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**PEER LEADERS' PERSPECTIVES OF THEIR INVOLVEMENT IN A MATHEMATICS ENRICHMENT  
WORKSHOP PROGRAM: A COMPARISON OF MOTIVATIONS AND OUTCOMES**

SARAH OPPLAND-CORDELL, DOUG ROSSKAMM, RICHARD BILYK, RUBEN ECHEVARRIA, NIC ALLEN

The purpose of this paper is to present Peer Leaders' (PLs) perspectives of their involvement in the Mathematics Enrichment Workshop Program (MEWP) at a Hispanic-serving, urban, Midwestern University. The MEWP utilizes undergraduate and graduate students as PLs to facilitate optional mathematics workshops that run parallel to required mathematics courses ranging from the developmental level through calculus II. PLs were asked to complete an open-ended survey that aimed to capture their perspectives of their PL experiences. This study examines participants' motivations for becoming involved with the MEWP as PLs and critical outcomes they experienced due to this involvement. In particular, this study addresses the following questions: (1) What are PLs' perceptions of their primary motivations for becoming involved in the MEWP? and (2) How do PLs' perceptions of such motivations compare to the outcomes they experience due to their MEWP involvement? Findings indicate that participants' motivations and outcomes were related to three overlapping themes: (a) educational philosophy, educational goals, and/or career goals, (b) the implementation of peer group work, and (c) reciprocal benefits related to their engagement with students.

Introduction

*I believe mathematics comprehension is a form of liberation and it is a personal goal of mine to help students understand math to further career possibilities.*

-Tony, College Algebra and Calculus I Peer Leader

*I have learned that silence in a classroom can be a dangerous thing and sometimes students that may be struggling will not ask for help.*

-Erik, Pre-calculus Peer Leader

These two examples of Peer Leaders' motivations for becoming involved in the Mathematics Enrichment Workshop Program (MEWP) speak to aspects of educational philosophy (e.g., "mathematics comprehension is a form of liberation") and personal goals (e.g., "to help students understand math to further career possibilities") that were related to his motivations for becoming involved in the MEWP. Erik's quote highlights examples of outcomes he experienced due to his involvement in the program - that "silence" in a mathematics workshop "can be a dangerous thing" because it may mean "struggling"

students are not seeking help. Comparing these quotations also reveals that while Tony's excerpt about his motivation for involvement is a more general statement, Erik provides a specific description of an outcome he experienced due to his involvement. Tony is motivated to become involved in the MEWP as a PL because he desires to help students understand mathematics (general description of a motivation for involvement), while Erik reveals that, as a PL, he "learned" that "silence in a classroom" can be a particular indicator for possibly identifying when students lack mathematical understanding (specific description of an outcome due to involvement). Such examples are important because while collaborative mathematics workshop programs (e.g., Peer Led Team Learning, Emerging Scholars Program) have been nationally recognized for strengthening student participants' achievement outcomes (e.g., Hsu, Murphy, & Treisman, 2008), little is known about PLs' perspectives of their key takeaways due to their involvement in such programs. As such, a major opportunity to understand how to both enhance these programs and maximize the beneficial experience to the PL themselves has not been leveraged.

Northeastern Illinois University (NEIU), a school originally founded as one of the first teacher training institutions in the state of Illinois in the late 1800s, is a Hispanic-serving, four-year university that serves approximately 11,000 culturally diverse, commuter students: approximately 42% Caucasian, 29% Latina/o, 10% African American, 9% Asian, and 10% other. While NEIU has expanded over the years beyond being purely a teacher training institution, NEIU continues to prepare a significant number of students for the teaching profession. Because the majority of MEWP PLs (and a significant number of students at NEIU) aim to pursue mathematical teaching careers, it is critical to understand the MEWP PLs' motivations for becoming involved in the program and the outcomes they experience due to this involvement. This information might potentially be linked to strengthening their preparation to be future mathematics teachers while also enhancing the program as a whole. In this article, we document PLs' perspectives of their primary motivations for becoming involved in the MEWP, the outcomes they experience due to their involvement in the MEWP, and we compare their motivations to their outcomes to gain a deeper understanding of their key takeaways as the MEWP PLs. Two questions guided our investigation:

1. What are PLs' perceptions of their primary motivations for becoming involved in MEWP?
2. How do PLs' perceptions of such motivations compare to the outcomes they experience due to their MEWP involvement?

