Extended Abstract with Poster

Is Distance Education Distant Education?

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Extended Abstract

Distance learning engineering course offerings are increasing in popularity among institutions of higher learning. These courses are often viewed as a cost-effective mechanism to deliver engineering education to worldwide student clients. As such, distance learning (DL) initiatives such as the Massive Online Open Course (MOOC) offerings initiated at Stanford University are being adopted by an increasing number of academic institutions such as MIT, Harvard, UC-Berkeley, and more recently the University of Texas System[1]. In the wake of this rapid expansion of engineering course offerings through MOOCs and other distance delivery modes, it is imperative to address whether or not such online instructional tools are suitable substitutes for in-class learning. A perception among some engineering educators is that students taking classes by distance do not receive the same level of learning experience as the students in class[2]. As a result, the DL students' understanding of course materials is presumed to be inferior to those of in-class students.

This study sets out to test this hypothesis by comparing the grades of distance versus in-class students who took the same exams. The data covers four graduate-level courses taught by the same instructor over a period of four-years. The mode of instruction for all four courses was video-streaming the lectures for on-line viewing on a secured website. After viewing the lectures online, DL students interacted with the instructor by E-mail. All other course transactions such as submittal of homework assignments and term papers and the returned graded work were also conducted electronically. Exams were administered electronically through a third-party proctor pre-approved by the instructor. The proctors were typically a supervisor at the DL student's work place or another professional acquaintance of the instructor at the student's place of employment. The exams were E-mailed to the proctors who administered the exam at the satellite location and returned a pdf copy of the completed exams to the instructor.

Statistical analyses were conducted to examine whether there was any difference in the mean exam grades of the two groups of students over the four-year period. The exam grades are used

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as a proxy for student's understanding of the course materials. Table 1 shows the mean exam grades of the two student groups in each of the four respective courses. As shown in Table 1, the mean grades of the DL students were by-and-large less than those of the in-class students. Therefore, a cursory conclusion could be that the DL students' understanding of the course materials is indeed inferior to that of the in-class students. However, the central question of this study is whether the observed differences are statistically significant. To address the above, a one-tailed hypothesis test is conducted with the null hypothesis being the exam grades are not different versus the alternate hypothesis that the DL grades are less than the in-class grades.

The group statistics for the DL and in-class grades, which formed the basis for the statistical tests, are summarized in Table 2. The results of the hypothesis tests are presented in Table 3. As shown in Table 3, the null hypothesis that the means are statistically the same cannot be rejected at either the 5% or 10% levels of significance which are typically used for these tests. In fact, the p-value corresponding to this test is 0.29, signifying that the mean grades of the two student groups (DL versus in-class) are statistically very close and that the null hypothesis cannot be rejected even at the 29% level of significance.

In conclusion, there appears to be no statistical difference in performance of the two student groups as quantified by their exam grades. It may be argued that the exam grades might not be an accurate measure of students' understanding of the course material. However, such grades have always been used by instructors as the key assessment measure for this purpose. Hence, it has been used in this study as a surrogate measure of understanding course materials. It should also be emphasized that the conclusions in this study are predicated on the specific distance learning delivery mode and student-instructor interactions described above and may not be valid for other types of delivery modes and interaction techniques. Although the majority of DL courses rely on the video streaming of lectures with web-based delivery, there is a wide variation in how the question and answer, homework assignments, project reports, and exams are handled. These latter elements may also play a significant role in the quality of instructions in DL classes.

References

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Table 1. Mean Exam Grades by Semester for In-Class versus DL Students in the Same Graduate Courses

Semester	In-Class Mean	DL Mean	P-value (1-tailed)
Fall 2008	88.60	88.67	0.493
Fall 2010	88.60	87.20	0.398
Fall 2011	81.00	78.75	0.394
Fall 2012	77.50	74.25	0.352
Total	84.10	82.13	0.293

Table 2. Group Statistics for Mean Grades of In-Class versus DL Students

	Groups	N	Mean	Std. Deviation	Std. Error Mean
Total Grades	In-Class	30	84.10	11.63	2.12
	DL	16	82.13	11.71	2.93

Table 3. P-Values for a 1-Tailed Hypothesis Test of Mean Grades of DL Students Being Less than Those of the In-Class Students

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	p-value Level of Sig. (1-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Total Grades	Equal variances assumed	0.138	0.712	0.547	44	0.293	1.975	3.609	-5.299	9.249
	Equal variances not assumed			0.546	30.55	0.295	1.975	3.617	-5.406	9.356