

Implementation of a Retake Policy: Who Benefits?

Dr. Jacqueline M. Jenkins, Cleveland State University

Fred Hussein

IMPLEMENTATION OF A RETAKE POLICY – WHO BENEFITS?

There are a variety of reasons why a student may not perform their best on a summative assessment. Perhaps they weren't adequately prepared, or perhaps they were prepared but succumbed to the stress of the situation. If lower scoring students are given a second chance, such as the opportunity to take a retake test, can they score higher? Does that benefit translate to a change in the percentage of students earning unsatisfactory grades in the course? To examine these questions, student performance in two different courses at Cleveland State University was evaluated. In each course, a retake policy had been implemented.

The first course, ESC 201 Statics is an undergraduate course taken by all civil and mechanical engineering students. A retake policy was implemented across three sections of the course, allowing students to take up to two retake tests for any of the six chapter tests. Each chapter test was worth 10% of the final grade. The scores on the retake tests were capped at 80%. The final grades, calculated with and without the retake grades, were compared to quantify the impact on student grades, and the difference in the percentage of students earning D and F grades in the course.

The second course, CVE 446-546 Transportation Engineering is a combined undergraduate and graduate introduction to transportation engineering course. The course has two midterm exams and a final exam. Two different implementations were tried over three years, 2020-2022, one allowed students to replace both midterms with a single retake exam, the other allowed students to retake the first of two midterm exams. The scores on the retake exams were compared to the original exam scores to quantify the benefit to the students. For the undergraduate students, the difference in the percentage of students earning D and F grades was determined. There are no D grade in the grading scale for graduate courses, so for graduate students the difference in the percentage of graduate students earning C and F grades was determined.

The results indicate that each of the different approaches taken to implement a retake policy in the two different courses positively impacted student success, measured in terms of an increase in letter grade. There was also a reduction in the number of students earning unsatisfactory grades. The results are discussed in terms of the additional workload needed by the instructors to implement the retake policy.

Introduction

Some believe that there is no place for retakes in college curriculum, as illustrated by the commentary by Snare [1], who grouped retakes, dropping the lowest score, and curving scores as approaches that can be used by professors to develop a perception of fairness. The commentary, however, neglects the potential for retakes to be a valuable tool to promote continued learning, and ultimately improve student achievement. In fact, retesting is a key component of both Keller's [2] and Bloom's [3] methods of instruction, and through many research studies retesting has been shown to be an effective learning tool.

Bostow and O'Connor [4] divided their educational psychology class into two groups of students ($N_1=20$, $N_2=21$); the remedial group was allowed to retake the weekly quizzes, and the non-remedial group was not. The pre-test scores of the two groups were comparable, and no significant difference was found between the mean scores of the groups on the initial quiz attempts. For those in the remedial group, the initial and retake scores showed no consistent difference in performance. However, the final exam scores of the remedial group tended to be greater than the non-remedial group, implying the retests served to increase their overall performance in the course.

Cates [5] examined the test and retest scores of 142 students who completed an educational psychology course during 1978, 1979, and 1980. The structure of the course included five tests, and either two, three, or four retakes, except once when offered during the evening it had only four tests and two retakes. Students chose whether to take a retake and would be rewarded with the highest of the original and retake scores. A total of 220 retakes were completed by 109 students, resulting in 139 (68.8%) increased scores. Of the retesters, 7% raised their grade from F to D and 12% raised their grade from D to C.

Freidman [6] allowed 109 students in two sections of an elementary statistics course the opportunity to retake the three lecture exams. Lower retake scores were not recorded and higher retake scores were averaged with the original exam scores. On average, students took 2.10 retakes and the average score increased by 16.99 points, resulting in an increase of just over one letter grade. Freidman also examined the final exam scores for students who had achieved an average grade B on the initial lecture exams, looking at the difference between those who took 0 to 1 retakes and those who took 2 to 3 retakes. The latter group was found to have higher final exam grades implying greater improvement.

Juhler et al. [7] examined the test and retest scores for 1,314 students who completed an intermediate algebra course. For each of seven chapter tests, if the student achieved less than a B grade, they could opt to take a retake. The score on the retake replaced the original test score, regardless of whether it was an improvement, but was limited to a B grade. On average, students were eligible to take 5.30 retakes and opted to take 2.31 retakes. The majority (88-95%) of students who took the retake improved their score. However, there was no significant correlation between the number of retakes and the final exam score.

Abraham [8] offered 150 students in intuitive calculus and college algebra courses the option to either drop the lowest test score or replace a low test score with a retake score. Students were allowed to take one retake for any of the tests. Lower retake scores were not counted. For students choosing to take multiple retakes, the score which represented the greatest gain was counted. A comparison of the final grades between those who dropped a test and those who replaced a test score with a retest score, showed that students who chose to retest performed considerably better on the final exam.

