

Online course and face-to-face lectures' quality comparison —— from study participation and learning continuity.

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1. Introduction:

In the traditional university teaching model, on-line courses only take a small part, and the degree of difficulty of these courses is always less than normal courses. However, to protect students and profs from COVID-19 pandemic, all around world universities stopped lectures and offer all instruction through remote methods. Online students' numbers increased sharply, but whether the online class quality can be as same as face-to-face instruction is still a problem. In a recent survey of community college students, only 3% believed that students learn more in an online-only class than in a face-to-face class. Except for technical problems, sense of instructor and peer presence, time management and self-discipline play an important role in on-line class quality(Benbunan-fich and Hiltz, 2003). In this research, we use diagonalization to calculate the number of students who can keep studying on-line courses for approximately one month until the final exam. We will compare this number to the number of students keeping have face-to-face courses to find out whether online courses cause worse class participation and self-discipline in undergraduates' study.

2. Set Up:

In order to estimate the degree of participation and continuity of both online study and traditional study, we decide to first determine the factors related to class participation. Students' participation in one lesson can be estimated in two ways: if we see the class as a whole group, the percentage of how many registered students attend this lesson shows students' participation. And if we estimate for individual, students' participation can be written as how many lessons of this course he/she has attended. In order to estimate study continuity, we want to know how many lessons students attend in succession. Therefore, we collect students' participation by individual attendance, but not the percentage of a whole class.

To calculate the continuity of study, we can estimate the number of students' continuous lessons or the number of students who keep learning day by day. Since we want to predict the continuity of traditional study and online study, we choose to collect the number of students who keep learning day by day.

Therefore, in this research, we counter individual attendance for the online class, predict the number of students who can keep learning continuously, and compare with total students who can keep learning when they have face-to-face class.

3. Methodology:

To predict the number of students who can keep learning online courses and compare it with the total number of the face-to-face class, we set two Markov chains to record students wills of attend online classes and attend face-to-face lectures.

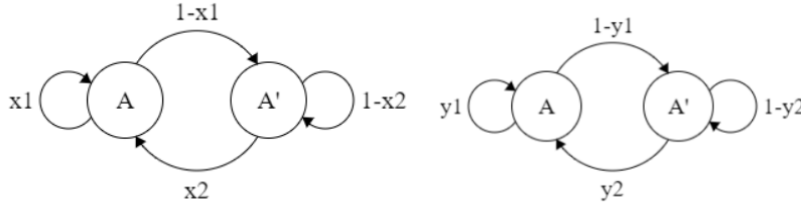


Figure 1 online class

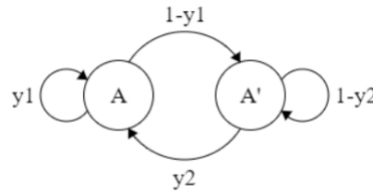


Figure 2 face-to-face class

We assume A means student attend to class, A' means student does not attend to class, $x1$ is the probability of student keeps staying in state A the next day, $x2$ is the probability of students keeps staying in state A' the next day.

And we can rewrite these two Markov chains as two 2×2 matrixes proportion of each of these four choices:

$$\begin{pmatrix} x1 & x2 \\ 1-x1 & 1-x2 \end{pmatrix} \text{ for online class,} \quad \begin{pmatrix} y1 & y2 \\ 1-y1 & 1-y2 \end{pmatrix} \text{ for face-to-face class}$$

These two matrixes show students' willing to participate class in different teaching model. By these two matrixes, we can predict the number of students who can keep studying online courses for one month, and the number of who can keep studying face-to-face. The difference in continuity will be shown be comparing these two numbers. So we can know whether online courses cause worse class participation and self-discipline in undergraduate's study.

4. Explicit computations

To predict the number of students who can keep studying in a long term, we made a questionnaire about attending willing for online study and lecture study. We want to get the prediction of how many numbers of students can keep studying for one month (30 days) in a 50000-student university.

For our sample study, we collect 50 university students and get the following data:

tomorrow \ today	Attend the class	Not attend the class
Will attend the class	26	23
Will not attend the class	24	27
Total	50	50

Figure 3: online class

tomorrow \ today	Attend the class	Not attend the class
Will attend the class	43	44
Will not attend the class	7	6
Total	50	50

Figure 4: face-to-face class

From the table, we can get:

For online class, among 50 students who attend the class today, there will be 26 of them attend the class tomorrow, and 24 would not. And among 50 students not attend the class today, there will be 23 of them attend the class tomorrow, and 27 would not.

