

ONLINE OR OFFLINE?

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ABSTRACT

*Teaching Calculus course in a community college is very challenging. There are many difficulties that the instructor needs to overcome to teach this course effectively and smoothly. Being a teacher of Calculus in Hostos community college for several semesters, I gathered various experience and teaching pedagogy which works very effectively for me. The pedagogy that will be described in this paper involved pre-lecture video concept based on “youtube” videos. I showed how this technique helped me in my class to increase class participation. I compare two sections of Calculus I which is taught in a regular way without any intervention and two sections of Calculus I which is taught using this pedagogy of pre-lecture videos. The measurement is taken using 20 questions which were fixed in all four sections. For each of these questions, the class participation is measured using the number of students raised their hands. The detailed is listed in the article. This method also has some byproduct benefits which I also discussed in some detail toward the end of the paper.*

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INTRODUCTION

The 21st Century ushered in a new era of globalization with accelerated rate of technological developments demanding a work force highly trained in STEM (Science, Technology, Engineering and Mathematics) fields. The current US administration has recognized this challenge by making education a priority by focusing particularly on the restoration of America’s Leadership in Higher Education with special emphasis on the role played by Community Colleges [1]. We have been charged with preparing a well-trained student population in the STEM fields to meet these challenges and stay competitive in the global markets. Consequently, innovative educational programs must begin at an early stage of students’ education with the theoretical and practical applications needed to become front-runners in this competitive world. We need to make the learning process exciting and interactive for students, thus increasing retention in the STEM areas [2].

City University of New York, like many other universities in the US, has diverse body of students. Thus a single method of teaching cannot be appropriate for all the students. Susan and Linda described this fact as follows: *By now it is axiomatic to point out that student bodies are increasingly diverse, not only in terms of ethnicity and gender, but also in terms of age, nationality, cultural background, etc. This diversity can affect classroom settings in many ways, including the diversity of learning styles. [3].*

After teaching Calculus I in Hostos community college for several semester, I have collected different pedagogy of teaching this subject to community college students specially a Hispanic dominated college like Hostos community college. This college is located at the heart of Bronx and at least 70% of the population is Hispanic. Usually, in my class of Calculus I, 60% of the students are Hispanic and 30% are Black and 10% are other ethnicity. African-American and Mexican-American students are more likely to prefer working with others to achieve common goals [4]. It was also pointed out that the metaphor of dialogue is more appropriate in that it emphasizes the interactive, cooperative, relational aspects of teaching and learning [5].

So we need to rethink our traditional way of teaching where students are thought of as empty bag and we fill them up with as much knowledge as quickly as possible. We also need to think about how much of this knowledge is in fact retained by our students for the long run. McKeachie pointed out the following:

*In a typical 50-minute lecture class, students retain 70% of what is conveyed in the first 10 minutes but only 20% from the last 10 minutes. If we really want to get our message across, we need to orchestrate “the material” in a multi-faceted way across the range of student learning styles [6].*

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The issue/problem that I have addressed in this article is the “low level class participation”. I will discuss the method of pre-lecture video technique and corresponding implication in my class. This is perhaps a broad methodology which may be employed in a variety of classroom and subjects. This works very effectively for me throughout the semester. The readers may find similar difficulties and experience as I did.

**Problem:** The problem at hand is the “low level class participation”. I always found in my Calculus I class that very few students are willing to participate in the class. I want to increase the number of class participation. So first I asked myself why this is the case?

### **WHY SUCH A LOW CLASS PARTICIPATION**

There may be several reasons behind this problem:

- Not enough background preparation. Students are somehow just passing pre-calculus without thoroughly understanding the materials.
- Break of study. Students are coming back to college after two/three years of break of study. So they forgot the materials from pre-calculus.
- Psychological obstacle “Math is hard” type of mentality.
- Students are not use to read Mathematics textbook. They can read History books or novel but when it comes to Mathematics, it is impossible.

All of the above means less preparation for a student to take a Calculus course. Hence students get confused in the class and cannot catch up. This way students are not even sure what to ask in the class and this result a low class participation.

**Solution:** Of course, these are some of the common issues that probably all the teachers have to deal with at some point of their teaching carrier. This is one of the reasons that the solutions to this problem are applicable in great generality.