Ashour et al. [9] used retakes as a mastery learning approach for an undergraduate engineering economics course taught in 2016. For each of two open-book quizzes, students had up to 3 tries to achieve at least a B grade. The first attempt was for full credit, the second attempt was for a reduced credit, and the third attempt was for a further reduced credit. All attempts had to be taken within a specified 48-hour window, after which the solutions were distributed. Student performance on the course exams were compared to those from the previous year, which did not have the mastering learning approach. Those who experienced the mastering learning approach performed better on the two midterms but performance on the final was not significantly different.

Carpenter and McCusker [10] wrote of a retake policy implemented in two junior level courses. In a programming course, students were given nine 10-15 minute quizzes. If they achieved a grade below 80% on any of the first eight quizzes, they could retake the quiz to improve their score, up to a maximum of 79%. Most of those who took the retake maximized their scores. The average increase on the final grade was less than 1%. In a signal and systems course, if the class average fell below 75% on any of the 15 minute quizzes and three 120 minute examinations, a take home retake was offered. The final score was calculated as the average of the original score and the retake score, however, the impact on the final grades was not reported.

Singelmann [11] incorporated retakes as one equitable grading strategy in a sophomore level electrical and computer engineering course. For exam questions, if the student could not demonstrate their understanding of the entire problem by getting all parts correct, then they had three options. 1) They could choose to take a written retake, which meant receiving a similar question on the next written exam. 2) They could choose to take a verbal retake which meant going through the same question with follow up questions from the instructor. 3) They could choose to complete a mini-project to make up the grade. Students were surveyed about the equitable grading strategy. Eight students commented on the retakes. Retakes provided a push to learn what they had failed to learn the first time.

Ritz et al. [12] compared student performance between two sections of a sophomore-level statics and mechanics of material course. The control section had graded homework and two midterm exams graded with generous partial credit. The experimental section had a mastery-style assessment method where homework was assigned but not graded and the two midterm exams were graded either with constrained partial credit or no partial credit. Students in the experimental section could retake portions of the exams up to two times. Students in both sections took the same final exam. When graded using the partial credit and no credit approaches, the differences between the control section and the experimental section were not significant.

In each of these examples, the instructors put in additional effort to administer a retake policy that includes preparing and grading the retake tests, possibly with the hope to improve student learning and success. Fortunately, in each example, improvements in test scores and sometimes even the final exam scores were realized. This has not always been the outcome. Elbrink [9],

Deatsman [10], and Glucksman [11] reported student behavior that acted contrary to the success of a retake policy, such that students procrastinated and took only the last available test attempt seriously. Thus the extra effort may not always be justified.

In this paper, three retake policies, implemented in two different courses at Cleveland State University are examined. The purpose was to determine whether students benefited from the retake policy by quantifying the number of students who improved their letter grade, and the change in the number of students earning an unsatisfactory grade. The results are discussed in terms of the level of effort that was required for policy implementation in each of the courses.

Methodology

Retake policies were implemented in ESC 201 Statics during the fall 2022 semester, and CVE 446-546 Transportation Engineering during the fall semesters of 2020, 2021, and 2022. All original test scores and retake test scores were recorded and maintained as per the regular administration of these courses. At the end of the fall 2022 semester, the use of the recorded grade data, with all identifiers removed, was approved by the Institutional Review Board for this post-course study.

To quantify the benefit of the retake policy on student success, the original and retake scores for each student were used to determine the impact on their final grade. The impact was also quantified as the change in the number of students earning unsatisfactory grades. For undergraduate students, that was the difference in the percentage of students with D and F grades. There is no D grade in the grading scale for graduate courses, so for graduate students it was the difference in the percentage of graduate students with C and F grades. In addition, the resulting change in the average grade for each course was calculated.

First Course – ESC 201 Statics

The first course was ESC 201 Statics, an undergraduate course taken by all civil engineering and mechanical engineering students at Cleveland State University. During the fall 2022 semester, there were 86 students in three sections of the course offered by the two authors. The authors coordinated efforts, presenting the same lecture material on the same days, during 50-minute class times, following the textbook *Engineering Mechanics: Statics* by Hibbeler. After covering the material from a chapter, students were given a review session to work on example problems, similar to problems they could expect to see on the chapter test. The chapter tests were paper-based tests completed during one, 50-minute class. Test problems were focused on the application of core concepts. For each test, multiple versions of the same questions were prepared using different variable values as a means to deter cheating. A total of six chapter tests were administered during the semester. Each test was worth 10% of the final grade. The final test covered two chapters and was worth 20% of the final grade. The remainder of the grade was made up of homework (10%), and quizzes (10%) that were administered during mandatory weekly recitation sessions. The final grade was translated to a letter grade as per the following grading scale.

Table 1. Grading Scale

A	A-	B+	B	B-	C+	C	D	F
≥94	90-93	87-89	83-86	80-82	75-79	70-74	60-69	<60

The retake policy allowed students to take a single retake for up to two of the chapter tests, excluding the final test. The score on the retake replaced the original test score, regardless of whether it was an improvement. The score on the retake was limited to 80%. This limit meant that students achieving B- or better on the original test could not benefit from taking the retake. It also meant, students retaking the test could not exceed the scores of those not eligible to take the retake. It was thought that the 80% limit would discourage students from using the first test as a practice test. The retake tests were similar to the original tests, to assess the application of the same concepts using different questions, but at the same level of difficulty, and the same point value. The retake tests were also paper-based tests and students had 50-minutes to complete them. A single test time for each retake was scheduled outside of the regular class schedule, one week after the original test.

