Jul 31st, 1:00 PM - 3:30 PM

Maximizing Participation in an Online Mathematics Course

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Autobiography

Who am I?

My name is Lauren Falck, and I am a senior at the University of Northern Iowa majoring in mathematics teaching with a certification in computer science. I grew up in a small town in northwest Iowa. My love of learning started at a young age because my mother was a teacher and my father was a self-taught contractor. With a desire for learning and my love for mathematics, I decided to become a mathematics teacher. This career will give me the opportunity to share my passion for a subject that is often disliked.

Why am I Researching Online Mathematics Courses?

Coming from a small school, the only way to advance in academics was to take online college courses. These courses were all self-taught where I read material or watched a video and then completed a formal assessment or wrote a paper. I quickly discovered with a non-interactive course, I was not getting the most out of the class. My perception of online courses changed in the spring of 2020 when my classes were suddenly put online. I then realized I needed to prepare myself, as a future educator, to be able to teach an online course in the most effective manner to achieve student participation.

Introduction

The year of 2020 highlighted many issues of online learning. For example, online classes do not enhance the learning of the students the same way face-to-face classes do.

My Concern

My main concern is the educational experience of students. Online classes do not achieve the same results as face-to-face classes. The lack of interactions in an online course can become problematic. Students are not as engaged in the course, which will result in a lack of learning.

Methods

In the Graph Theory class I assisted with, students worked on problems in small groups. I wanted to measure each student's contribution to the solutions. Every time a student participated in answering a problem, they received a point. The points were divided by how many problems there were each day to give each student a percentage of daily participation. The data I collected highlighted peer socialization and in-class participation, female students in group participation, and higher and lower student participation.

My Story

The summer of 2020 I was asked to be the undergraduate Teaching Assistant (TA) for an online Graph Theory course for the Michigan Math and Science Scholars (MMSS) Program. I was under the instruction of Professor Douglas Shaw and worked with the graduate Teaching Assistant Will Dana.

Michigan Math and Science Scholars Program

The Michigan Math and Science Scholars (MMSS) Program is a program formulated for high school students to present current topics and research in mathematics and sciences that they might not experience in a typical high school setting. This program encourages students to love and engage in mathematics and sciences at a young age.

Graph Theory

Graph Theory is a branch of mathematics that studies the relationship between vertices that produce a graph. In this course, students engaged in the following tasks: studied properties of certain types of graphs, hunted for graphs, learned various theorems, constructed mathematical proofs, and even added new findings to graph theory research. As a TA, my main responsibility was to help students in small groups with their problems; however, I also got the valuable opportunity to teach lessons and observe an online interactive mathematics course.

Resources

Crawford-Ferre, H. G., & Wiest, L. R. (2012). Effective Online Instruction in Higher Education. *The Quarterly Review of Distance Education*, 13(1), 11-14.

Dasgupta, Nilanjana & Scircle, Melissa & Hunsinger, Matthew. (2015). Female Peers in Small Work Groups Enhance Women's Motivation, Verbal Participation, and Career Aspirations in Engineering. *Proceedings of the National Academy of Sciences of the United States of America*. 112. 10.1073/pnas.1422822112.

Raygoza, M., León, R., & Norris, A. (2020). Humanizing online teaching. http://works.bepress.com/mary-candace-raygoza/28/

Robert A. Ellis , Paul Ginns & Leanne Piggott (2009) E-learning in higher education: some key aspects and their relationship to approaches to study, *Higher Education Research & Development*, 28:3, 303-318, DOI: 10.1080/07294360902839909

Tidwell, Deborah & Linda Fitzgerald. (2007), Self-study as teaching. In, J. John Loughran, Mary Lynn Hamilton, Vicky Kuber LaBoskey & Tom Russell, Eds, *International Handbook of the Self-Study of Teaching and Teacher Education Practices*, pps. 79-112. Springer.

Triyanto. (2019). Understanding Student Participation within a Group Learning. *South African Journal of Education*, 39(2), 1-8. doi:10.15700/saje.v39n2a1629

Conclusion

Every teacher's goal is to provide an environment in which all participants have the opportunity to learn and explore using their critical thinking skills.

How to Maximize Participation in an Online Math Course:

1. Provide informal social events for students and staff
2. Make sure there are multiple female students in a group
3. Place both higher-participating and lower-participating students in the same group

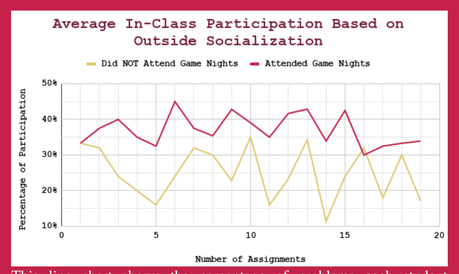
What Am I Going to Do?

