

# Second Time is a Charm: The Impact of Correcting Missed Exam Questions on Student Learning

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## Abstract

This study determined the learning benefit of correcting missed exam questions. The results show that in addition to exams being an assessment tool, they can also be used as a tool for student learning. The availability of this information will provide help considering design, development, and improvement of traditional assessment methods for student learning.

## Introduction and Objectives

One of the missions of the university is to guide students in learning specific fundamental principles to enhance life-long learning. Assessment methods, such as exams, should test the student's understanding of the material and provide feedback to students and professors (McKeachie, 2002). However, given that exams provide an impetus for students to quickly study the class material right before the assessment date, exams often only evaluate the student's knowledge at the time the exam is given and regrettably, often fail to be a learning tool. The typical lifecycle of an exam ends after it has been corrected by the professor and returned to the student. Risley (2007) observed an exam lifecycle similar to our own teaching experiences: 1) students take exam, 2) professor grades exams, 3) professor returns graded exams, 4) students look at their grade, see what they missed, check to make sure the points were added correctly, 5) students place the graded exam in their notebooks, maybe never to be looked at again until it is time to study for the final exam, if the final exam is comprehensive. Few students may take the time to determine what they missed on a certain question and to re-work the problem or even correct their mistakes on the exam. Factors such as student procrastination, social activities, part-time employment, and busy exam schedules frequently lead to last-minute

studying behavior, which may jeopardize the efficacy of exams as a tool to help students learn course material. Thus, there is a need to explore whether student learning could be enhanced by modifying the traditional lifecycle of exams.

Alternative teaching methods may provide some benefits to students' learning. Haskett (2001) explored many alternative teaching methods, such as reducing the number of lectures throughout the quarter, face to face evaluations rather than conventional testing, resubmission of work until a desired grade is received, and oral presentations with literature reviews instead of term papers. Students' response to resubmitting their work was mostly positive, which suggests that this approach could be a successful teaching method. Light (1990) interviewed thousands of students to determine the qualities of the best courses they had taken at the university. In his study, students expressed that one of the characteristics of the highest ranked courses includes "the opportunity to revise and improve their work before it receives a final grade, thereby learning from their mistakes in the process" (Light, 1990, pp. 8-9). This finding is supported by Bain (2004) who suggests it is important to give students multiple chances to demonstrate their comprehension when administering an exam.

Many studies have examined the usefulness of retaking exams, homework assignments, and quizzes to enhance learning (e.g. Bacon and Beyrouty, 1988; Haskett, 2001; Nickels and Uddin, 2003; Brye et al., 2005; Risley, 2007). Results of these studies generally show that students do better on the makeup exams regardless of whether the date of the makeup is announced, they work in groups, or they can use their notes. These studies also demonstrated some physiological benefit for the students who reported greater inter-student cooperation. Bacon and Beyrouty (1988) reported increased interest in the course while

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others observed increased communication between student and professor (Longer et al., 1987), decreased anxiety (Brye et al., 2005), and perceived, enhanced learning (Bacon and Beyrouty, 1988; Longer et al., 1987; Brye et al., 2005).

Though many studies have documented the effects of student learning through student self evaluation with questionnaires and results on makeup exams, few studies have looked at the long term effect on student learning.

Allowing students to look at material twice and to receive feedback regarding the material that has been submitted allows for a better quality work to be turned in later in the semester/quarter. Students are interested in knowing their mistakes and, if given the opportunity, almost three-fourths of students will resubmit better work (Haskett, 2001). Students often perform better in a class where they have a better perspective of the outcome and a better attitude regarding their grade (Risley, 2007).

One alternative to the traditional exam lifecycle would be to allow the student to review the graded exam material, correct their missed exam questions, and return them to the professor for regrading. Although some studies have addressed the usefulness of correcting missed exam questions (Risley, 2007), to our knowledge, no study has assessed the learning benefits of this alternative exam lifecycle as determined by final exam grades.

The objectives of this study were to (1) identify student perceptions of correcting missed exam questions, (2) compare the learning benefits of this alternative method to the traditional exam lifecycle that ends with the professor returning the exam, and to (3) evaluate benefits vs. cost to the instructor with regard to allowing students to correct missed exam questions. The availability of this study's information will be useful in considering design, development and improvement of traditional assessment methods for student learning.

