



New Approaches to Peer Leader Training

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New Approaches to Peer Leader Training

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Abstract

This paper describes a Peer Leader training course that has been modified to include innovative components focusing on developing content and pedagogical knowledge, practicing rehearsals, generating action research projects, doing poster presentations, and writing a reflective letter to new Peer Leaders. Through these innovations, four types of reflection--on relevant research and theory, on students' experiences, on peer practice, and on one's own practice--have been incorporated into the course. The new course components promise to offer more opportunities for trainees to practice peer leading in a structured and safe environment in which immediate and supportive feedback is available, and group practice and reflection are optimized.

Keywords: Peer-Led Team Learning (PLTL), Undergraduate STEM Courses, Peer Leader Training, Teacher Education, Rehearsals, Action Research, Reflective Letters

Introduction

Peer-Led Team Learning (PLTL) has proven to be a high-impact practice (Keup, 2016), widely implemented in undergraduate and lab courses, with positive outcomes for students related to increased content knowledge, deeper engagement with content material, more active engagement in peer scientific discourse, lower withdrawal rates, higher course pass rates and improved confidence (Liou-Mark et al., 2015, 2018; Kokkelenberg; Lee & Choi, 2010). Students who participate in PLTL workshops under the guidance of Peer Leaders are also found to benefit from an increased sense of community and connections to campus and academic resources (Shook & Keup, 2012). PLTL programs also offer benefits for Peer Leaders who develop leadership skills and grow as group facilitators (Chase et al., 2020; Hoiland, Reyes & Varelas, 2020).

Adequate Peer Leader training is considered an essential component of any PLTL program (Becvar, Dreyfuss, Dickson, 2008; Hung et al., 2008). However, studies have shown that Peer Leaders often misconstrue their role in supporting students or revert to the lecture models that they have been exposed to as students (e.g., Clark & Raker, 2020). Such results raise concerns about insufficient or inadequate training and call for rethinking the ways in which Peer Leaders are prepared. Peer Leaders need to be skilled at facilitating group interactions, diagnosing and managing misconceptions, helping student clarify ideas, and effectively scaffolding student communication (Becvar, et al., 2008; Narode, 2012). Several studies have demonstrated that well trained Peer Leaders contribute to more sustained student communication and conceptual understanding. Brown, Sawyer, & Frey (2009) showed that Peer Leaders who employed facilitative interactional practices had a higher percentage of group student-to-student interactions and fostered more student participation. This paper describes a modified training program for Peer Leaders, specifically focused on the course *Peer Leader Training in Mathematics*, offered at our institution.

A Peer Leader Training Framework: Borrowing from Teacher Education Research

It is beyond dispute that the effectiveness of the Peer Leaders depends first and foremost on their training in both content knowledge and in pedagogy (Dreyfuss, 2021.; Crockett, et al., 2012). Peer Leaders are typically selected from among upper division students with strong content knowledge who have performed well in the courses they are chosen to lead. Most institutions seem to rely on the selection of knowledgeable Peer Leaders who are then provided with orientation in curriculum design in advance of assuming their role. In our institution for example, content training with modules used in the various

PLTL workshops is organized in the summer. These summer workshops work to create a community of practice (CoP) context (Wenger, 1998), in which Peer Leaders work through the course material collectively, in ongoing discussion with peers.

Peer Leaders need training in both content and pedagogy, and most of the training offered thus far has been focused on pedagogy (e.g., Dreyfuss, 2021.; Crockett, et al., 2012) Attention to pedagogy is justified, as it has been found that Peer Leaders' questioning techniques and interaction style significantly affect the duration and depth of discussions in PLTL workshops (e.g., Brown et al., 2010; Sawyer et al., 2013; Knight et al., 2015). The fact that Peer Leaders play a key role in student-to-student discourse is also confirmed in general K–12 research studies about teachers' influence on student discussion (e.g., Carlsen, 1993; Hanrahan, 2005). One key component of effective peer learning lies in the ability to facilitate sustained discussion during collaborative problem solving (e.g., Sellami et al., 2017; Eren-Sisman et al., 2018), which is an important responsibility of the Peer Leader. Brown, Sawyer, & Frey (2009) found that when Peer Leaders used facilitative discourse and provided ample scaffolding, students not only engaged in extended discussions, but also exhibited increased conceptual understanding. Their findings are consistent with broader research in mathematics education that identifies teachers/instructors' discourse as among the most influential factors in improving student performance (e.g., Hill et al., 2005). They also point to the necessity for Peer Leaders to develop sophisticated skills in organizing and facilitating productive conversations through detecting student misconceptions and scaffolding student ideas, which is a tall order even for education students with four years of training (e.g., Franke, Kazemi & Battey, 2007; Lampert & Cobb, 2003; Lampert et al., 2013).