Data

The ESC 201 gradebook from fall 2022 contained grades for all three sections and was available for analysis. The personal indicators (i.e. name and student identification number) were removed.

The original scores on the six chapter tests are shown on Figure 1. The strata of the grading scale are also provided as horizontal lines at 94%, 90%, 87%, 83%, 80%, 75%, 70%, and 60%. The scores by letter grade are given on Table 2 **Error! Reference source not found.** Given that the retake grades were capped at 80%, it was expected that students who scored between 70 and 80 were likely not to choose to take the retake because the largest impact on the final grade would be less than 1%, since the test itself was only worth 10% of the final grade. The number of students who chose to take a retake test are shown in parentheses on Table 2 **Error! Reference source not found.** A total of 27 retake tests were completed by 21 students, of which six took two different retake tests.

Table 2. Distribution of Original Chapter Test Scores

Test Scores	Test					
	1	2	3	4	5	6
90-100%	34	50	45	30	45	49
80-89%	29	17	24	20	16	15
70-79%	5 (1)	11	8	9	13	7
60-69%	7	3	2	13 (3)	7 (2)	8 (2)
50-59%	5 (3)	2 (2)	2 (1)	4 (2)	2	2
0-49%	6 (3)	3	5 (2)	10 (5)	3	5 (1)

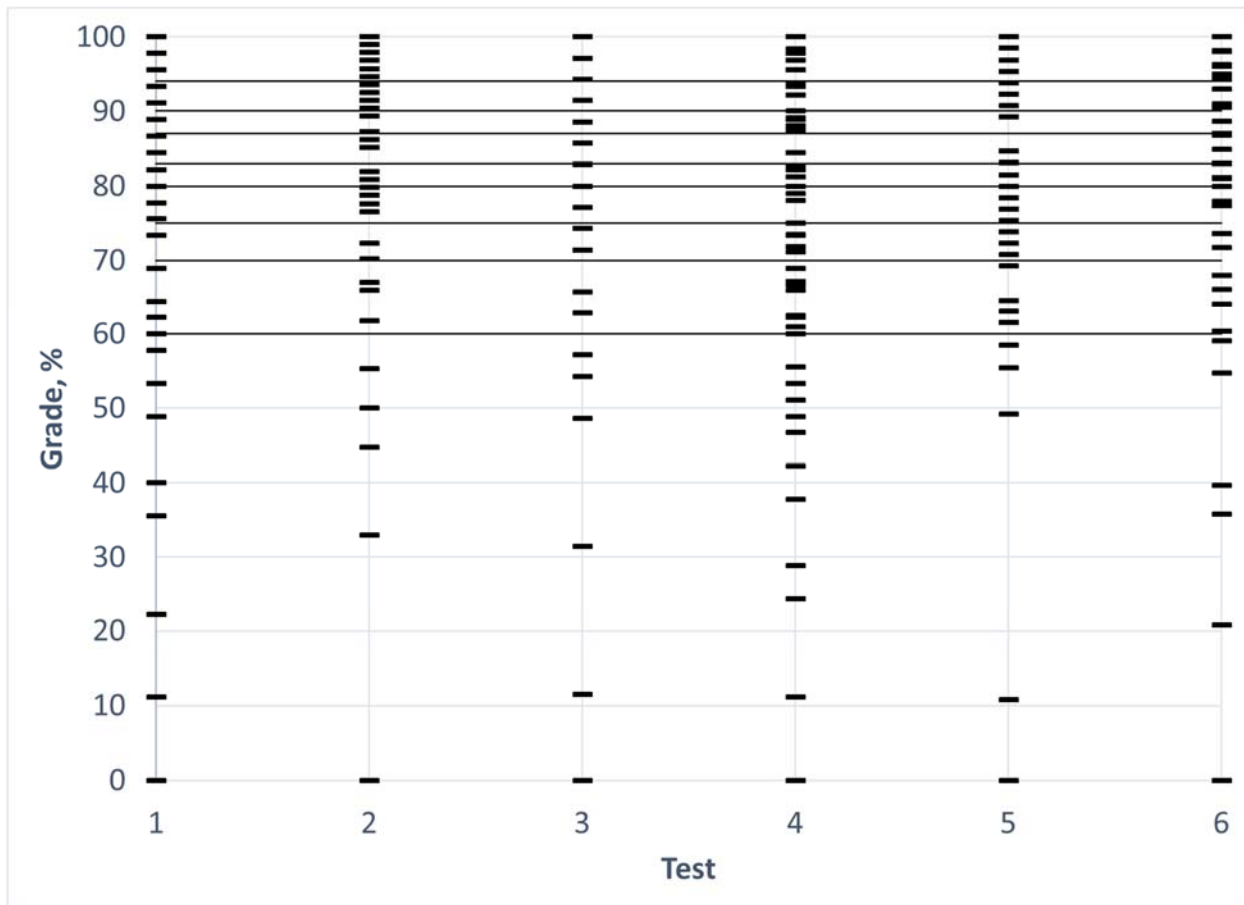


Figure 1. Original Chapter Test Scores

Analysis

To determine the impact to students, the difference between the original scores and the retake scores for those who retasted were of interest. These averages are included on Table 3 and show that the average retake score was much higher than the average original score for the retesters for each chapter test.