### **THE CONCEPT OF PRE-LECTURE VIDEOS**

Any teacher has a limited amount of time in their hand that they can spend teaching background materials that students supposed to know before they come to the class. I found in my class that the majority of the students do not have the proper background. I need a quick method and technique to address this in the current semester. I use the concept of pre-lecture videos. These are videos collected from the internet, usually from “youtube”, and posted them in the blackboard site of the course. The reason I called these pre-lecture videos is that students supposed to and must watched these videos before they came to the class. These are usually very short videos not more than 10 minutes in length. These videos usually based on some preliminary topics which students need to know to understand the following lecture. As an example, students will watch videos on “factoring trinomials” on the blackboard before they come to my lecture on “Analytic approach to limit” where students need to be able to factor to do problems. Factoring trinomials is a topic that students need to know even before they come to pre-calculus. But believe it or not many students in my Calculus I class did not know how to do it. This way student seems to be confident in my class and understand the lecture more smoothly and not paying too much attention to the preliminary materials. Now students are asking questions on the actual Calculus part instead of asking questions on preliminary materials.

### **MEASUREMENT**

The measurement of the class participations are taken over four semesters. This is taken over two sections of Calculus I where no involvement of pre-lecture video techniques took place and two sections of Calculus I where this pedagogy of pre-lecture video technique is employed. All the other variables are kept constant – for example the lecturer, class time etc. are kept same. The 20 questions that are used to measure classroom participation are given below (although the actual content of the question is not that important). These questions are asked various times throughout the semester.

1. What you think the Calculus is about?
2. What is the word “limit” means to you?
3. What is the difference between the limit of a function as “ $x$  approaches  $a$ ” and actual value of the function at “ $x = a$ ”?
4. What is the conjugate?
5. What is the slope of a line?
6. Given two points, how to find the slope?
7. Given a point and a slope, how can you find the equation of a line?
8. Can a tangent line intersect a graph?
9. Does every point on a graph must have a tangent line?
10. When a function is increasing, what can you say about its derivative?
11. If a function is continuous at a point, does the function need to be differentiable at that point?
12. Just by considering the graph of  $\sin(x)$ , where do you think the derivative is 0?

13. Can we distribute derivative under multiplication? Give a counter example.
14. What is the area of a triangle/rectangle/trapezoid?
15. Can we distribute integral under addition and subtraction?
16. Can we distribute integral under multiplication?
17. Can you use power rule of derivative to find integral of “x to the power n”?
18. Is the formula that we found for the integral of “x to the power n” makes sense for all “n”?
19. Why we cannot use FTC to calculate integral of “1 over x” from  $x = -1$  to  $x = 1$ ?
20. We know that integral of  $\cos(x)$  is  $\sin(x)$ . How can we use this to find integral of  $\cos(2x)$ ?