The PLTL models aim to train Peer Leaders not only to become skilled facilitators of student-to-student discussions (Gosser & Roth, 1998; Gafney & Varma-Nelson, 2008; Otero et al., 2010; Sellami et al., 2017), but also skilled listeners, capable of detecting student misconceptions and scaffolding student ideas. Several approaches to training in this area exist. Some institutions have developed semester-long training courses (Tien et al., 2004; Otero et al., 2010; Sellami et al., 2017). Others use pre-semester or in-semester individual or group training (Cracolice & Broffman, 2021). For example, Gosser et al. (1996) described training Peer Leaders via frequent meetings with faculty, in which the Peer Leaders review and discuss workshop materials. Most of the training courses contain the following components: 1) Introduction to appropriate theory of learning, team development and educational research literature; 2) discussion of how to apply this research to their sessions; and 3) self-reflection after each session followed by feedback (e.g., Szteinberg, et

al., 2020). These courses tend to emphasize pedagogical knowledge above content knowledge. For example, Goldstein (2012) describes Peer Leader training meetings (or training course) throughout the semester that include the following elements: group dynamics (e.g., cooperative learning), pedagogical tools (e.g., ice breakers, concept maps), basic learning theories (e.g., learning styles), equity issues (e.g., gender, race and ethnicity issues), developmental theories (e.g., Vygotsky, Perry), skill and leadership development (e.g., reflective writing and exercises), and assessment (informal and summative). “The most common manner in which students are prepared is for the faculty to lead a workshop each week with the Peer Leaders as the members of the group. In this way, the faculty can model the desired listening and collaborative learning skills. . . To this end, it is very helpful for leaders to have explicit instruction in various collaborative learning methods such as pair problem-solving, structured round robin, brainstorming, etc.” (David Gosser, p. 9, in Dreyfuss, 2021).

The problem that mathematics teacher educators have long wrestled with is that explicit instruction in how to orchestrate discussions, question students and scaffold discussions does not work very well in practice, as most novice teachers are not able to enact behaviorally what they apprehend theoretically (e.g., Kazemi, Franke, Lampert, 2009). As a palliative, researchers and practitioners suggest a “pedagogy of enactment,” a training in the performance of carefully selected instructional activities (e.g., Grossman et al., 2009; Grossman & McDonald, 2008, Lampert & Graziani, 2009). These activities, which represent tasks enacted by the prospective teachers whether in classrooms or with their peers, are termed “rehearsals.” Magdalene Lampert describes the latter as approximations of practice (Lampert et al., 2013), “opportunities to rehearse and develop discrete components of complex practices in settings of reduced complexity” (Grossman & McDonald, 2008, p. 190). Such components include launching a task, helping students understand the task, questioning, eliciting student ideas, clarifying ideas, connecting students’ ideas, helping the group test their ideas, offering just in time support (suggestions, ideas, hints) and feedback, and helping students agree or disagree with each other’s ideas. The website, Teaching Works (2022), calls these components of rehearsals “high leverage practices.” Rehearsal situations include instructional protocols that function as working guides. They help novice teachers in planning and enacting lessons: in how to introduce an activity, encourage student participation, work with representations, and respond to student error. Two types of teaching practice can be identified: routine and nonroutine. The former consists of specified moves in the protocol that require little exercise of judgment on the part of the novice, thus freeing cognitive capacity for her to attend to non-routine practices.

Non-routine practices are underspecified due to their dependency on the unpredictable aspects of the context, such as what students might say or do. Typically, teacher candidates participating in rehearsals are expected to follow protocol guides when enacting a situation. Rehearsals seem to offer an appropriate structure for Peer Leader training, especially in courses in which Peer Leaders can rehearse with their peers and receive feedback from both them and the instructor.

Another possible training dimension consists in Peer Leaders actually conducting action research--that is, an intentional and systematic inquiry, pursued with the goal of gaining insight into student learning, or any other aspect of the process of organizing learning (Cochran-Smith & Lytle, 2006). It has been found that action research helps teachers enrich their understanding of what is actually transpiring in the classroom, and thereby become more reflective practitioners. It is seen as a tool in developing teachers' capacity for making autonomous and professional judgments and decisions about their classroom practice (e.g., Kincheloe, 2003; Iliško, Ignatjeva & Mičule, 2010). Such research requires us to engage in the process of planning, acting, questioning, observing, and reflecting. It is critical and reflective, and also requires attentiveness to one's biases, predispositions and values (Schwandt, 2001). Teacher initiated research is a process of systematic, critical and reflective evaluation of teaching practice, whose ultimate goal is to adjust that practice for better effectiveness (Sagor, 2000). It encourages teachers to try out new ideas, methods and materials, and to make informed decisions about curriculum development (Hansen, 1997). Typically, such research stems from the teachers' own questions and reflections on their everyday classroom practice. Similarly, we have hypothesized that peer-leader engagement with action research may enable them to relate their particular inquiry to theories of teaching and learning, and thereby establish stronger links between theory and practice (Bullough & Gitlin, 2001).

There are several reasons why it is beneficial for Peer Leaders to engage in action research, not least to arrive at a better understanding of their actions as Peer Leaders through enriching their understanding of what is going on "on the ground" in the classroom—what students think, feel, struggle with, etc. Peer Leaders conducting research in their PLTL workshops promises to help them cultivate professional judgment, and to gain confidence (Iliško, Ignatjeva & Mičule, 2010). Action research can be followed up by presentations, such as posters either informal posters as described in Gallery walk (Gallery walk, 2009) or formal presentation. Jalloh et al. (2021) has expounded on the benefits of Peer Leaders presenting posters as encompassing "scholarly research, observation, analysis, critical thinking, understanding of agency, as well as writing, design,

creativity, and public speaking skills” (p. 93). Finally, we consider research that contributes to the literature on Peer Leaders’ training by examining how they reflect on their experience, and what the benefits of that reflection are. Szeinberg et al. (2020) conducted a study which examined annual “advice books” that seasoned Peer Leaders were asked to complete and pass on to new leaders. The study found that these books provided a space for cognitive apprenticeship and for gauging new Peer Leaders’ expectations, and act to generate a supportive community of practice composed of a blend of new and more experienced Peer Leaders.