Table 3. Average Chapter Test Scores

Average Test Score	Test					
	1	2	3	4	5	6
Retesters – original scores	47.3	52.7	39.0	46.4	61.5	57.2
Retesters – retake scores	66.0	80.0	60.0	76.3	80.0	80.0
All students – original scores	81.2	87.4	85.3	76.5	84.9	85.3
All students – with retake scores included	82.8	88.0	86.0	79.9	85.4	86.1
P(T<=t) one-tail	0.012	0.080	0.087	0.003	0.079	0.075

To determine the impact to the overall class, the difference between the original scores of all students and scores with the retakes are also of interest. These averages are also included on Table 3 and show that the retakes impacted the class average for each of the chapter tests. One-

tail, comparison of means test ($t_{crit}=1.663$) were conducted to determine whether the test averages for each of the chapter tests increased with the retakes. All differences were found to be significant ($\alpha=0.05$). With the retakes, the average final grade for the three sections of the course increased from 84.1% to 84.8%. A one-tail, comparison of means test ($t_{crit}=1.663$) found the increase in the final grade as a result of the retakes to be significant ($\alpha=0.05$, $P(T \leq t) < 0.0001$).

To determine the impact to individual students, the final grades with and without retake scores were plotted on Figure 2. For those students who did not take a retake test, their final grade with and without the retake score is the same, and is represented by horizontal bar markers which form a diagonal line through the graph. For those students who opted to take one or two retakes, their scores are represented by circular markers. Note that all of the circular markers are positioned above the diagonal line of horizontal bar markers, indicating all students who chose to take a retake improved their final grade.