### Methods

The work described in this article is part of a larger study that began during fall 2013 that aimed to understand the MEWP student participants' and PLs' perspectives of the MEWP at NEIU in order to evaluate and strengthen the program. This larger study was segmented into two individual reviews: (a) a project that aimed to explore the MEWP student participants' experiences and perceptions of the MEWP and (b) a project that aimed to investigate the MEWP PLs' experiences and perceptions of the program. The latter project is the focus of this study. For this latter study, we used qualitative methods to conduct an in-depth exploration of participants' experiences. This involved coding participants' responses to an open-ended survey. Ten of nineteen invited PLs agreed to participate in this project (~53%). The work presented in this article is based on the investigation of this population's experiences and perceptions of the MEWP.

### *Mathematics Enrichment Workshop Program*

Enrichment mathematics workshops at NEIU date back to the late 1990s, and were designed “to provide a richer learning environment for students in Calculus and Pre-calculus courses” (Rutschman & Jensen, 2007, p. 1). At the time of this study, workshops were offered for developmental math, college algebra, trigonometry, pre-calculus, calculus I, and calculus II. The optional workshops run parallel to students’ standard mathematics courses (lecture courses) and are held for two hours a week. In the workshops, PLs encourage peer groups to collaboratively solve challenging problems. Although diverse pedagogical techniques are implemented in the workshops, students are typically encouraged to share their strategies and solutions and to engage in whole class discussions.

PLs are undergraduate or graduate students majoring in mathematics who have completed calculus I, calculus II, and calculus III with an A or B in each course, have at least a 3.0 GPA, and have a high level of enthusiasm and strong leadership skills. They devote at least five hours per week facilitating mathematics workshops, including preparation work. As workshop facilitators, they have an understanding of and commitment to the Emerging Scholars Program (Treisman, 1992) and Peer Led Team Learning models (Gosser et al., 2001).

### *Data Collection*

An open-ended survey containing four categories was developed by the first and second authors to better understand the PL experience and to capture information that would assist the program in improving future workshops. PLs were asked to respond to the following topics and subtopics, but were also given the freedom to provide thoughts beyond these particular topics:

- (1) *MEWP involvement*
  - a. Why did you decide to get involved with MEWP?
- (2) *Program challenges*
  - a. Foundational mathematical backgrounds of MEWP participants
  - b. Analytical and problem solving capabilities of the students in the program
  - c. Observations on the impact faculty have on students’ understanding of specific topics
  - d. Faculty adherence to course structure/schedule/syllabus
- (3) *Personal takeaways from your involvement in MEWP*
  - a. Improved personal conceptual understand of material
  - b. Appreciation of student learning styles and individuality
  - c. Ability to manage a classroom organization and maximizing impact to students
- (4) *Key learnings related to involving students in effective learning process*
  - a. Effective pedagogical approaches employed to increase student participation
  - b. How you have meet key challenges with students understanding key concepts or process orientation
  - c. Impacts you may have had beyond direct math content (e.g., identifying a student who is at risk in some way and directing the student to the appropriate support services)

### Data analysis

Data analysis consisted of three main phases. Phase one involved using an iterative coding process to identify emerging themes. This process involved revising codes as insight was gained. Phase two involved coding across the four survey categories to identify any evidence that might apply to multiple categories. When comparing codes across the four categories, it became clear that the responses for category 3 (i.e. personal takeaways from your involvement in MEWP) and category 4 (i.e. key learnings related to involving students in effective learning processes) could be included in category 1 and/or 2 if we modified the category 1 and category 2 descriptions. That is, we modified category 1 from reason for involvement in MEWP (initial code) to motivations for involvement in MEWP and outcomes due to involvement (final code). We also modified category 2 from program challenges (initial code) to challenges PLs faced and how they managed those challenges (final code). This paper will focus on the revised category 1, and highlights the three codes that emerged in that particular category as seen in Table 1. Phase three involved meticulously analyzing the evidence for the three codes listed in Table 1. For each of the three categories, we identified whether the evidence supporting that particular category was a motivation for involvement and/or an outcome due to involvement in the program.