Skalicky (2008) advises that Peer Leader training programs should consider multiple ways of embedding opportunities for Peer Leaders to reflect critically on their practice. Following on Brookfield’s (1995/2017) four lenses for reflection on practice, he suggests that the following reflective practices may benefit those in the role of Peer Leaders.

1) By reflecting on the literature in educational theory and research that informs practice, as it provides a foundation for a vision and for the clarification of beliefs about best practices;

2) by reflecting on learning and the learning environment through the eyes of the students in the peer-led workshops: receiving feedback, both informal and formal, from the students can shed light on how they are experiencing the learning environment--their mindset, relations within the group, struggles with the content, and more;

3) reflecting on other Peer Leaders’ experiences: participating in purposeful conversation with peers provides different perspectives on similar issues of interest, problematic areas, and alternative approaches to resolving them; and

4) reflecting on one’s own experience as a Peer Leader. This includes self-reflection both as a learner and as a Peer Leader. The thoughtful consideration of one’s own learning experiences enables a connection with the experiences of one’s students, and with one’s own goals as a learner. Self-reflection on one’s role as a Peer Leader helps the trainee become more aware of the assumptions at play when planning and enacting one’s own practice.

In the next sections, the PLTL training program at New York City College of Technology (“City Tech”) is described, and how the theoretical framework discussed above was used to modify the previous peer leading training course to include components focusing on developing content and pedagogical knowledge, practicing rehearsals, action research projects, research poster presentations, and the writing of a reflective letter to new Peer Leaders. Through these innovations, the four types of reflection discussed above--on

relevant research and theory, on students' experiences, on peer practice, and on one's own practice-- have been incorporated into all the modified course components.

The PLTL Program

The PLTL program at City Tech was initiated in the mid-1990's, and actively recruited undergraduates majoring in science, technology, engineering, and mathematics disciplines to train as Peer Leaders for STEM workshops. The PLTL model has been successfully implemented in various STEM disciplines. Courses such as chemistry and statics have also employed PLTL in their lab components. The PLTL model is used predominately in mathematics courses, and typically between 30 and 40 sections of our undergraduate mathematics and statistics courses utilize PLTL each semester in one or another of these modalities, mostly in Quantitative Reasoning, College Algebra and Trigonometry, Precalculus, Calculus, and Statistics courses. A recent paper describes the new modalities that were designed to meet the challenges of online undergraduate mathematics courses and the increasing demand for flexible student support (Kennedy & Masuda, 2021).

The program has three main Peer Leader training components—a one-credit training course, a summer orientation and module training for the organization of course content, and ongoing biweekly meetings of novices with experienced Peer Leaders to discuss issues arising from practice. The *Peer Leader Training* course meets once a week for 50 minutes over the course of 15 weeks. The course is housed in the Mathematics department, and is typically taught by a mathematics education professor. It is required for all novice Peer Leaders, who are simultaneously assigned to one of the courses that includes a PLTL workshop—that is, STEM foundation courses in chemistry, civil engineering, or mathematics. The former *Peer Leader Training* course focused on various topics related to learning theory, communication theory, group dynamics and facilitation, whether in a mathematics course or in a chemistry or static lab activity. In 2018, the course was redesigned to include new components and new dimensions, based on what was outlined above, and described in more detail below.

The Modified Peer Leader Training in Mathematics Course

The redesign of the course includes the following course components.

1) Learning Theory and Pedagogy

These were addressed through readings, group discussions, group exercises, and reflections. The course topics were slightly modified to include the following:

Session 1: Introduction – Group Facilitation Scenarios

- a) What is Peer-Led Team Learning?
- b) Team building

Session 2: George Polya's Model for Mathematical Problem Solving

- a) Polya's problem solving techniques,
- b) Questioning, and questioning techniques

Session 3: Effective Communication

- a) The value of active listening
- b) Five ways to listen better
- c) How to get students to participate in class discussions.
- d) Characteristics of effective listening
- e) How to get students to talk in class

Session 4: Team Development and Facilitation

- a) The five stages of team development: a case study.
- b) Community toolbox: Developing facilitation skills.

Session 5: Vygotsky's Zone of Proximal Development

- a) The Zone of Proximal Development (ZPD)
- b) Scaffolding in the ZPD
- c) Facilitation of communication and scaffolding: The tools of classroom talk.

Session 6: Self-Determination Theory and Self-efficacy

- a) What is Self-Determination Theory?
- b) Extrinsic vs. intrinsic motivation: What's the difference?
- c) Strategies for motivating students
- d) Fixed vs. growth mindsets: The two basic mindsets that shape our lives.