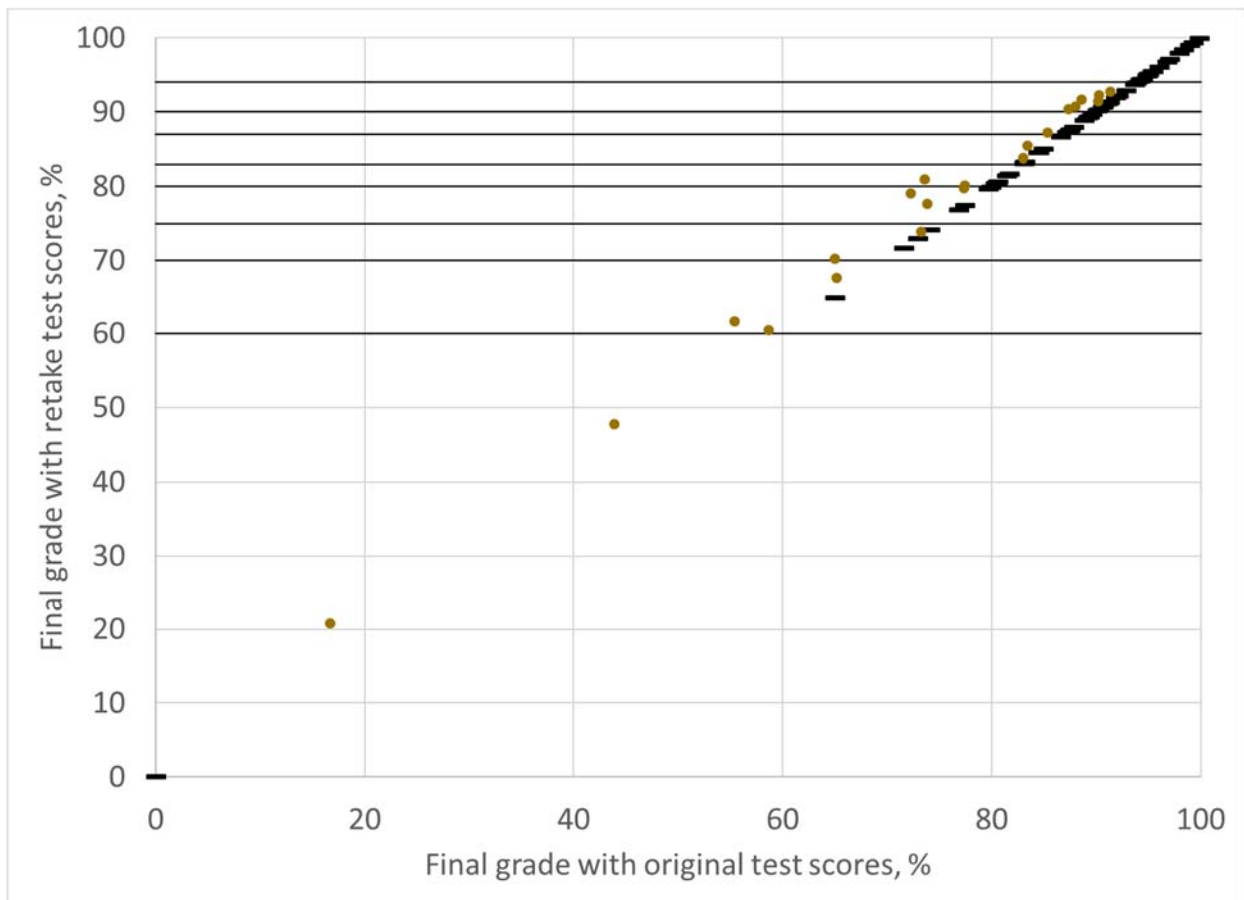


Figure 2. Final Grade With and Without Retake Scores

The increase in grade was further explored by looking at the difference in letter grade, if any, students achieved through the retakes. The data is shown on Table 4. Nine students (10%) increased their final grade but not enough to increase into the next letter grade. Ten students (12%) increased by a single letter grade, including two students (2%) who went from F to D, and

one student (1%) that went from D to C, and two students (2%) improved by two letter grades. Without the retake, 6 students (7%) would have received a grade of D or F. With the retake 5 students (6%) received a grade of D or F.

Table 4. Impact of Retakes on Final Letter Grade

Final grade without retake scores	Grade	Final grade with retake scores								
		F	D	C	C+	B-	B	B+	A-	A
	F	2	2							
	D		1	1						
	C			1	1	2				
	C+					2				
	B-									
	B						2	1		
	B+								3	
	A-								3	
	A									

Results

The implementation of a retake policy in three sections of a statics course made a difference to the grade of twenty-one students, of which twelve increased at least one letter grade. Even though the policy stated that the retake grade would be counted regardless of whether it represented an improvement, no students experienced a drop in grade. This suggests that the students took the retake opportunity seriously and applied themselves to do better on the retake. It should be noted that it was not uncommon for students who did poorly on the original chapter test to visit one of the instructors during office hours to go through the test problems.

Of the twelve students who increased at least one letter grade, two went from F to D, and one went from D to C. The difference between F and D is obvious. The difference between D and C is also significant because the Bachelor of Civil Engineering program has a limit of 2 D grades across statics, mechanics, and civil engineering courses and the Bachelor of Mechanical Engineering program has a limit of 2 D grades in engineering science courses, of which statics is one, and mechanical engineering courses. The number of students earning an unsatisfactory grade (i.e. D or F) reduced by only one student.

Second Course – CVE 446-546 Transportation Engineering

The second course was CVE 446-546 Transportation Engineering, which is an introductory course, and is cross-listed at both the undergraduate (446) and graduate (546) levels. It is a core course in the Bachelor of Civil Engineering program and a preferred course for the transportation specialization of the Master of Science in Civil Engineering program at Cleveland State University.

There is no assigned textbook for this course. The lectures have been developed based on AASHTO’s Geometric Design on Highways and Streets, TRB’s Highway Capacity Manual,

ITE's Recommended Practice for Transportation Impact Studies, and the TCRP Report 165 Transit Capacity and Quality of Service Manual. Copies of these resources are either available online or through the course reserve at the Michael Schwartz library and students are encouraged to read the sections referenced in the lecture materials.

All students complete the weekly assignments and receive three exams, scheduled as two midterm exams and one final exam. For undergraduate students, the assignments and each exam is worth 25% of the final grade. For graduate students, the assignments and each exam is worth 20% of the final grade, and they make up the remaining 20% by writing an argument essay on a transportation engineering topic. The final grade is translated to a letter grade as per the following undergraduate (446) and graduate (546) grading scales.

Table 5. Undergraduate and Graduate Grading Scales

	A	A-	B+	B	B-	C+	C	D	F
446	≥90	85-89	80-84	75-79	70-74	65-69	60-64	55-59	<55
546	≥90	85-89	80-84	75-79	70-74		65-69		<65

Over the past five years the enrollment in this course has increased while the performance on exams has decreased. The first notable difference in performance occurred during the fall 2019 semester when the regular instructor was on sabbatical and the course was taught by a part time instructor. The following year, the regular instructor resumed teaching the course but was forced to teach remotely because of the pandemic. The lectures were offered synchronously. There were 53 undergraduate and 14 graduate students enrolled. Both the instructor and the students were new to online testing. The exams were coded to present one question at a time and prevented students from back tracking through questions. These measures were implemented to curb cheating. After the first 75 minute exam, students demanded a retake, arguing that they were not used to the structure of the test and that it impacted their scores. Students were offered a single retake exam, which was also implemented online and in the same format (i.e. one question at a time and no back tracking). The original grades were forfeited and the grade on the retake was used in the calculation of the final grade, regardless of whether it was an improvement.

For the fall 2021 and fall 2022 semesters, CVE 446-546 was offered as a traditional lecture course, with paper-based, in-class exams. The midterms were 75 minutes and the final exam was 120 minutes. For the fall 2021 semester, there were 51 undergraduate and 43 graduate students enrolled, and for the fall 2022 semester, there were 40 undergraduate and 51 graduate students. For this introductory course, these graduate enrollments are very large, up to twenty times previous graduate enrollments.