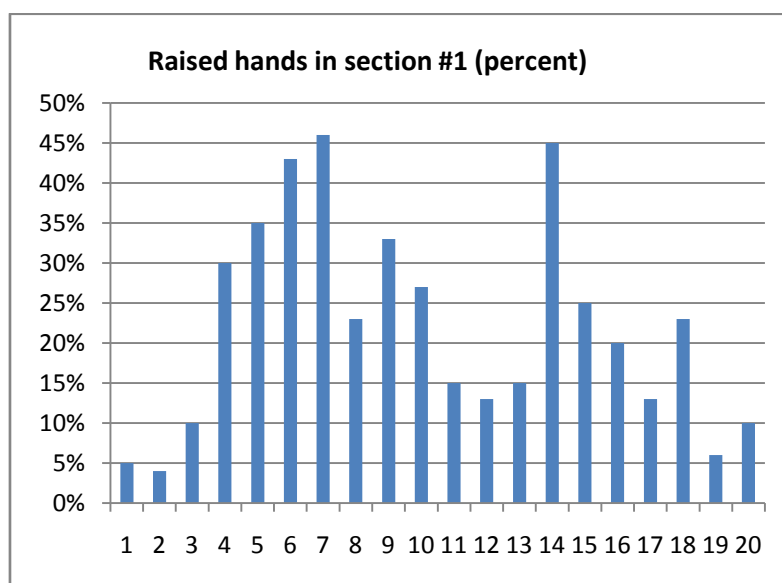
### ASSESSMENT

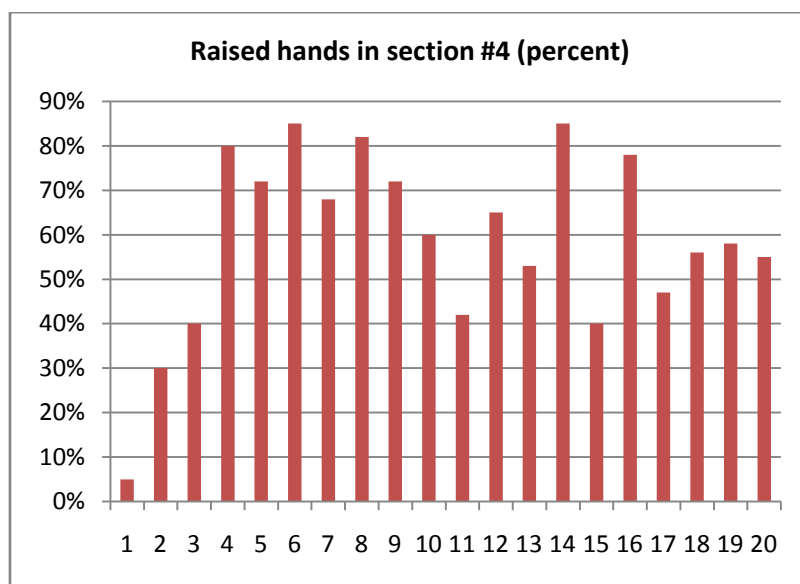
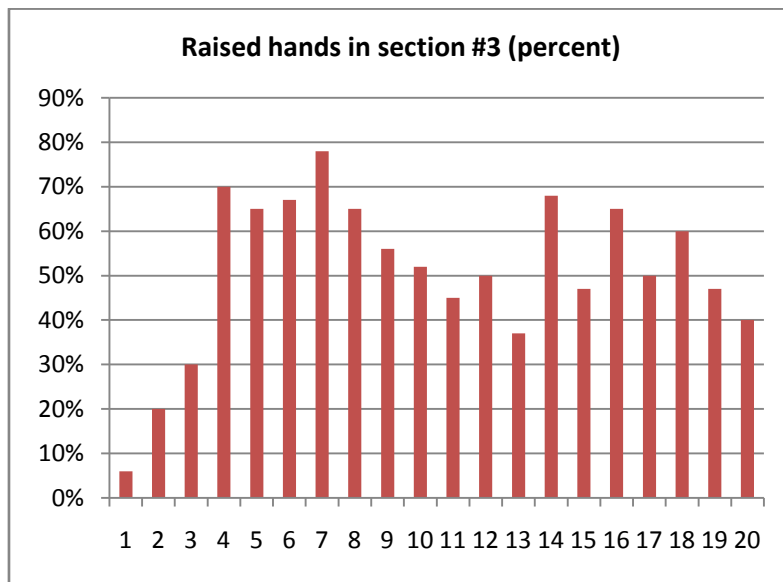
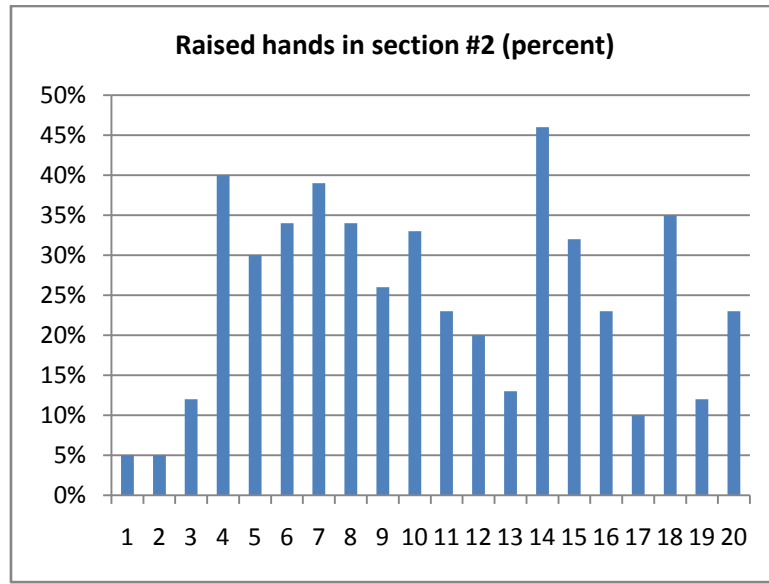
Each of these twenty questions is asked various times throughout the semester. Each time, the number of students raised their hands are counted and recorded. This is done for all the four sections of Calculus I throughout a period of two years. The data is presented in the following table. For convenience, I named the section as section # 1,2,3 and 4. Section # 1 and 2 is a regular section where I did not use any pre-lecture video techniques. In section # 3 and 4, I did use the pre-lecture video technique. I presented the data as percent (Table 1) – this gives for example what percent of the students raised their hand compare to the whole class. And only this is what we care about. The numbers are rounded to the nearest whole number.