Session 7: Howard Gardner's Multiple Intelligences Theory

- a) Multiple Intelligences Theory: Widely used, yet misunderstood
- b) Eight types of intelligence

Session 8: Equity, Diversity, and Inclusion

- a) Diversity and inclusion
- b) Helping diverse learners succeed
- c) Increasing equity for all students

Session 9: Helping ELL and Students with Special Needs Learn

- a) Culturally Responsive Mathematics Teaching
- b) Helping English language learners and students with special learning needs

Typically, readings were assigned, which were then collectively discussed in class. For the purposes of the course, we employed the use of videos portraying instructional practices, where the instructor worked with small or large group of students, on the understanding that, before Peer Leaders can enact successful pedagogical routines, they need to be able to discern the basic elements of best practice. The use of video acted to enhance Peer Leaders' "noticing" capacities (Sherin & Han, 2004; van Es & Sherin, 2002; van Es & Sherin, 2008), and to help them develop the capacity to identify, analyze and interpret various teaching and learning situations, and to formulate effective strategies in response. Short video examples were selected from [Engage NY Video Library](#) archive (n.d.) demonstrating various possible Peer Leaders' moves such as, for example, organizing groups and assigning roles to group members, launching an activity, questioning or challenging students, and facilitating group discussions. Longer videos showed extended episodes of expert instructors organizing group problem solving, and soliciting, selecting and sequencing student responses for group discussion. Some of these were selected from the *Video Cases to Support Teaching and Learning* (Boaler & Humphreys, 2005), although other video cases can be chosen as well, e.g., *Learning and Teaching Geometry: Video Cases for Mathematics Professional Development, Grades 6–12*, developed by WestEd (Seago et al., 2017). These cases were used in conjunction with assigned readings about the role of the facilitator and facilitation moves (e.g., Chapin & Anderson, 2009) as well as conversational rules and norms for conducting group discussions (see Resource Library, 2022; Graduate Student Instructor, 2022).

2) Rehearsals

"Rehearsals" consist of the enactment of routines following a given protocol. A "routine" represents one given aspect of peer leading, for example launching an activity, which includes framing it in relation to previously discussed materials, and offering some

orientation into what needs to be accomplished through it. Other routines involve dividing a large group of students into smaller groups, assigning roles, and introducing conversation rules; questioning a group to identify where the problem is, and offering some guidance; scaffolding the problem-solving approaches of a group as students struggle with the process; leading a discussion to help several groups share methods and solutions, and so on. Often rehearsals are preceded by the course instructor modeling the rehearsal task: this allows Peer Leaders to experience the task from the point of view of the student, and to see how the instructor used specific questions and moves to help the group problem solving process. Following this, the group of Peer Leaders is split into groups of three to four people, who rehearse a similar task among themselves. The instructor monitors these rehearsals and offers feedback. Often after some practice, one of the small groups is chosen to demonstrate the task in question in a “fishbowl” setting, where the chosen group enacts the given task while everyone else observes and takes notes. One of the members of the small group acts as facilitator. The enactment is followed by collective reflection on the quality and character of the facilitation, and any other aspect that is deemed important. Both Peer Leaders from the inner circle and the outer circle of the fishbowl are encouraged to participate in the reflection. The practice is then repeated by another group. Over the duration of the course, different tasks are rehearsed at different times, sometimes driven by problematic situations that the Peer Leaders have experienced. The advantage of using rehearsal is that it combines enactment of content and pedagogical knowledge and can serve as a vehicle of helping Peer Leaders improve their performance in relation to both.

3) Action Research Project

Early in the course Peer Leaders were asked to select a research question that they wished to answer through data collection and analysis conducted with their PLTL workshop group. The course instructor held individual meetings and email exchanges with each Peer Leader to help them phrase the question so that it was clear, focused and answerable in the given context. Below are examples of two research questions and abstracts as offered by two Peer Leaders.

RQ1: To what extent do students persist in mathematical problem solving?

Abstract: Do students persist in solving problems? Do they show "grit" or do they easily give up? What reasons do students give to justify their persisting in problem solving or their abandoning the problems they work on? My research would examine to what extent students persist and what reason they present for their actions. I will collect data

about the degrees to which students complete their worksheets during their peer-learning sessions and homework. I will also interview individual students to explore what drives or curtails their persistence.

RQ2: Do students develop a habit of self-reflection throughout problem solving in the PLTL workshop?

Abstract: I want to study how students reflect on their problems throughout assignments. Reflection is a key part of the learning process. When students finish a problem, they move on without examining results. I want to gather data in order to examine whether and to what degree each module is completed by the members of students in the PLTL workshop. I will continue to implement George Polya's problem solving protocol and listen and record their steps in finding solutions and verifying their results. I will continue to ask the same questions to students whenever they ask for help: What is the problem asking? What technique could be used? I want to observe if these students are asking themselves these questions later on in the course and see if they become more reflective.

Peer leaders are guided through the action research process: generating a question, collecting data in the form of surveys, or observational checklists and field notes, and analyzing the collected data. Peer Leaders are given space to share their research questions, data collection procedures, methods of analysis, and to plan for presenting the study results with others.

4) Poster Presentations

Upon completion, the action research study results are presented in one of the last classes in a Gallery Walk, during which all Peer Leaders are expected to mount informal posters on the classroom wall in the form of multiple documents and images reporting on their research question, data collection, data analysis, results and conclusions. A Gallery Walk requires Peer Leaders to move around the room and explore each other's poster presentations. In addition, an opportunity for a more formal poster preparation and presentation is offered by the Semi-Annual Student Research Poster Session at the college. Sample posters are featured in the Appendix.