After the second midterm exam during the fall 2021 semester, international graduate students claimed to be having a difficult time adjusting to the different style of instruction and testing. So to help with this adjustment, a single paper-based, 75 minute, in-class retake was offered to replace the scores on both the first and second midterm exams, worth 50% of the final grade. It was expected that these students were now familiar with the instructor's approach to testing (e.g. types of questions, level of difficulty, etc.) after taking two exams, and would therefore better

prepare and perform better on the retake. For that reason, the retake grade replaced the original exam grades, regardless if it was better or not. For the fall 2022 semester, the same claims were being voiced after the first midterm exam. A paper-based, 75 minute, in-class retake was offered to replace the score on the first midterm exam.

Data

The data available for analysis included the midterm exam grades, the retake grades, and the final grades for 252 students from the fall semesters of 2020, 2021, and 2022. Over the 3 years, there were a total of 90 students who opted to take the offered retake exam. The letter grades achieved on the original midterm exam(s) have been broken down by year and by undergraduate (446) and graduate (546) levels on Table 6. For 2020 and 2022, the grades represent the average grade on the first midterm exam, whereas for 2021 they represent the average grade on the two midterm exams. The number of students choosing to take the retake are shown on the last column. Over the three years, forty-three students (30%) in CVE 446, and forty-seven students (19%) in CVE 546 chose to take the offered retake exams.

Table 6. Letter Grade Distribution on Original Exam(s)

		Letter grade									Number of students opting to take the retake
		A	A-	B+	B	B-	C+	C	D	F	
2020	446	8	2	1	4	2	6	1	1	28	35 of 53 (66.0%)
	546	4	0	1	0	1		2		6	9 of 14 (64.3%)
2021	446	3	9	1	6	8	4	4	4	12	4 of 51 (7.8%)
	546	1	1	4	3	3		0		31	13 of 43 (30.2%)
2022	446	8	4	4	6	2	3	3	4	6	4 of 40 (10%)
	546	9	2	2	1	3		4		30	25 of 51 (49.0%)

Analysis - Undergraduate (2020-2022)

To examine the impact of the retake policy on the final grades of the undergraduate students, the data were first grouped by year. The descriptive statistics are provided on Table 7. One-tail, comparison of means tests were conducted to test whether the final grades of the undergraduate students were greater with the retake scores included. For each year, the impact of the retake policy on the final grade of the undergraduate students was found to be significant at $\alpha=0.05$ (2020: $P(T \leq t) < 0.001$, 2021: $P(T \leq t) = 0.044$, 2022: $P(T < t) = 0.027$).

Table 7. Final Grades of CVE 446 Students with and without Retake Scores

Year	Number of students	Without Retake Scores		With Retake Scores	
		Average	Variance	Average	Variance
2020	53	69.8	209.4	73.3	185.5
2021	51	69.8	259.2	70.4	241.3
2022	40	78.1	179.8	79.1	132.5

The average final grades with and without retake scores for 144 undergraduate students are plotted on Figure 3. For the 101 students who did not take a retake test, their final grade with and

For the 43 undergraduate students who chose to take the retake exam, the impact on their final letter grades are shown on Table 8. There was no change for fifteen students (10%), an increase by one letter grade for sixteen students (11%), an increased by two letter grades for seven students (5%), and an increase by three letter grades by another six students (4%). For all the undergraduate students who chose to take the retake, none experienced a drop in letter grade.

Results - Undergraduate

Six CVE 446 students would have earned an F, but by taking the retake, these students improved their final grades; one received D, two received C, and one received C+. An additional seven students would have earned a D grade, but with their retake scores, five received a final grade of C and one received a final grade of B-. Therefore, over the three years, 9 undergraduate students (11%) avoided unacceptable grades of D and F because of the retake tests.

Analysis - Graduate

To examine the impact of the retake policy on the final grades of the graduate students, the data were grouped by year. The descriptive statistics are given on Table 9. One-tail, comparison of means tests were conducted to test whether the final grades of the graduate students were greater with the retake scores included. The impact of the retake policy on the final grade was found to be significant at $\alpha=0.05$ for 2020 and 2022 (2020: $P(T \leq t)=0.021$, 2022: $P(T < t) < 0.001$) but not significant for 2021 ($P(T \leq t)=0.360$).

Table 9. Final Grades of CVE 546 Students with and without Retake Scores

Year	Number of students	Without Retake Scores		With Retake Scores	
		Average	Variance	Average	Variance
2020	14	74.9	278.2	76.6	258.7
2021	43	60.3	441.5	60.1	434.3
2022	51	66.6	521.7	69.6	516.4

The average final grades with and without retake scores are plotted on Figure 4. For the 61 graduate students who did not take the offered retake test, their final grade with and without the retake score is the same, and is represented by horizontal bar markers. For the 47 graduate students who took the retake, their scores are represented by circular markers. The circular markers shown below the horizontal bar markers represents students who experienced a decrease in their final grade. For eight graduate students, their final grades with the retake score are lower than the final grade without the retake score, and of those, two dropped in letter grade.

