander	Kennedy	69
		Jennifer Petering	Kennedy, Magruder	70
		Rosetta Jordan	Magruder	71
		Lance Scott	McKenney Hills Alternative	72
		Edward Singleton	McKenney Hills Alternative	73
		Todd Malkoff	McKenney Hills Alternative	74
		Meghan Milanchus	Northwest, Lakelands Park	75
		Catherine Ulicny	Paint Branch	76
		Jeneen Stewart	Paint Branch	77
		Sana Pasha	Paint Branch, Springbrook	78
		Howard Putterman	Quince Orchard	79
		Carrie Dischiave	Rockville	80
		Clarie Lefebvre	Senca Valley	81
		Nicole Holmes	Seneca Valley, Sherwood	82
		Seth Kenton	Sherwood	83
		Christina Baldwin	Sherwood	84
		Steve Shifflett	Walter Johnson	85
		Other MCPS Teachers		
		Janet Kovach	Alternative Program	86
		Chris Kennedy	B-CC	87
		Mike McGarry	B-CC	88
		Rachel Sears	Bethesda-Chevey Chase	89
		Dan Levin	Blair	90
		Jennifer Kempf	Blair	91
		Paul Kroeger	Blake	92
		Mike Myers	Blake	93
		Daxel Tarner	Blake	94
		Clinton Brown	Churchill	95
		Kim Ferlick	Churchill	96
		Elena Pisciotta	Damascus HS	97
		David Culpepper	Damascus HS	98
		Bettie Jo Chronister	Damascus HS	99
		Jill Steinberg	Damascus	100
		Beth Daniels	Einstein	101
		Joelle Miller	Einstein	102
		Gloria Hearne	Gaithersburg	103
		Patrick O'Connor	Gaithersburg	104
		Wayne Breslyn	Gaithersburg	105
		Kathryn Sander	Kennedy	106
		Donna Considine	Magruder	107
		Meredith Zanni	Magruder	108
		Joseph Thomas	Mark Twain	109
		Richard Menendez	Northwest HS	110
		Erol Miller	Northwood	111
		Jill Coutts	Northwood HS	112
		Niambi Wills	Northwood HS	113
		Toya Jones	Northwood HS	114
		David Gillespie	Poolesville	115
		Kathy Bettinger	Poolesville	116
		Dorothy Harris	Quince Orchard	117
		Lori Martioski	Richard Montgomery	118
		Kevin Martz	Richard Montgomery	119
		Gregg Gochnour	Rockville	120
		Natasha Ezerski	Seneca Valley	121
		Cathy Cross	Sherwood HS	122
		Linda Loomis	Sherwood HS	123
		Diane Niedzialkowski	Springbrook	124
		Serenity Bush	Springbrook	125
		Vickie Kroeger	Springbrook	126
		Jeffrey Charuhas	Thomas S. Wooton HS	127
		Bill Morris	Walter Johnson	128
		Monica Crimino	Watkins Mill	129
		Greg Letterman	Watkins Mill	130
		Dedra Jones-Mattox	Wheaton	131
		Lisa Taschenberger (Gerhardt)	Wheaton	132
		Marie Paul	Wheaton HS	133
		Don Demember	Whitman	134
		Stuart Shifrin	Whitman	135
		Chris Canham	Wootton	136
		Susan Phillips	Wootton	137