

Transfer Student Higher Success with Multiple-Attempt Testing in Engineering Dynamics

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Abstract

Transfer student success seems a ceaseless challenge lingering for decades. This issue aroused the interest to be investigated in an *Engineering Dynamics* course conducted in the interim of COVID-19, delivered virtually as a Mixed-mode to 236 students. 76 of those students were transfer students from the University of Central Florida affiliated institutions. During the course, three tests were conducted with three attempts each. Each attempt was allotted 90 min and each test was done within a week. To maintain high-integrity, a combination of *LockDown Browser*, *Respondus monitor*, as well as *Proctor Hub* were all used in conjunction with a strict condition that all students were to keep only one screen and allow the camera to capture what they were doing as well as their faces. All formative and summative assessments were facilitated using Canvas Learning Management System (LMS). A higher success of at least 24% in Test 3 (T3) alone for Transfer students, and an overall success of Transfer students that matches those of the First Time in College students (FTIC) students 51% - 51%, contrary to past experiences. More than 90% of students agreed that this method is an effective new technique to be adopted for future assessments.

Keywords

Transfer students, FTIC, LockDown Browser, three-attempt tests, higher success, masterly learning.

Introduction

Unfortunately, many students appear not to have gained enough learning or studying techniques before they reach mid-university level such as required to take Engineering Dynamics. One main reason is they use Chegg¹ and other websites to help them solve their assignments that illusively convince them they know the material when most receive 100% in these assignments. Very similar material appears in the tests and yet the students are surprised why they fail the tests. This self-deceit of “I know the material well”, I got a 100%, or close enough in the assignments discourages the students from deeply plunging into learning the material more appropriately. Regrettably, they ignore the opportunity to practice solving the assignments’ problems rigorously until they get the correct answers, despite the multiple attempts permitted by Connect-McGraw Hill, K. K. Archer², thanks to Chegg.

Transfer students experience transfer shock, which is typified by a decrease in student performance as in Cedja³ and Hills⁴. The shock is occasioned by social and academic adjustment issues that include, learning a new system, environment, policies, and academic culture. Transfer shock is more pronounced in engineering majors as per Lakin & Elliot⁵. The dip in GPA often occurs during the first semester post transfer. However, for some students, the shock lingers for a longer period in what Lakin & Elliot refer to as “transfer norming” which in turn impacts their time to degree explained by Smith, Grohs, & Aken⁶. A prolonged transfer shock or transfer norming necessitates a rethink on how we do academics and provide necessary scaffolds for students to be successful in gateway courses. The testing method may provide students with multiple chances to identify their knowledge gaps, relearn target material, and attain mastery through retesting, an intervention focal to this research. The three-attempt testing may have come to give hope to solve these obvious concerns and to make some positive changes.

As per Y. Terada⁷, students motivation was down during COVID-19 which affected them negatively, not to mention their prior inherent weaker learning habits. In this paper, the assignments approach of multiple attempts was borrowed for the tests, to give hope to students each time they obtained a better mark in each additional attempt. The concern of the integrity of the assessment, to avoid cheating and grade inflation discussed in M. M. Lanier⁸, A. Fask et al.⁹, as well as P. Charlesworth et al.¹⁰ was resolved using strict integrity techniques that deterred students from even trying. G. Herman¹¹ discussed second attempt and weighted average grades to be effective positive advancement in the students’ learning outcomes.

The three-attempt testing helped the students learn the material by repetition only to bring them to an elevated cognitive level. With the hope that “I could still do better next attempt”, students were motivated to keep learning for a higher grade, resulting in deeper understanding and better appreciation of the knowledge they gained, digested and absorbed, making them ready for upper classes, Arora et al.¹² This hope and consistent learning supported the students in a scaffolded learning style as described in L. A. Fish¹³. Note that multiple-testing techniques could not be done had it not been for the digital learning and the Canvas facilitation as in Nader et al.^{14, 15}. However, the question we are addressing here is, how did the Transfer students benefit from multiple testing? So, let’s first learn more about the course.

Course Delivery and Testing Environment

This Dynamics course was conducted virtually once a week during Spring 2021 as a mixed-mode course. In this course, the students were assigned video homework about short videos created by the course instructor and based on the textbook by P.J. Cornwell et al.¹⁶, as well as LearnSmart (LS) homework assignments from Connect - McGraw Hill. These assignments were finished before the students attended the virtual classes. During the weekly virtual lectures, the instructor solved around 8 problems with the students during the 1.5 hours. The students also had after class homework assignments that were due about two days before the tests opened. An hour after the deadline of the latter assignments, the solutions were opened for the students to learn from their mistakes and become more ready for the tests.