Table 1. Codes for Motivations for Involvement in MEWP and Outcomes Due to Involvement

Code	Code Description
1	Educational philosophy, educational goals, and/or career goals
2	The implementation of peer group work
3	Reciprocal benefits related to their engagement with students

### Findings

In this section, we provide a detailed description of three main themes that emerged related to PLs' perspectives of their involvement. Within each of the three themes, we discuss both motivations for participants' involvement and the outcomes they experienced due to their involvement.

#### *Educational philosophies, educational goals, and/or career goals*

The first theme that emerged was educational philosophies, educational goals, and/or career goals. *Educational philosophies* refers to aspects of participants' survey responses that described their personal beliefs about education. *Educational and career goals* refers to aspects of participants' survey responses that described their personal aspirations related to academics (e.g., attending graduate school) or occupations (e.g., teaching secondary mathematics).

*Motivations.* Eight of the ten participants provided responses related to motivations within this particular category. These responses were segmented into two main categories: (a) the MEWP opportunities aligning with their personal educational philosophies and/or (b) the MEWP opportunities aligning with their goals.

Four participants discussed how the MEWP goals aligned with their personal educational philosophies. For example, two participants indicated that becoming a PL would allow them to

understand and support students' varied mathematical learning styles, which they viewed as important. Two participants strongly believed that the MEWP model benefited students. For one PL, this belief was tied to their prior participation in the collaborative practices of a calculus II workshop as a student participant. For the other PL, this viewpoint was related to their belief that the MEWP's use of collaborative learning empowered students (which aligned with his "mission as an educator").

Four participants also related their motivations for involvement to their educational goals, including their education majors and their interest in mathematics. For six participants, an important stimulus driving involvement was their awareness of how the MEWP provided opportunities that aligned with their career goals. Five of these participants desired to strengthen their understanding of mathematical pedagogical techniques, while three cited interest in strengthening their classroom management skills. One participant spoke about viewing their program involvement as "a great opportunity to understand methods of effectively reaching students," which he perceived as "valuable" for his "teaching career." Another participant, who aimed to be a high school teacher, related his involvement to both teaching methods and classroom management. In the following quote, he indicates that he became involved in the MEWP to both "gain the experience of being in front of a classroom" and to assist students with learning mathematics in "different" ways:

When I was student in high school I always thought it was the coolest thing to be a teacher. Since I was a sophomore in high school I wanted to be a teacher and on top of that I loved math. I got involved with the MEWP for a couple of different reasons. The first reason was that I wanted to *gain the experience of being in front of a classroom* and helping students learn in a way *different* than that of what they are used to.

One participant who identified developing leadership skills as a motivation for involvement stated, "...no matter if I continue in an education degree program, obtaining leadership skills will get me farther in any career I end up in."

*Outcomes.* As compared to motivations (as previously described), all ten participants gave more diverse and detailed responses regarding the outcomes they experienced that were tied to educational philosophies, educational goals, and/or career goals. While one participant spoke to the MEWP allowing him to develop educational "philosophies," other participants often indicated connections between educational practices they viewed as important and the outcomes they experienced.

Eight participants provided diverse examples of how their involvement allowed them to experience outcomes that aligned with their educational goals. For example, students indicated that their workshop experiences assisted them in preparing for future "student teaching" assignments and strengthened their preparation for "working in groups" in their required mathematics classes.

All participants experienced outcomes that aligned with their career goals. Important outcomes participants experienced related to career goals included opportunities to develop personal pedagogical techniques, classroom management skills, strengthened understandings of varied student learning styles, a deeper understanding of mathematics, and a strengthened desire to teach mathematics. Such findings are discussed in more detail in the following paragraphs.

Seven participants indicated that their PL experience aided them in developing pedagogical techniques. This included reviewing key topics at the beginning of each workshop meeting, using "well

developed” questions, encouraging open discussions, and applying “non-critical” teaching approaches. For example, one participant stated: “I feel that the program has allowed me the opportunity to build my own personal understanding of, not only mathematical topics, but also of personal pedagogical philosophies and approaches.”