For the 47 graduate students who took the retake exam, the impact on their final letter grades are shown on Table 10. There was no change for twenty-two students (9%), an increase by one letter grade for fifteen students (6%), and an increase by two letter grades for eight students (3%). One student dropped by one letter grade and one student dropped by two letter grades.

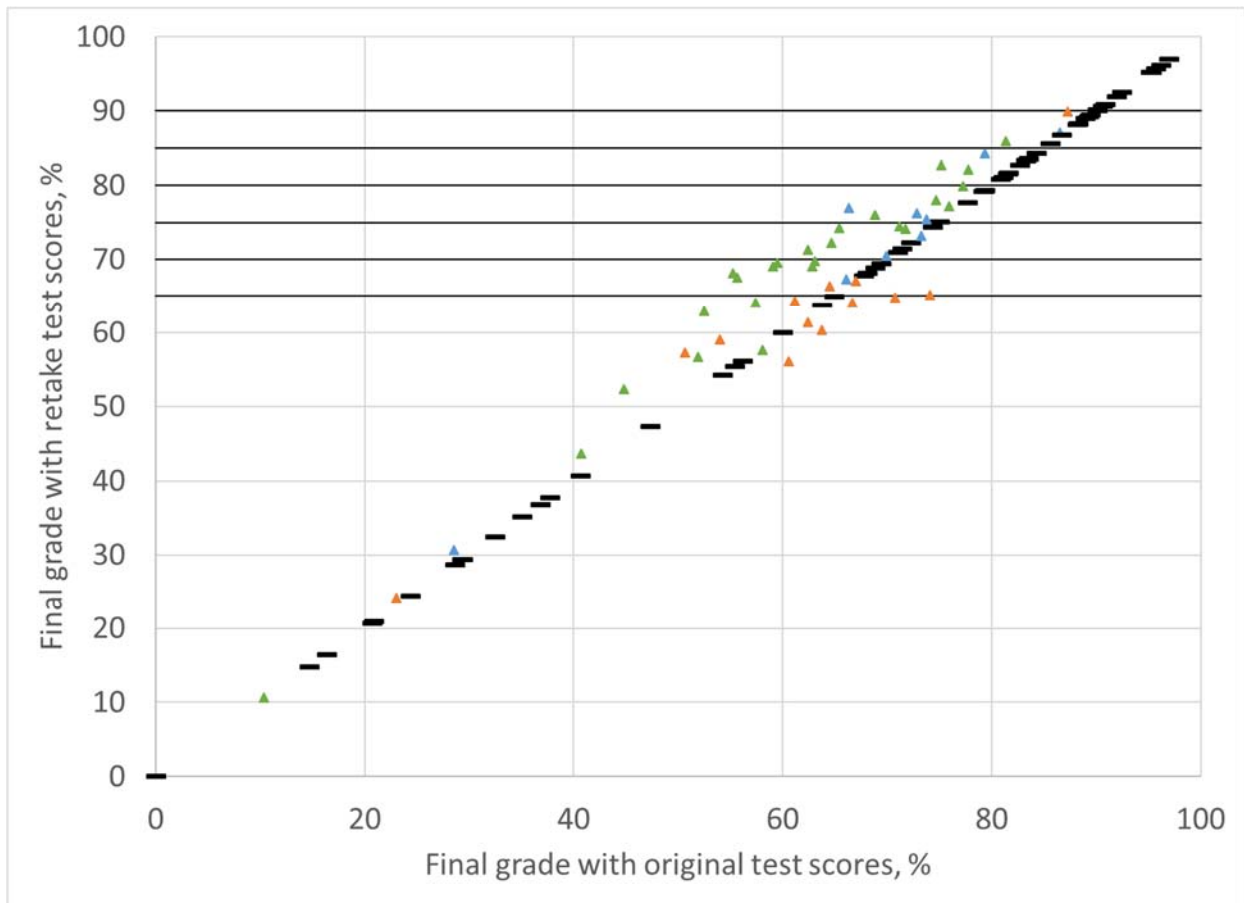


Figure 4. Final graduate grades with and without retake scores.

Table 10. Change in Graduate Letter Grade

		Final grade with retake scores							
		Grade	F	C	B-	B	B+	A-	A
Final grade without retake scores	F		13	4	5				
	C			4	1	3			
	B-			1	2	4			
	B			1		2	3		
	B+							2	
	A-							1	1
	A								

Results - Graduate

Nine CVE 546 students who would have earned an F in the course benefitted from taking the offered retake and increased their final grade. Of those, four students had a final grade was C and 5 students had a final grade was B-. However, neither of these grades are considered acceptable for graduate studies. Students earning one grade of F or two grades of B- or less are subject to an optional dismissal. Students earning two grades of F regardless of grade point average, or 9 hours of less than B grades and a grade point average of less than 3.00 are dismissed. Seven CVE

546 students benefitted from the retakes by improving their final grade from an unacceptable grade of C or B- to an acceptable grade of B.

