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Abstract Name: Impact of Math Science Partnership Work of Higher Education Faculty

MSP Project: Mathematics and Science Partnership of Greater Philadelphia

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1. Questions(s) or issue(s) for dialogue at Learning Network Conference session:

Among MSP participants, there has been a significant amount of interest around issues of engagement of STEM faculty. Of the 15 discussion groups on MSPNet, the one on STEM faculty engagement has by far the most postings (238 as of mid-December 2009) compared with the next most active topic (87 postings). Westat (NSF's MSP Evaluator) recently published a report (Zhang et al, 2009) on the effect of MSP engagement by STEM faculty including the impact of MSP engagement on the STEM faculty members' teaching and research among many other factors. This preliminary study adds to the discourse on faculty engagement by further exploring: a) the nature of the impact of partnership work on teaching and research among higher education faculty members and b) relationships between variables related to professors' professional experience (such as field of research and instruction and tenure status) and the influence of their MSP experiences on their instruction and/or research. Furthermore, this study explores the possibility of impact on professors' knowledge and thinking within their disciplines.

2. Context of the work within the STEM education literature and within your MSP project:

This study was undertaken as part of a research supplement to the Math Science Partnership of Greater Philadelphia (MSPGP) specifically to explore the impact of partnership work on professors' scholarly lives. This current study follows a series of other studies: 1) a pilot survey (Pomeroy 2008a), 2) case studies of MSPGP professors whose partnership work had a significant impact on their scholarly lives (Pomeroy, 2008b), and 3) a study comparing the impacts of educational outreach work as reported by a sample of non-MSP NSF science grant awardees and MSP STEM faculty members (Pomeroy and Rui, 2009).

3. Claim(s) or hypothesis(es) examined in the work (anticipating that veteran projects will have claims, newer projects will have hypotheses):

Previous studies within this research supplement have explored the hypothesis that engagement by higher education faculty in K-16 partnerships through various mechanisms may also have a pushback effect on the professors' academic lives – most specifically their teaching, their research and their disciplinary knowledge. While the impact of K-16 partnership work is not limited to MSPs (Pomeroy and Rui, 2009), the potential for this kind of bidirectional impact may be highest in partnerships such as the National Science Foundation's (NSF) Math Science Partnership (MSP) program. Each of the aforementioned studies was limited by a small sample

size or low response rate. To explore the hypothesis as it may relate to all faculty involved in MSPs, the authors were able to collaborate with Westat on their annual survey, which is required of all participating faculty members. The contribution of this particular study is that it includes all 605 MSP higher education faculty members who responded.

Thanks to data-sharing by Westat, this study explores the possibility of relationships between impact and faculty characteristics such as: field of teaching, field of research, rank, type of institution and number of hours of engagement in the MSP during the survey year. The study is limited, however, in several ways: a) it does not identify or examine the relationship between type of MSP or type of faculty engagement and impact; b) it covers only one year (2008) of data collection thereby potentially missing the impact of engagement that might have occurred in previous years; and c) because the questions were embedded in the much broader Westat survey, there was no opportunity for more in-depth probes concerning impact.

4. Evaluation and/or research design, data collection and analysis:

The Westat questions prompted respondents to discuss the impact of their MSP-related work on their instructional practices and their research. Of the 605 total respondents, 548 (90.6%) reported a positive impact on their instructional practice or research. The open-ended responses for each of these two questions were coded separately and recursively through the use of emerging themes (Miles and Huberman, 1994; Fielding and Lee, 1998). At the culmination of three increasingly more refined coding passes through responses for each question, fifty-one separate codes were developed to describe various impacts on respondents' instruction or research while an additional twenty codes for the impact of MSP work on disciplinary research were identified. Many responses had multiple codes. Because many areas of overlap became apparent between the two sets of responses and their respective sets of emerging themes, the two sets of codes were combined and responses for those who answered each question separately were pooled. When thus combined, the codes were further refined and resulted in a new set of 66 codes. This set was then used to recode all responses. Some responses received as many as seven different codes.

To assure large enough cell sizes for statistical analysis, codes were clustered into nine themes (Level 1, listed in table below) and sub-themes (Level 2). Where appropriate for qualitative analysis, more fine grained codes were assigned a third level (Level 3). The n in the table below is the number of faculty who indicated a positive impact in each of the Level 1 categories.