5) Advice Letters to the New Peer Leaders

As a final assignment the Peer Leaders are asked to reflect on their experience and to write a letter offering advice to new Peer Leaders. These letters represent a final reflection by the Peer Leaders completing their training. They are shared and discussed among all group members during the last class meeting, and are used as an introduction

to the training for the new incoming trainees. Sample advice letters can be found in the Appendix.

Conclusion

This paper has described the design and implementation of a Peer Leader training course that has been modified to place greater emphasis on student action, reflection and group deliberation. In the introduction and direct practice of the discursive tools of critical thinking in a group mathematical problem-solving setting, trainees develop facilitation skills through immediate experience. Through the design and implementation of action research projects relative to their immediate setting, they enhance their listening and “noticing” capacities, become more familiar with the relevant research literature, and are given the opportunity to connect theory with practice in fresh new ways. Through the powerful lens of videography, they are able to witness examples of best practice firsthand. Through small group “rehearsals,” they are given the opportunity to enact short activities and facilitation tasks in a “fishbowl” format and receive feedback from their peers and their instructor. These modifications, in addition to the introduction of posters and “advice letters,” represent, we believe, an enhancement of the training process that allows for practicing facilitation of collaborative problem-solving, group and individual self-reflection, a greater sensitivity to student learning process, and thereby the overall enhancement of communication, clarity, and purpose in the classroom.

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SUPPORTING INFORMATION

APPENDIX¹

Student Posters



Students Perspective on Enjoyment in Mathematics Classes

M. M & Y. S. Faculty Mentor: K.

Mathematics Department, New York City College of Technology, CUNY

Abstract

The project will focus on students' perspective of enjoyment in mathematics. The research questions that will be explored are: 1) Do students enjoy math classes? If so, what aspects of the classes they find enjoyable and why? If not, what aspects they do not enjoy and why? and 2) What do students think would make the math classes more enjoyable? Data will be collected by administering surveys to students from two mathematics courses. The data will be organized, analyzed and presented at the poster session.

Introduction

Although students spend a lot of time studying and doing mathematics, we don't know enough about how they view mathematics and whether they enjoy it. Enjoyment in mathematics might enhance students' engagement and academic performance. The propose of this study is to examine the students' perspective on enjoyment in mathematics classes. The study focuses on students from calculus I and calculus II classes. 22 students out of 34 from calculus I and 14 out of 24 from calculus II participated in the survey.

Literature Review

How students perceive mathematics and why they need to study it differs from student to student. Some students think mathematics is important for future purposes and others believe it is useful for everyday life. Only few students understand mathematics as enjoyable practice, and "consider the nature of mathematics to be about having fun" (Young-Loveridge et al., 2006, p. 587). Another has found that there are no differences in students' enjoyment in mathematics when they worked on abstract mathematical problems, word problems and modelling problems. (Schukajlow et al., 2012). In general, no much research has been done on student enjoyment with mathematics and thus this study is concerned to find more about it.

Data Collection

Data was collected through administering a survey to students from two math classes in spring 2019. One of the two classes was Calculus I, and the other—Calculus II course. Altogether, surveys were completed by a total of 36 students.

Acknowledgment

Sincere thanks are extended to our mentor, professor Nadia Kennedy, for being so generous with her time and to the students who participated on the survey. This project is supported by the Emerging Scholars Program at the New York City College of Technology, CUNY.

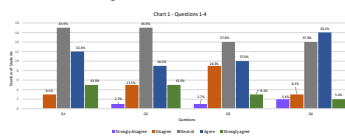
Data Analysis

Based on the survey, we found that about 47% students enjoy mathematics classes. The report different reasons for enjoying mathematics—39% report that they enjoy mathematics because mathematics make them feel powerful; 36% report that they enjoy it because mathematics is fun and engaging; 50% report that they are good at math; 50%—report that they love math because it makes them think; and 61% report that they enjoy it because math challenges them. Overall, 53% report that they like their calculus classes. Moreover, flexibility of solving mathematics and applying real world problem appears to make mathematics more interesting for some students. On the other hand, some students struggle in mathematics classes and find classes to be challenging, which makes them feel frustrated and anxious. Some students find the course pace too fast, which contributes to their frustration and not liking of mathematics.

The detailed results are presented below:

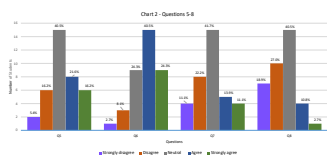
Questions 1-4:

- 1- I enjoy doing mathematics.
- 2- Mathematics makes me feel powerful.
- 3- Mathematics is always fun and engaging.
- 4- I feel that I am good at math.



Questions 5-8:

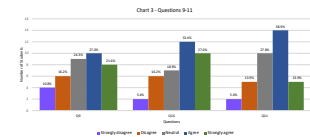
- 5- I have always felt that I have talent for math.
- 6- My success in math depends entirely on my hard work.
- 7- My love of math was instilled by my teachers.
- 8- My love of math was instilled by my parents.



Data Analysis - Continuation

Questions 9-11:

- 9- I love math because it makes me think.
- 10- I love math because it challenges me.
- 11- Overall I like my math classes.