Discussion

A simple comparison of grades with and without retakes scores demonstrated the value of retakes for student success. In ESC 201 Statics, ten students (12%) increased their final grade by a single letter grade, and two students (2%) improved by two letter grades. The number of D and F grades in the course decreased by one. In order for this to have occurred, the instructors spent additional time and effort to develop the test materials, prepare solutions, proctor the retake tests, grade the retakes, and keep the test records. The amount of additional time spent by the authors for these activities is estimated at fifteen hours. For each of the six chapter tests, a retake test (with solutions) was developed, adding an approximate six hours. Each retake was 50 minutes, scheduled outside of the regular class times, so that was another six hours. A total of twenty-seven retake tests were completed, which took approximately two hours to grade. And there was probably an hour spent setting up the gradebook and entering the retake grades in Blackboard. In addition to these activities, they also experienced much greater demand during office hours, and sometimes outside of office hours, to go over test questions and homework problems. Is the increase in student success, as measured by an increase in letter grade worth fifteen hours plus of extra work? I guess so, because the retake policy is in effect again for the Spring 2023 semester.

For CVE 446-546 Transportation Engineering, the answer is less obvious because the data represents both remote and face-2-face instruction, both online and paper-based exams, a dramatic increase in graduate student enrollment, and two different retake policies. For each semester, the additional effort was on the order of five to six hours, which was spent preparing the retakes and solutions, grading the retakes, and adjusting the gradebook in Blackboard. The exams were proctored during the scheduled class time and students not taking the retake had the time off. Overall the retake policy led to 29 undergraduate and 23 graduate students increasing their final letter grade by at least one letter grade. Because of the retake policy, nine undergraduates and 7 graduates avoided unacceptable grades. The analysis also showed that fourteen undergraduate and twenty-four graduate students did not improve their final letter grades despite taking the retake. Additionally, twenty-nine graduate students who had scores under 70 (less than B) on the original exam(s) chose not to take the retake. Perhaps these results indicate that a retake policy can help those students who want to improve their grades.

References

- [1] C. E. Snare. "Implications of Considering Students as Consumers". Commentary. Vol. 45, Iss. 4. 1997, pg. 122.
- [2] F. S. Keller. "Goodbye, teacher..." *Journal of Applied Behavior Analysis*, Vol. 1, No. 1, 1968, pg. 79-89.
- [3] B. S. Bloom. "Learning for Mastery. Instruction and Curriculum." Regional Education Laboratory for the Carolinas and Virginia, Topical Papers and Reprints, No. 1, 1968, pg. 1-12.

- [4] D. E. Bostow, and R. J. O'Connor. "Comparison of Two College Classroom Testing Procedures: Required Remediation versus No Remediation". *Journal of Applied Behavior Analysis*, Vol. 6, No. 4, Winter 1973, pg. 599-607.
- [5] W. M. Cates. "The Efficacy of Retesting in Relation to Improved Test Performance of College Undergraduates". *Journal of Educational Research*, Vol. 75, No. 4, March/April 1982, pg. 230-236.
- [6] H. Friedman. "Repeat Examinations in Introductory Statistics". *Teaching of Psychology*, Vol. 14, No. 1, February, 1987, pg. 20-23.
- [7] S. M. Juhler, J. F. Rech, S. G. From, and M. M. Brogan. "The effect of optional retesting on college students' Achievement in an Individualized Algebra Course". *Journal of Experimental Education*, Vol. 66, No. 2, 1998, 125.
- [8] P. Abraham, "A Microscopic Look at Assessment: Dropping a Lowest Test Score versus Allowing a Retake Test". In: *Proceedings of the Regional Campus Mathematics Conference* (Canton, OH, May 19-21, 1999), Association for University Regional Campuses of Ohio.
- [9] O. Ashour, F. Aqlan, and P. C. Lynch. "A Hybrid Mastery-Conventional Assessment in Engineering Economy". In *2017 ASEE Annual Conference & Exposition*, 2017 Jun 24.
- [10] Carpenter, and J. McCusker. "Retaking Object-Oriented Programming Quizzes for Study Habit Insights and Improvements". In *2019 ASEE Annual Conference & Exposition 2019* Jun 15.
- [11] L. Singelmann. "Who Benefits from Equitable Grading? A Case Study from a Core Electrical and Computer Engineering Course". In *2021 ASEE Virtual Annual Conference 2021* Jul 26.
- [12] H. Ritz, K. Dimiduk and A. van Paridon. "Effect of Mastery-graded Exams on Student Outcomes in Statics and Mechanics of Solids Course". In *2020 ASEE Virtual Annual Conference 2020* Jun 22.
- [13] L.C. Elbrink, "A flexible and forgiving testing program". *School Science and Mathematics*, 73, 1973, pg. 686-690.
- [14] G. A. Deatsman, "An experimental evaluation of retesting". *American Mathematics Monthly*, 87, 1980, pg. 131-132.
- [15] M. D. Glucksman, "Use of retesting as a teaching device in an elementary algebra course". *School Science and Mathematics*, 73, 1973, pg. 725-729.