Table: 1

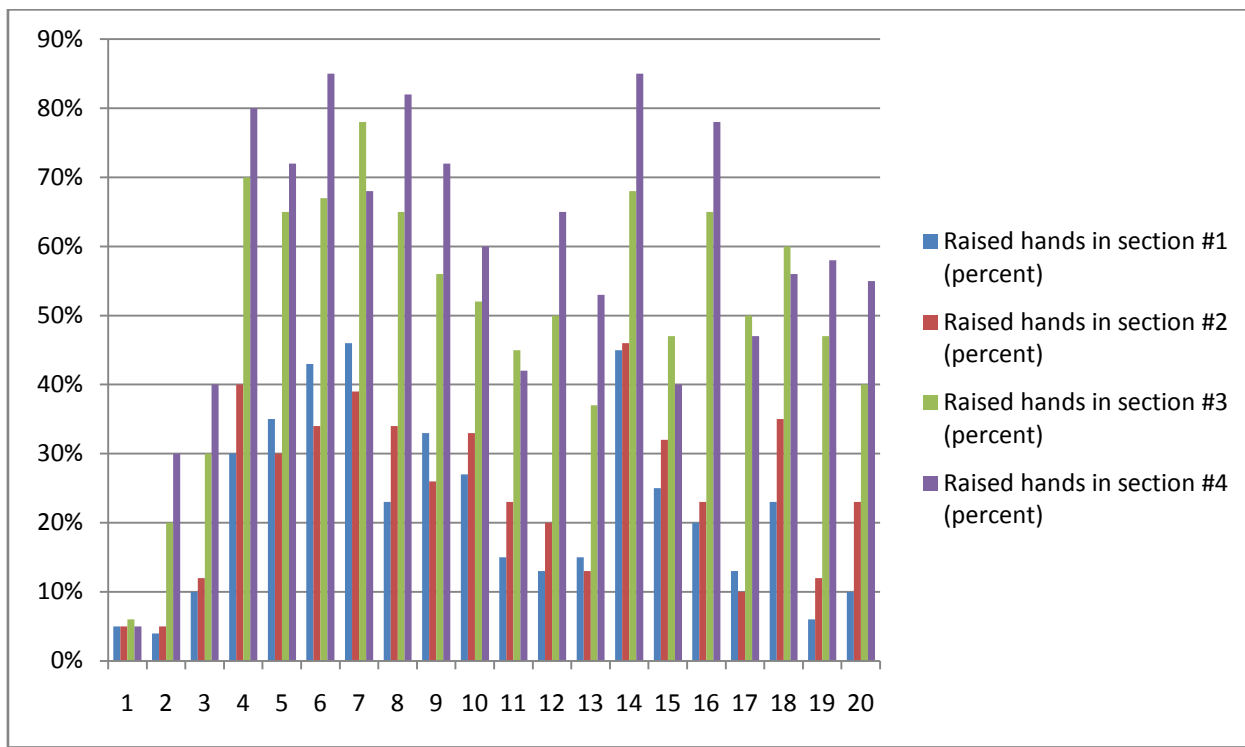
Question #	Raised hands in section #1 (percent)	Raised hands in section #2 (percent)	Raised hands in section #3 (percent)	Raised hands in section #4 (percent)
1	5%	5%	6%	5%
2	4%	5%	20%	30%
3	10%	12%	30%	40%
4	30%	40%	70%	80%
5	35%	30%	65%	72%
6	43%	34%	67%	85%
7	46%	39%	78%	68%
8	23%	34%	65%	82%
9	33%	26%	56%	72%
10	27%	33%	52%	60%
11	15%	23%	45%	42%
12	13%	20%	50%	65%
13	15%	13%	37%	53%
14	45%	46%	68%	85%
15	25%	32%	47%	40%
16	20%	23%	65%	78%
17	13%	10%	50%	47%
18	23%	35%	60%	56%
19	6%	12%	47%	58%
20	10%	23%	40%	55%

The following is the bar graph for each of the four sections:





The following is the bar graph for all four sections combined:



## ANALYSIS

It is evident from the above data that the number of class participation increased in section 3 and 4 compare to section 1 and 2. For some unknown reason, we also observed that the number of class participation in section 4 is generally higher than section 3. But in any case, it proves that the technique of pre-lecture videos do increase the number of class participation.

## CONCLUSION

There are some other benefits of this approach that I recognized throughout the semester which is not related to class participation. These are listed below:

1. Students are more prepared to understand my lecture.
2. Students are getting less confused in the class.
3. The grade of students are relatively better (although not significantly).
4. Students are learning more than one way of solving a problem – one from the pre-lecture video and one from my lecture.
5. Students are asking questions on the Calculus part of my lecture instead of preliminary content.

Overall, in this article, I tried to explain my personal experience teaching Calculus in Hostos community college. I also explained how I use pre-lecture video technique to increase class participation. Other instructor of the same subject may find similar difficulties. I hope this article will give some new direction or teaching pedagogy to all the instructors who are teaching science related subject especially in a community college.

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