Results

Overall, the data shows that more than half of the students like mathematics classes. About 46% of students agree that they enjoy math classes. 64% think their success in mathematics depends entirely on their hard work. Only 1/4 of them agree that their love for mathematics was instilled by their teachers and about 14% agree that their love for mathematics was instilled by their parents. Most students believe that the way instructors present mathematics is the reason that makes mathematics either enjoyable or unpleasant.

Conclusion

Although some students believe that the challenging of mathematics is the key to enjoy it, others complain about its difficulty. From students perspective, having more class time to do mathematics would make mathematics more pleasurable. Additionally, most students believe that applying mathematics to real life situations would help students make more sense of mathematics and thus make it more enjoyable for them.

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¹ All names in the posters and advice letters have been changed.



What do peer-leaders learn in facilitating groups during peer-led workshops? Is there a Difference between what New and Experienced Peer-leaders Learn from Group Facilitation?

R. C. and B. C. , Faculty Mentor: K.

Mathematics Department, New York City College of Technology, CUNY

Abstract

The study will focus on peer-leaders learning in the context of peer-led workshops, which they facilitate for one semester or more semesters. The study will focus on the following research questions: 1) What do peer-leaders learn in facilitating groups during peer-led workshops? And 2) Is there a difference between the learning of novice and experienced peer-leaders?

Introduction

Peer-led team learning (PLTL) is a model of teaching undergraduate science, math, and engineering courses that introduces peer-led workshops as an integral part of a course. The purpose of this study is to examine what do peer-leaders learn in facilitating groups during peer-led workshops and to compare the learning of the novice and experienced peer-leaders.

Literature Review

Suzanne L. Hamid a student at the University of Tennessee has done research to explore the experiences of peer leaders in first-year seminars. He stated, "Of the 83 peer leaders, 79 perceived that being a peer leader had changed them significantly" (Hamid). "They also claimed that their leadership and communication skills were shaped and enhanced" (Hamid). The researcher found that the experiences of peer leaders at the institution's studies have benefited the peer leaders and were strongly suggestive and concluded that Peer leaders derived personal, social and career building benefits from serving as peer leaders. In this study, we examine what the peer learns in facilitating groups during peer-led workshops and compare it between the novice and experienced peer-leaders.

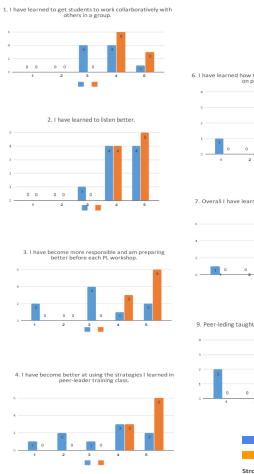
Acknowledgment

The project is supported by the Emerging Scholars Program at the New York City College of Technology, CUNY.

Research Questions

What do peer-leaders learn in facilitating groups during peer-led workshops?
Is there a Difference between what New and Experienced Peer-leaders Learn from Group Facilitation?

Data Analysis



Data Collection

The participants in this study will be the peer-leaders, who facilitate peer-led workshops at City Tech in Spring 2019. Some of them are novice peer-leaders, undergoing training in Spring 2019, and others are experienced peer-leaders, who have previously done the training and have facilitated groups for one or more semester. Data will be collected through surveys, and organized, analyzed, and presented in a poster.

Results

The data from the ten graphs have shown that the experienced peer leaders have improved and learned much more than the novice leaders in facilitating groups during peer-led workshops. Most of the experienced peer leaders chose to agree and strongly agree on the statements in the survey for what they have learned and improved while the new peer leaders are wildly spread from strongly disagree to strongly agree. Apparently, the novice peer leaders still in progress of improving to become a better peer leader. The more experience they have gained the more confidence they will have become. A good facilitator means you have the ability to organizing work with groups of people and guide the people to meet their goals effectively. At the beginning of the peer leading most of the new peer leaders have issues or concerns regarding what is the best way to help your group. However, as time goes on the new peer leaders start to manage the method or the strategies that motivate and facilitate the students. Therefore, as the graph has shown not many new peer leaders chose to agree and strongly agree on what they have learned and improved compare to experienced peer leaders.

Conclusions

According to the result from data, the peer leaders have improved and learned to communicate better, listen better, and use scaffolding to help the students when facilitating the students. Overall, they have become a better and successful peer leader. The difference between the novice and experienced peer leaders is that the experience has learned and improved much more than the novice peer leaders in facilitating the groups. Therefore, you can indicate that peer leaders have improved through time.

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Students' Perceptions of the Impact of Peer-led Workshops on their Team-working and Problem-Solving Skills

D. M. , Faculty Mentor: K & C.

Mathematics Department, New York City College of Technology, CUNY

Abstract

The study will explore the benefits for students of participating in a weekly one-hour workshop over the course of one semester. The workshop functions as a mandatory lab component of a Statics course. The participants in the study are the students attending the peer-led workshop. Data will be collected through surveys, and organized, analyzed, and presented in a poster.

Introduction

A peer-led team learning (PLTL) is a form of group learning that helps students understand class materials in a way that is more interactive than a lecture. Typically the students will work with peers in small groups on a set of problems selected in advance by the instructor. A trained peer-leader acts as a facilitator for the group and helps the students interact with one another and share ideas in the interest of solving the problems together. The purpose of this study is to examine the students' perceptions of the effects of the peer-led workshop on their problem solving and team-working skills.