After this research, I realized how important building relationships is for optimizing a student's education. In my future classroom, I will provide out-of-class social events and will be more conscientious of designing groups.

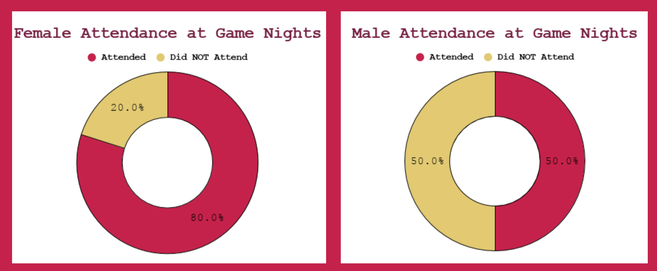
My Findings

Peer Socialization and In-Class Participation

Once a week, a virtual game night was held with the teaching staff and students. After our first game night, I noticed that the students who attended seemed to be engaging more within their in-class small groups. I decided to investigate. First, I reviewed their Professional Problems Google Doc history to measure each student's contribution to the solutions. I gave each student a point for every contribution to solving a problem; as a result, multiple students could get a point for the same problem. Then I took the points each student earned from assignment contributions and turned them into percentages. After coding these results, I compared the daily participation percentage between the students who attended the game nights and those who didn't. It is important to note that some students may have been contributing verbally, which I was, unfortunately, not able to track.



This line chart shows the percentage of problems each student contributed to solving. The pink line represents the average of the students who attended the game nights while the yellow line represents the average of the students who did not attend the game nights.



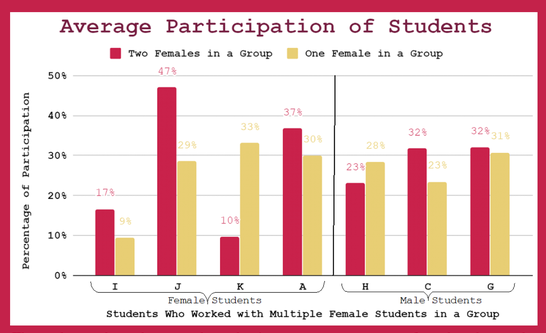
These two pie charts show the attendance of female and male students at the out-of-class game nights. The left pie chart shows the female students' attendance, and the right pie chart shows the male students' attendance. On both pie charts, the pink color represents those who attended the game nights while the yellow color represents those who did not attend the game nights.

Results:

According to the data I collected, those students who attended the game nights participated more in class compared to those who did not attend the game nights. Plus, female students were more likely to attend an out-of-class social event compared to male students.

Female Students in Group Participation

After the first observation, I was curious if there were any other tendencies surrounding gender. First, I averaged each students' percentages for the groups they were in. I noticed that female students participated more when there was another female in the group. Next, I took the average participation for students when there were two female students in a group and compared it to when there was only one. I also included the male students who experienced having both one female and two female students in their group. It is important to note that not every student in this course had the opportunity to have multiple female students in their group; therefore, those students were not included.



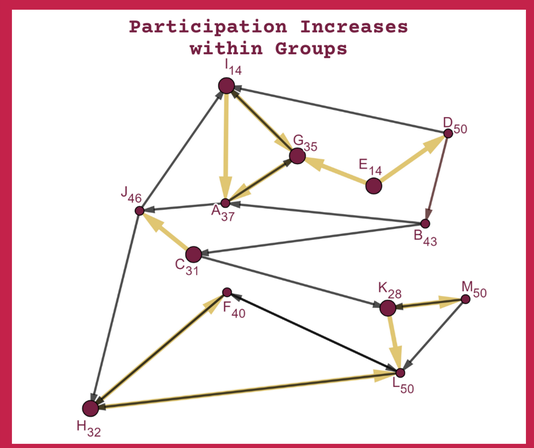
This column chart shows each student's average participation for when he or she worked in a group with two female students and compares it to when he or she worked in a group with one female student. The pink color represents when there were two female students in a group, and the yellow color represents when there was only one female student in the group. The left four students (I, J, K, and A) are female while the right three students (H, C, and G) are male.

Results:

According to the data I collected, students participated more in their groups when there were two female students present in the group. Not only was this trend true for female students, but it was also true for male students.

Higher and Lower Student Participation

After examining group participation related to gender identity, I wondered if there were any other trends surrounding group work. Again, I looked at all the students' percentages of participation for the groups they were in. I created a vertex for every student and connected an arrow from that student to the other students who were in the group when that student participated the most.



This directed graph shows the relationship between lower-participating and higher-participating students. Each vertex point has a letter representing a student with a subscript next to the letter, which shows how many problems the student helped solve. The enlarged vertices points represent the students who participated less than average. The yellow arrows represent lower-participating students with improved participation because they were with higher-participating students.

Results:

According to the data I collected, it is evident that students who had a lower participation tendency participated the most when they were in groups with students who had a higher participation tendency.