Eight participants described diverse ways they developed classroom management skills. This included recognizing the importance of exhibiting strong organizational skills, developing leadership skills, developing patience, and developing a student focus in the classroom. Regarding this latter factor, students gave a variety of ways they learned to help students stay focused, including by showing students that they cared, using positive reinforcement techniques, being as accommodating as possible in and outside of the classroom, and balancing and acknowledging all students needs “to help all students succeed”.

Four participants experienced a strengthened understanding of varied student learning styles, as illustrated, for example, by the following quote:

...seeing how they become really excited because they are able to complete the problems on their own. As I am a mathematician and have a passion for mathematics, being able to convey the concepts in a manner in which another person can understand is really fulfilling.

Eight participants indicated that their involvement strengthened their understanding of mathematics, as captured in the following quote: “...being involved with explaining the topics and principles has strengthened my foundation of many basic mathematical principles”.

One of two students also indicated that their PL experience reinforced their desire to teach mathematics, as highlighted in the following excerpt:

I think it also helped shake some doubts I had about becoming a high school math teacher. I realize now that there will certainly be a lot of hardships, but it also is very satisfying to see a student who previously struggled with math now feel more confident in his/her ability.

#### *The implementation of peer group work*

A second main theme that emerged was the implementation of peer group work. *The implementation of peer group work* refers to aspects of participants’ survey responses that described ways they desired or were involved with leading students in engaging in mathematical group work. Although this theme is related to the previous category, we are including this as a separate theme because several participants emphasized that the implementation of peer group work was a motivation for their involvement in the MEWP and/or related to an outcome they experienced due to this involvement. It should also be noted that group work is a widely discussed theme and objective of the MEWP.

*Motivations.* Five participants viewed the MEWP’s emphasis on group work as encouraging them to become PLs. Participants provided varied reasons for wanting to lead a collaborative mathematical learning environment, including that this leadership role aligned with their educational philosophies, that they believed leading group work would be “a rewarding experience,” and that they desired to gain experience teaching mathematics in a group environment (including due to having limited exposure to

group work in their own mathematics classes). A participant discusses this latter factor in the following excerpt:

I was so fascinated by the idea of having workshops center around group work with peers taking the same course. I had always wanted to form a study group in my previous math classes, but was not successful because of my lack of speaking to other classmates. These workshops served the purpose of students coming together, learning the same material...

*Outcomes.* Seven participants revealed that they experienced a strengthened understanding of how to implement group work in learning environments. As with the previous category, respondents provided more diverse and detailed responses regarding the outcomes they experienced as compared to responses for motivations. Three primary themes emerged for outcomes in this category: (a) building an environment of student cooperation, (b) utilizing scaffolding, and (c) learning how to better foster motivation and confidence within individual students and within student groups.

Three participants indicated that their leader experiences assisted them in building an environment of student cooperation, as summarized in the following quotation: “[the MEWP] helps each student learn to assess the work of other students and provide help and feedback, in a non-critical manner.”

Three participants described how they developed an improved understanding of utilizing concepts of scaffolding, as expressed in the following excerpt: “Some key challenges were also solved using the other students in the workshop. The best way to learn and remember something was by explaining it to others -use the other students to help facilitate the workshop.”

Four participants indicated they learned how to better foster motivation and confidence within individual students and within student groups. For example, one PL stated: “To my amazement, I have found that competitive games have been very exciting and motivating. Students have been really receptive to these games and often request more incorporation of games.”

#### *Reciprocal benefits related to participants' engagement with students*

A third main theme identified is reciprocal benefits related to participants' engagement with students. *Reciprocal benefits related to participants' engagement with students* refers to aspects of participants' survey responses that described ways they benefited (or could benefit) from engaging with workshop students and/or ways they positively impacted (or could positively impact) workshop students. Although this theme is related to the previous categories we are including this as a separate theme because several participants often wrote about such reciprocal benefits as a motivation for becoming involved in MEWP and/or outcome they experienced due to this involvement.