The tests were open for a week with three attempts each. Each attempt was allotted 90 min. To access these tests virtually, students had to download LockDown Browser, to use Proctor Hub and Respondus Monitor. In addition, students had to push their computer screens about three feet in front of them or diagonally to give a full view of their faces and what they were writing before they would enter their answers into the computer. Their tests would not be valid otherwise. The cameras were later checked. The tests were automatically corrected using Computer-Based Assessment (CBA). For each attempt the students were allowed to ask the GTA what they got wrong and the GTA went over the problems with the students such that they could learn from their mistakes. Now, this was made possible via the different questions banks that were in store for each type of questions and that totaled more than 250 problems per test. These question banks had different level of difficulty that allowed for fair testing opportunity to each student clearly explained by Nader et DeMara¹⁷. For each attempt, there were about ten problems out of more than 250 problems, which were effectively less likely to repeat themselves per attempt, thus mitigating the cheating possibilities, as in C.J. Lee¹⁸. Each attempt was based on different questions styles such as multiple choice, numerical answers, True/False, multiple drop down as suggested in T. Tian & R. F. DeMara¹⁹ and Marsh et al.²⁰, thus ensuring a thorough and therefore a fair testing approach. The best mark out of the three attempts was retained. The students participated in a survey whose results are shown in Appendix A of Nader et DeMara¹⁷. More than 90% agreed that it is an effective method with the hope it be applied in other courses as well.

Results

Two groups of students were considered in the analysis, the FTIC and TS. The number of students succeeding in an attempt are those who obtained greater than 70% in each attempt. The percentage success for each for each attempt is represented below in Table 1. It can be easily seen that all students, be it FTIC or TS were constantly improving in each attempt for every test (T1, T2 & T3). Notice that more FTIC students succeeded in comparison to the TS for every attempt in every test.

Percentage Success	T1			T2			T3		
	At. 1	At. 2	At. 3	At. 1	At. 2	At. 3	At. 1	At. 2	At. 3
FTIC	26%	42%	60%	24%	52%	63%	26%	45%	48%
TS	14%	15%	34%	23%	35%	55%	11%	22%	40%

Table 1: Students' success in each attempt for the three tests.

However, the course considers the best mark in each test out of the three attempts per test leading to Table 2, representing the overall percentage success for each test. In other words, Table 2 was derived from the maximum grades of each Excel column for each test (T1, T2 & T3). Note that students who took Attempt 1 and succeeded, did not do Attempt 2. Similarly, with Attempt 3 for those who did well in Attempt 2. In essence the best grade of each of the three Excel column will lead to a higher overall average for T1. These best results are depicted in Table 2. We note the struggle of the TS in T1 was 42% success in comparison to FTIC of 55% success. In T2, the TS learned quickly how to deal with this new testing environment and scored higher than the FTIC (70% compared to 57%) and in T3 both groups got the same grade. What is remarkable is that the average success for each group in these tests comes to be 51%.

Percentage Success	Best of T1	Best of T2	Best of T3	Average Success
FTIC	55%	57%	42%	51%
TS	42%	70%	42%	51%

Table 2: Overall students' success – the best attempt for each test.

A Repeated Measures ANOVA for within subjects' design was conducted on students who had completed three attempts in each test. The results reveal that students' performance in each attempt significantly increased from Attempt 1 (M = 10.83, SD = 5, N = 142) to Attempt 2 (M = 13.60, SD = 4.78, N = 142) and Attempt 3 (M = 15.56, SD = 5.32, N = 142). According to Mauchly's Test of Sphericity, the variances of differences are homogenous $W = X^2(2) = 1.586, p = 0.452$. The findings are appealing to the fact that TS may be helped using this style of testing, at least for the fundamental or foundational courses.

Note that the course is comprised of assignments other than these tests and that the students' overall success in the course depended on other assignments.

Discussion and Conclusion

More data needs to be collected before concrete conclusion can be drawn regarding the knowledge enhancement the students gain from multiple testing, and hence their grades improvement. Table 1 suggests that in all of the progressive attempts the students consistently improved their marks with no exception meaning it is a strong evidence at least for this course. The questions are; What about other different courses? What if the students were given a different testing environment, change of an instructor or a shorter testing time, will multiple testing still work?

Three-attempt testing seems to solve or perhaps mitigates yet another issue that which is transfer shock as discussed earlier. Statistical data presented earlier, suggested consistent results of improvement with each attempt. The evidence is also depicted in Table 2, where FTIC and TS got the exact same average success rate 51% - 51% for the tests. The interesting thing is that it is not such a challenge to give these tests once large questions pools are prepared since it is all digital and even more interesting is that students like it much, as per the survey in Nader et DeMara¹⁷, more than 90% confirmed it was effective in their learning. The students now ask for it as per the experience of the author.

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