## Materials and Methods

### Study Design

Given that the overall population of this study was college students, the sample consisted of students enrolled in classes taught by the two investiga-

tors. Specifically, the classes were agricultural science and marketing classes at Arkansas State University in Jonesboro, Arkansas and California Polytechnic State University, San Luis Obispo, California. In this study, a written survey was distributed that consisted of questions regarding demographics, perceptions about the opportunity to correct missed exam questions, and perceptions about personal learning achievements. All students were given the option to complete the survey without any incentive to participate. Table 1 provides an overview of the time of the data collection and the course distribution. Overall, data was collected in 13 courses over two years. The data collection began in the spring of 2006 at Arkansas State University and in the fall of 2007 at California Polytechnic State University and it continued through the spring of 2008 at both universities.

**Table 1. Course Distribution and Time of Data Collection**

Class	Time of data collection	Non-Regrading Group (n=128)		Regrading Group (n=190)	
		Respondents	Total class enrollment	Respondents	Total class enrollment
Agricultural Economics	Fall 2007	-	-	34	41
Agricultural Marketing	Spring 2007	-	-	11	12
Agricultural Statistics	Spring 2006	21	22	-	-
	Fall 2006	-	-	29	35
	Spring 2007	-	-	25	35
Global Agricultural Marketing	Fall 2007	-	-	34	44
	Spring 2008	33	34	-	-
Soil Fertility	Spring 2006	-	-	18	21
	Spring 2008	20	27	-	-
Soil Science	Fall 2006	31	40	-	-
	Spring 2007	-	-	13	14
	Fall 2007	-	-	26	28
	Spring 2008	23	23	-	-
Total number of students		128	146	190	230
Response rate		88%		83%	

To carry out a complete investigation of the issue, this study was administered with two different student samples, each containing a different version of the survey. The two versions of the survey were not modified over time, in order to preserve a constant environment for the data collection. In addition, all students were exposed to the same course materials and each sample was provided with similar semester/quarter exams. Lastly, to the extent possible, the instructors tried to minimize any alteration in their teaching styles. These measures were implemented to control for any variability in external factors over time and to allow a cross-comparison of the survey



questions between both samples. To our knowledge, no previous study has collected data on this issue with a comparative control sample.

The two samples consisted of 190 students enrolled in the regrading sample, and 128 students in the non-regrading sample (control group). A 'regrading survey' was distributed to all students enrolled in the sample classes at the end of the semester/quarter after they had completed the class, and had the option to correct their graded semester/quarter exams for additional points. Similarly, a 'non-regrading survey' was also distributed to students in the non-regrading sample asking similar questions as the regrading sample. Students in the non-regrading sample were not offered the regrading option and were not told anything about resubmission for additional points. On the regrading survey, students were asked to rate the effectiveness of correcting missed exam questions on their learning, whereas the non-regrading survey explored the students' opinions of whether they learned from their mistakes on exams. All students were asked about their study habits to determine whether they had used their semester/quarter exam as a learning tool to study for the final exam. Student learning was measured subjectively by assessing students' perceptions about their learning of the material.

Some students in the non-regrading sample would ask about the regrading option because word traveled from previous quarters/semesters, but they were still not given the option. Risley (2007) observed the same "word-of-mouth-effect."

Overall, the response rate shown in Table 1 shows the distribution of the students across the different courses over time. The number of students in each class and the response rate is included in the table to show that a high response rate was received from each sample and that the student enrollment was similar across groups.

In addition to student feedback, professors participating in this regrading option provided reflections of their experiences. These reflections were completely open and were not guided by any specific questions.

## Data Collection

Students were placed into the regrading or non-regrading groups based on the class in which they were enrolled and the semester/quarter that they were taking the class. An entire class for the semester/quarter was either a regrading or non-regrading sub-sample.