*Motivations.* Five participants mentioned that reciprocal benefits related to their engagement with students encouraged their involvement in MEWP. The most common motivations mentioned were a desire to help students strengthen their understanding of mathematics (PLs impacting students) and to gain a unique perspective of students (students impacting PLs). For example, the following quotation captures both aspects of this reciprocal relationship and is also representative of several participants' perspectives: “I enjoy getting to know other students at the university and learning about their struggles and being able to help them in some way.” Another respondent provided a unique perspective to this

category by indicating that, “as an older student,” he believed it was important for him to interact with “students of a younger generation” to prepare for his future teaching position.

*Outcomes.* Three primary themes emerged in this outcome category: (a) teaching style adaptation, (b) helping students strengthen their understanding of mathematical processes, and (c) helping students experience strengthened mathematical identities.

Two respondents indicated that their leader experiences assisted them in learning how to adapt their teaching styles to students’ needs, as summarized by the following quotation: “In some cases, I have had to modify approaches or techniques continuously until a desired positive effect had been achieved.” Another response described the development of an improved understanding of how to modify their teaching style in a way that strengthened student engagement:

My focus has been to work on developing a style that is engaging to the students as well as amiable and inviting, putting effort towards not talking “over the students heads” and not intimidating them, but rather keeping a free and open discussion, that, while being directed towards the entire group, is also presented in a way that presents itself as a personal conversation.

Three respondents indicated that they learned how to help students strengthen their understanding of mathematical processes as captured in the following quote: “. . . process orientation is a matter of helping students breakdown information into segments.”

Five students found helping students experience strengthened mathematical identities as an important outcome, as indicated in the following quotation:

I’ve also been able to witness students who are taking the workshop become more comfortable and confident in math. It’s very satisfying for me to see these students be able to do something they weren’t able to the week before.

### Discussion and conclusions

This study presented PLs’ perspectives of their primary motivations for becoming involved in the MEWP and critical outcomes they experienced due to this involvement. Interestingly, common themes emerged across the participants for both motivations and outcomes despite using open-ended surveys. The findings clearly indicated that (a) educational philosophies, educational goals, and/or career goals, (b) the implementation of peer group work, and (c) reciprocal benefits related to participants’ engagement with students contributed in critical ways to motivating their involvement in MEWP and were also tied to the outcomes they experienced. Such emergent themes were intimately related to complex issues including PLs’ beliefs (e.g., belief in the effectiveness of the MEWP model, passion for mathematics) and histories and lives (e.g., previous involvement in MEWP as student participants). Findings also revealed that participants were able to articulate more detailed, diverse, and broad outcomes as compared to their motivations for involvement. The findings indicate that participants gained much more from the PL experience (i.e. outcomes) than they had initially anticipated (i.e. motivations).

Educational studies on collaborative academic support programs that solely use quantitative methods to investigate the benefits PLs gain from their involvement in such programs would not reveal

such significant and complex benefits, including benefits that can prepare PLs for future teaching careers. The use of qualitative methods in this study, and specifically open-ended surveys, not only allowed for capturing the complex nature of participants' motivations for involvement in MEWP and the outcomes they experienced due to this involvement, but the richer outcomes they experienced as compared to motivations.

PLs' perspectives of their reasons for involvement and how they are ultimately impacted as a result of their involvement in collaborative mathematical support programs is an underexplored topic in mathematics education research. The findings of this study indicate that exploring such perspectives is critical because PLs can provide valuable knowledge regarding how collaborative academic support programs benefit them. For example, an important finding of this study is that leading mathematical group work can provide PLs with numerous experiences that better prepare them for future teaching careers, experiences they may not gain through other on-campus teaching experiences.

A significant implication this study has for research on collaborative academic support programs is that we must not only consider how these support programs benefit students, but also how they benefit PLs. Additional investigations of how PLs experience collaborative academic support programs are needed. Future research should use qualitative methods to examine the meanings PLs give to their experiences in collaborative academic support programs. Applying qualitative methods will allow for capturing additional knowledge regarding PLs' perspectives of the complexities of their experiences. Such research may expand knowledge about how to design collaborative academic support programs so that PLs can gain additional benefits supporting their future goals.

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