Level 1 Themes	n
Disciplinary Knowledge	47
Research	208
IHE Instructional Practice	239
Impacts Relating to IHE Students	71
Other IHE Impact	57
Teacher Preparation & Development	208
District Level Work	82

Project or Partnership Management	122
No Impact or Not Applicable	57

Findings on Association between type of Impact and faculty characteristic variables

To investigate whether certain faculty career status and institutional characteristics are associated with the four highest frequency types of perceived impact (see above), logistic regression was used to construct four multivariate models for predicting those who perceived a type of impact versus those who did not. The four binary outcome variables are: 1) whether there is any impact on research, 2) whether there is any impact on instructional practice, 3) whether there is any impact on teacher preparation and development, and 4) whether there is any impact on project and partnership management. The analyses were based on the sample of respondents teaching either STEM or education (N= 533). Measures of the magnitude of association (i.e., effect size) produced by logistic regression analysis are represented by odds ratios (OR). The results show that faculty who perceived MSP's impact on their research are more likely to be from doctoral institutions (OR=1.5), have achieved tenure (OR=1.8) or are tenure-track (OR=3.9), and have invested more than 200 hours (1.6), and less likely to be a researchers in STEM compared to education (OR=.3). On the other hand, faculty who perceived MSP's impact on their instructional practice are more than twice as likely to be from 2-year colleges (OR=2.2) and be teaching STEM (OR=2.4). No meaningful and significant associations were found pertaining to those who perceived impact on teacher preparation and development. However, faculty who perceived MSP's impact on project and partnership management are much less likely to be from 2-year colleges (OR=.2) and to be primarily doing research in STEM fields (OR=.6).

Findings on Breadth of Impact

The number of Level 2 codes that were applied to each respondent was explored as an indicator of the breadth of impact. Forward stepwise linear regression analysis was performed with the total number of Level 2 types of impact as the outcome variable. The outcome variable ranges from 0 to 7 with a mean of 1.95 and standard deviation of 1.21. The regression analysis was applied to the full sample (N= 602), for individuals teaching STEM or education (N= 533), and for individuals researching STEM or education (N= 511), respectively. Variables with p-value of less than .15 were added to the model and variables with p-values greater than .15 were removed from the model. Tolerance index was used to control for multicollinearity. Predictors with tolerance values less than .30 suggest multicollinearity and were removed from the model. The following variables were selected as potential predictor variables:

- Two-year college (1=Yes, 0=No)
- Doctoral institution (1=Yes, 0=No)
- Achieving tenure (1=Yes, 0=No)
- Tenure-track (but not yet tenured) (1=Yes, 0=No)
- Involved for more than 200 hours (1=Yes, 0=No)
- STEM Researcher (1=Yes, 0=No)
- STEM Teacher (1=Yes, 0=No)

The study uncovered several key findings regarding the relationship between faculty characteristics and overall depth of engagement in MSPs, including:

- Faculty who invested more than 200 hours in the MSP are associated with higher level of perceived impact of the program than others ($p < .01$). This is consistent with both the full and subsamples.
- Faculty whose main research field is STEM are associated with relatively lower level of perceived impact compared to faculty whose main academic work lies in education ($p < .05$). This is consistent with both the subsample of individuals teaching STEM or education or subsample of individuals researching STEM or education.
- For the full sample, having tenure or being tenure-track is positively associated with the overall perceived impact of the MSP. Specifically, having tenure is associated with .32 points in overall impact ($p < .01$) while being tenure-track is associated with .42 points in overall impact ($p < .01$).

Disciplinary Knowledge

While the frequency of responses indicating a positive impact on professors' disciplinary knowledge was not great (5.3%), the hypothesis that MSP-type engagement could result in such an impact was demonstrated.

5. Key insights (retrospective for veteran projects, prospective for newer projects) that have value for the Learning Network:

This study provides evidence that supports the Westat study and the two previous studies in this research supplement. In addition, the study provides valuable insights as to the associations with the types of impact and faculty characteristics. The qualitative aspect of the study also helps unpack the nature of the impacts reported by faculty. This study raises new questions for exploration and it provides further evidence of the value of MSP-type engagement to the scholarly activities of the faculty in particular, to the academy in general, and to STEM reform.

References

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