Literature Review

Of the many studies that have examined the effectiveness of the PLTL model, only one tested the model as a predictor of critical thinking gains. Quidadamo, Brähler, and Crouch (2009) examined the impact of PLTL on critical thinking gains in six undergraduate science and math courses at a research university in the Pacific Northwest. Results showed that the PLTL model had a positive impact on critical thinking gains. In addition, grade performance and retention improved. Like many cooperative learning strategies, the PLTL model encourages students to actively engage in their own learning. Differing from traditional cooperative learning strategies, however, this model provides guidance to the students in a setting outside of lecture and without teacher intervention (Deming, 2001). Results showed that the PLTL model encouraged communication and articulation of knowledge, understanding, and skills.

Acknowledgment

The project is supported by the Emerging Scholars Program at the New York City College of Technology, CUNY.

Research Questions

The study focuses on the following research questions:

- 1) Do peer-led workshops help students become better at team-working?
- 2) Do peer-led workshops help students develop problem solving skills?

Data Collection

Data was collected using the online service, SurveyMonkey. Two surveys were created, and each focused on one of the two research questions. Each survey consisted of 8 questions. Both surveys were distributed to the students, who took part in the peer-led workshops of the Statics shortly after the students' first midterm exam. Below are the questions in each of the two surveys:

Q1.6 for Research Question 1

1. The peer-led workshops have helped me to feel more confident solving problems with another peer.
2. The peer-led workshops have helped me to become better at communicating during teamwork.
3. The peer-led workshops have helped me to become a better listener during teamwork.
4. The peer-led workshops have helped me to become more comfortable working with others.
5. I have started to work more often on homework or test prep with a partner outside after class.
6. The peer-led workshops have helped me to come to like studying with a partner outside of class.

Q1.6 for Research Question 2

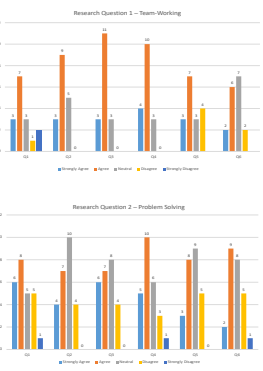
1. The peer-led workshops have taught me to think about the process first before solving a problem.
2. The peer-led workshops have helped me to be more persistent in problem solving.
3. I am less willing to give up if I encounter problems I think are difficult.
4. I am more confident with the topics covered.
5. I try my own method in solving problems more frequently.
6. My problem solving skills have improved.

Data Analysis

Based on the surveys, we found that students perceive that as a result of their attending the PLTL, they:

- * Improved their communication skills.
- * Improved their ability to work effectively with another student.
- * Improved their listening skills.
- * Improved their determination in solving unfamiliar problems.
- * Gained confidence in solving problems
- * Improved their thinking process in problem solving

The raw data from the surveys is given below.



Additional Comments

Regarding additional positive benefits from participating in peer-led workshops, the students commented that: 1) The peer-led workshops have helped them improve relationship with their peers; and 2) The peer-led workshops have helped them to approach problems in class differently.

Results

Overall, 75% or more of the students perceived that there was improvement in their communication and interpersonal skills. Most of the students agreed that working together was much better for them than working alone. About 80% or more of the students believe that they became better at explaining ideas, at listening more carefully, and became comfortable working in a group.

Only about 60% of the students felt that their thinking about the process of problem solving has improved. Overall, the perception of 65% of the students was that they improved their problem solving skills. In addition, most students felt that the workshop helped them to understand each other's idea through interactions. In turn, this motivated students to work on the problems and find ways to solving them. Overall there was a clear consensus that their teambuilding skills had improved as well.

Conclusions

The overwhelming perceptions of the students was that the peer-led workshops have helped them to improve both their team-work and problem solving skills. The biggest challenge was getting the students to begin conversing with one another because this workshop has not been integrated into more classes.

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“Advice Letters” to the New Peer LeadersLetter 1

Dear new Peer Leader,

Welcome to the world of peer leading. I hope you are going to enjoy your journey as a Peer Leader as I have done. Let me give you a taste of some of my experience as a Peer Leader.

Since becoming a new Peer Leader in Fall 2018, I have learned many things. I have improved my communication, my English, and my math skills. I have learned how to deal with students and what exactly my job as a Peer Leader. I have learned different strategies to solve problems and that was because I have reviewed materials to be able to help students and I have exchanged ideas and thoughts with students and with other Peer Leaders. I also have developed my ability to help students by instructional scaffolding and questioning techniques. Peer leading is not just helping students to solve problems but helping myself to develop many skills. From the research I have done for the class, I have learned about the Peer Leaders’ perspective of their development throughout the semester.

When you peer lead, it is not surprising to have students who are not willing to work. Your job is to make them work effectively by scaffolding their learning. Also, many students, unfortunately, think math is a hard subject and they cannot excel in it, but we -as Peer Leaders - have to make them see math differently either by telling them that math needs to be practiced or by providing some fun strategies that make the subject interesting.