And for face-to-face class, among 50 students who attend the class today, there will be 43 of them attend the class tomorrow, and 7 would not. And among 50 students not attend the class today, there will be 44 of them attend the class tomorrow, and 6 would not.

So for online class, if students attend the class today, 52% of them will attend class next day. And if students do not attend the class today, 46% of them will attend class next day.

And for face-to-face class, if students attend the class today, 86% of them will attend class next day. And if students do not attend the class today, 88% of them will attend class next day.

Then we can get these two forms as two 2*2 matrixes to show the proportion of each of these four choices:

$$A = \begin{pmatrix} 0.52 & 0.46 \\ 0.48 & 0.54 \end{pmatrix} \text{ for online courses, } A = \begin{pmatrix} 0.86 & 0.88 \\ 0.14 & 0.12 \end{pmatrix} \text{ for face-to-face courses}$$

$$\text{For online class, we get } P = \begin{pmatrix} 23 & -1 \\ 24 & 1 \end{pmatrix} \quad D = \begin{pmatrix} 1 & 0 \\ 0 & 0.06 \end{pmatrix},$$

$$\text{for face-to-face class, we get } P = \begin{pmatrix} 44 & -1 \\ 7 & 1 \end{pmatrix} \quad D = \begin{pmatrix} 1 & 0 \\ 0 & -0.02 \end{pmatrix}$$

We suppose for a random university, there are 50000 students.

Assume there are 25000 attend the class today and 25000 not. Then we calculate the number of students attend the class after 30 days for two different teaching models using the matrix A above.

$$x_{k+1} = Ax_k, \text{ where } x_0 = \begin{pmatrix} 25000 \\ 25000 \end{pmatrix}, \text{ then } X_{30} = A^{30} x_0 = (PDP^{-1})^{30} \begin{pmatrix} 25000 \\ 25000 \end{pmatrix}$$

For online class

$$A = PDP^{-1}$$

$$P^{-1} = \begin{pmatrix} 1/47 & 1/47 \\ -24/47 & 23/47 \end{pmatrix}$$

$$X_{30} = (PDP^{-1})^{30} \begin{pmatrix} 25000 \\ 25000 \end{pmatrix} = PD^{30} \begin{pmatrix} 1/47 & 1/47 \\ -24/47 & 23/47 \end{pmatrix} \begin{pmatrix} 25000 \\ 25000 \end{pmatrix} = \begin{pmatrix} 24468.09 \\ 25531.91 \end{pmatrix}$$

For face-to-face class

$$A = PDP^{-1}$$

$$P^{-1} = \begin{pmatrix} 1/51 & 1/51 \\ -7/51 & 44/51 \end{pmatrix}$$

$$X_{30} = (PDP^{-1})^{30} \begin{pmatrix} 25000 \\ 25000 \end{pmatrix} = PD^{30} \begin{pmatrix} 1/51 & 1/51 \\ -7/51 & 44/51 \end{pmatrix} \begin{pmatrix} 25000 \\ 25000 \end{pmatrix} = \begin{pmatrix} 43137.25 \\ 6862.75 \end{pmatrix}$$

After 30 days, for online course, there will be about 24468 students attend to class.

For face-to-face study, there will be 43137 students attend to class.

From the sample collected from 50 students, we get the prediction that for a 50000 students-enrolled university, we have 24468 students keeping study in a month. This number is much less than the number of students who can keep studying face-to-face (43137). Therefore, when having online classes, students willing of attending to class is much lower than when they have face-to-face class, and they show worse self-discipline. Students' participation and study continuity are worse than the traditional teaching model in university study.

5. Conclusion

As we have shown in part 4, when having long-term online courses, the number of students who can keep studying is much less than the number of students who keep studying in the traditional teaching model. According to the rapidly decreased number, class participation, and study continuity attend to be worse than the conventional teaching model in university study. When students lack in the sense of instructor and peer presence, their losing self-discipline causes a worse quality of online classes. From the outlook of teaching quality, online courses still behind than face-to-face teaching. Consequently, online education still has a long way to go in the future.

6. Reference:

Benbunan-fich.R and Hiltz.S.R(2003)Mediators of the effectiveness of online courses, *IEEE Transactions on Professional Communication*, 46(4), 298 - 312

