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Peer-Assisted Learning in Calculus II: Examining Gender Differences

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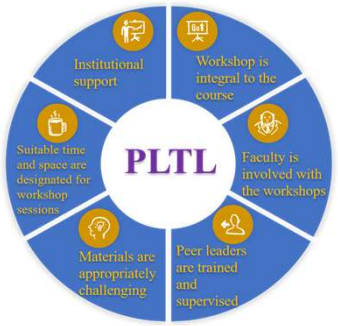
Abstract

Mathematics is a topic in which undergraduate students find challenging, particularly for females. By providing a peer-assisted workshop during the semester, undergraduates are offered academic support throughout the course. New York City College of Technology, though a Department of Education Minority Science and Engineering Improvement Program (DOE MSEIP) grant, has adopted the Peer-Led Team Learning (PLTL) instructional model in a few Calculus II sections. Peer Leaders engage the students one-hour a week in working on selected problems sets in a collaborative setting. This project examines if there are gender differences in Calculus II class in 1) PLTL workshop attendance, 2) departmental final grade, and 3) Calculus II course grade. Results showed that there were no statistically significant gender differences in all three areas. Hence, the PLTL workshops may be an intervention that may help females succeed in higher-level mathematics courses if they persist in the course.

Peer-Led Team Learning (PLTL)

- Peer-Led Team Learning (PLTL) is an instructional model where students work collaboratively in groups.
- In the PLTL workshop eight to ten students are assigned to a group with a designated pear leader. The workshop is held one hour each week after the respective lecture class.
- In addition, faculty members are closely involved in the PLTL session, thus peer leaders can discuss what topics to cover during the PLTL workshop and ask the professor questions.
- The six critical components of the PLTL model are displayed on the right.



Literature Review

- According to the recent reports, while more women are getting STEM (Science, Technology, Engineering, and Mathematics) degrees, they still lag behind men. (Liou-Mark, Ghosh-Dastidar , Samaroo , and Villatoro 2018; Osikominu, Pfeifer 2018).
- Women are less likely to pursue math-intensive fields due to their relatively lower math and science expectancies and values in comparison with men. (Wang and Degol 2013).
- In Sweden, the Supplemental Instruction (SI) is a method of improving student performance by using collaborative activities under the guidance of a 'senior' student. (Malm, Bryngfors and Mörner 2014). All students who attended SI meetings performed better on average than those students who did not attend. More importantly, female SI students are more frequent visitors to SI meetings than male students. And, those female SI students earned higher average score in their math class in the first school year.
- The Peer-Assisted Learning program in the United States is a similar program to Supplemental Instruction (SI) in Sweden. In medical school, Peer-Assisted Learning (PAL) leaders can provide guidance to students to improve their academic performance and help struggling students improve their critical thinking and problem-solving skills. The Peer-Assisted learning program also encourages students form study groups, which help make the study experience more enjoyable with their peers (Usman and Jamil 2019).
- In addition, both female and male students were satisfied with the contents covered in PAL. They felt easy to communicate with a peer as compared to their teacher, and the peer tutors also performed well in their respective sessions (Usman and Jamil, 2019).

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Methodology

- This research study used data collected from the Peer-Led Team Learning (PLTL) workshops sections of MAT 1575: Calculus II between Fall 2016 to Fall 2018 academic years (five semesters) at New York City College of Technology.
- Attendance was taken every workshop session by the peer leaders. There were a total of 13 workshop sessions every semester.
- At the end of the semester, the department final grade and the course grade were collected. Gender of the participants were also recorded.
- Independent z-tests at the $p<.05$ level were conducted to determine if there were statistically significant mean differences between mean and female in their workshop attendance, department final grade, and course grade.

Participants

- There were a total of 217 undergraduates who enrolled in the PLTL workshop section of Calculus II from Fall 2016 to Fall 2018 (five semesters)
- Seventy-seven students were excluded from the study because they either did not state their gender (27), received an absent grade (ABS) as their departmental final grade (6), a grade over 100 percent (14), W grade (19), WU grade (6). Thus, the total valid participants for the study was 140.
- There were 28 females and 112 males who qualified for this study.

Results

- Based on the z-test, there were no statistically significant mean difference in the departmental final grade between males and female undergraduates taking Calculus II. Results showed males scored slightly higher than females on the departmental exam. A summary is shown in Table 1.
- Based on the analysis of the research on total workshop attendance and course grade, there were no statistically significant mean difference between female participants and male participants in the MAT 1575 Course. The result is shown in Tables 2 and 3.

Table 1. Summary Results of Departmental Final Grade

	Female(n=28)	Male(n=112)	Z-test
Mean	65.89	71.58	
Standard Deviation	17.63	16.88	Z= -1.5169 P=0.06463

Table 2. Summary Results of Total Workshop Attendance

	Female(n=28)	Male(n=112)	Z-test
Mean	11.18	11.02	
Standard Deviation	2.21	2.75	Z= 0.3264, P=0.3720

Table 3. Summary Results of Course Grade

	Female(n=28)	Male(n=112)	Z-test
Mean	2.04	2.20	
Standard Deviation	1.25	1.24	Z= -0.5779, P=0.2816

Limitation of the Study

- A small sample size of females. The gender imbalance can be seen in the participation of higher-level math courses.
- Students with W/WU grades were excluded from the study. It may be interesting to examine the reason for withdrawal from the course.

Conclusions

- The PLTL workshop in Calculus II may be beneficial if students attend it every week.
- If females were supported in a problem-solving session, they can perform just as well as males in higher level courses.

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