One of the key ideas that makes Peer Leaders more confident is to review materials before the workshop, so Peer Leaders will be able to give the maximum help needed for students. To facilitate the group work in the workshop, it is better to encourage students to work together and to help each other, then observe their progress and give them hints. If you get many students who are asking different questions, of course it is not possible to work with each one of them at the same time, but you can let them help each other while you help one of them at a time. That way you have all of them working, you save time, and everyone gets help during the workshop. Some students are not willing to work as a team, but you - as a Peer Leader - have to keep encouraging them to do so. Try to build positive relationships with your students and have then build these same relationships with one another.

For the research, choose a topic about peer leading that captures your interest, so you enjoy the research throughout the semester. Be enthusiastic about finding research results that help you to learn more about peer leading. The feeling you will have when you

get the research done is the part that will make you feel happily satisfied because you have learned something new. If you do survey or interviews to collect data for your research, ask students or Peer Leaders to do their best to answer the questions so your collected data is more accurate. I know some respondents do not take ~~survey~~ surveys seriously, they just write anything to finish the survey so please encourage them to be thoughtful and give their honest answers. When you do the posters, organize them well and make them look clean and clear. Also, apply to be an Emerging Scholar.

I am sure you are going to enjoy being in the classroom with professor K. because she makes the class enjoyable. Also try to make the workshop fun so students enjoy it and you enjoy the work with them as well. Good luck!

Y.

Letter 2

Dear New Peer Leaders,

I want to start this letter by, first, welcoming you to another semester in City Tech and to the exciting world of peer leading. Peer leading is an experience that many of you, if not all, will be experiencing here for the very first time in this school and in your lives. I would like to share the many things that I have learned during my peer leading experience this semester.

1. You may feel a little nervous initially and not prepared to be a Peer Leader for the class. That is something you will get over as soon as you are familiar with the students in your workshop.
2. Your students will ask you many questions pertaining to what they have learned. Be completely honest with them. If you do not know or remember, say so. You can always ask for assistance from other Peer Leader or use the resources you have at your disposal.
3. You may feel you are all alone with the students. Trust me, you are not. Your peers can help you. Other students in the class will also help you.
4. The research project may seem pointless at first. It isn't pointless. In fact, it is extremely necessary, helpful, useful, and fun once you get your data collection together.

5. Dr. K. will speak with you about joining the Emerging Scholars at the beginning of the semester. If your GPA and schedule allow it, do it.
6. When you are doing your poster presentations, Microsoft PowerPoint and/or Apple Keynote are your allies. Make them as beautiful as you possibly can. The world is yours.
7. Expect students from other groups to ask you questions if they have any. Can you answer their questions? Yes. Should you answer their questions? Absolutely.
8. There may be some students who ask for help when they just want you to give away the answer. Don't do it. DON'T DO IT AT ALL!!!! You would not be helping the students by giving them the answers. You can give them a way to arrive at the answer(s) on their own. Teach them how to fish, so to speak.
9. The modules that you hand out at the beginning of the peer-leading session should be returned by the end of the session. If they aren't completed, give the students until the next session to complete it. They may surprise you with what they learn.
10. Most importantly, be patient. It will take you further.

I really hope that everything I have put in this letter helps you in this course. Best of luck, and most importantly, have fun.

Sincerely, K., Future Educator

Letter 3

Dear Future Leader,

Hope you have high expectations of yourself this semester, do not be nervous. I know you are more than a conqueror. First, I would like to share a picture of myself before the beginning the Fall 2018 semester. I didn't really know how to be a group leader. I felt that I could be a much better communicator. Therefore, I knew I wanted a space to practice planning and executing my intentions. Then one day out of the blue I got an e-mail about becoming a Peer Leader, and although it was last minute, I went for it.

In my classroom setting, I worked as the professor's assistant with another peer. She and I didn't really get to lead the class because it was a "CO-session" but we got to

communicate with students every so often. I made the best of the situation. Before class began, I practiced speaking to random students. This helped me to become more confident with my speech skills. Sometimes I felt like the conversation wasn't going anywhere, so in the short moments I pushed myself to confidently listen, dialogue and end conversations. As a Peer Leader you gain tactical knowledge that can improve your interpersonal skills. In life, such skills are very important, and help you get your point across to people.

A key to grow as a Peer Leader is to pay attention to both verbal and nonverbal communication. You'll get many hints about your delivery if you pay attention to facial expressions. Being a peer-leader is about growing to become comfortably uncomfortable with who you are. Therefore, be yourself every time you communicate with your students. If you have any concerns there is a support system provided by your MEDU professor. Use this opportunity to comfortably speak your mind. Currently you are very blessed to have a MEDU professor who aims to provide you a safe place to grow. Take this opportunity to learn to listen to useful criticism while you're in a classroom setting.

Additionally, understand that "your experience isn't going to be like everybody else's. Your experience is going to be tailored to who you are right now and will help you grow in the direction you need to grow for your future." Make sure to take advantage of being in the position of Peer Leader. Speak to others about what you learn or have learned. Hopefully this semester will provide you will plenty of opportunities to learn to wisely speak your mind.

You may encounter not knowing what the heck you are doing. Not knowing what to do is sometimes natural, so push yourself to want to know. With that, I will leave you with the best advice ever, "take chances, make mistakes, get messy!" – Ms. Frizzle from the Magic School Bus.

Sending You the Best Towards Your Future,

T.