Students who were enrolled in the regrading sample were told at the beginning of the quarter/semester that they would be offered the option to correct their semester/quarter exams and submit them for regrading. This procedure was not offered for the final exams due to time constraints. These students wrote their semester/quarter exam, received back the graded exam, and then had the opportunity to resubmit the missed questions. The

incentive for making corrections was that students could earn up to half of the points missed on the exam, based on the correctness of their re-submitted answers. All participants in the regrading sample were informed that the exam solutions would be discussed in class once the regraded exams were returned, but that until then, no answers would be posted. It was up to each student to decide upon which and how many answers they would choose to rework. Students were not allowed to mark their graded exam copies and had to submit their reworked answers on separate sheets of paper stapled to the original exam. Students were required to resubmit their exams by the next class period; late exams were not accepted. The instructors then regraded the submitted answers, where a correct reworked solution obtained full credit, i.e. half of the original points of that exam question, while incomplete answers could earn some partial credit. For example, if a student completely missed an exam question that was worth 10 points on the original exam, but would resubmit the correct solution to the missed exam question during the regrading period, he/she could earn up to an additional five points. Incorrect answers did not get any points, but a student could not lose any of the points from the original exam. They also could not earn additional points for already correctly solved answers from their original exams. All of the reworked points were summed and added to the students' original exam score. After the regrading period, the exams were returned to the students and all of the answers were discussed in class or posted. At the end of the semester/quarter, all exams and regraded answers were collected.

Risley (2007) offers his students identical conditions for reworking exams, while Nickels and Uddin (2003) awarded 80% of the points lost. Instructors may choose to alter details such as amount of additional points offered or resubmission time frame according to their needs.

The non-regrading sample served as the control group since their semester/quarter exams were based on the traditional lifecycle of an exam. The survey questions for the non-regrading sample consisted of hypothetical questions regarding the option to resubmit their exams for additional points. The questions on each survey were similar to allow for comparison between the two groups, i.e. the non-regrading and regrading group, respectively.

## Data Analysis

This study employed six types of variable groups: 1) demographics and study habits, 2) method of correcting missed exam questions, 3) motivation for correcting missed exam questions, 4) test anxiety, 5) post-exam learning, 6) benefits and cost to the instructor with regard to allowing students to correct missed exam questions.

All students who attended classes that utilized the regrading treatment were combined as the "regrading sample," while the other students were



treated as the control group. We analyzed the data by comparing the survey responses between the treatment and the control group. Descriptive statistics were compared with regard to the questions about demographics and study habits. For all other questions, independent t-tests were used to determine the difference between the groups' answers.

Regarding demographics, several variables may impact student learning such as age, gender, marital and employment status, year in school, and the university attended. In addition, the survey assessed school responsibilities such as number of hours worked per week, credit hours/ units enrolled, and how far from campus the student lived. In order to assess the general study habits of the students, questions about the number of hours studied for the course in which the survey was given, were included.

Questions about major, age, and year in school may allow for comparisons regarding maturity and knowledge level. State of residence and proximity of the students' residence to their particular school were evaluated to allow for comparison between Arkansas State University students and California Polytechnic State University students.

The survey also included questions about whether the students took advantage of the opportunity to correct missed exam questions. We assessed the methods of correction by asking the students whether they corrected the exam questions by working with other students, visiting the professor during office hours, or using books and/or notes. Students were allowed to select more than one method of correction in their answers. We combined the answer categories "fully agree" and "agree" in this question, as these were indicative of students who employed this method.

In addition, the data analysis assessed whether the opportunity for regrading eased test anxiety or altered the students' study efforts for the exam. A comparison was made to determine the change in the anxiety levels of students who were allowed to correct their exams compared to the anxiety levels of the control group. When students are less anxious about taking an exam, a more relaxed and positive learning environment is established.

We also collected subjective learning measures, such as their perceptions regarding the extent of what they learned from the mistakes they made on the exams. Both surveys

included questions about students' ability to retain the class material after the exam in order to assess the benefits of the alternative exam lifecycle for student learning.

Lastly, the non-regrading group was asked whether they would take the opportunity to correct mistakes if they thought it would enhance their learning of the material. The regrading survey employed a similar situation and asked if they received no points for making corrections on their exam, would they still have taken the time to make corrections to their exam. All students had the opportunity to make corrections to learn from their mistakes, but only the students in the regrading treatment had the extra incentive of turning back their exam to be regraded and gain back points missed on the semester/quarter exams.

## Results and Discussions

### Demographics and Study Habits

A comparison of demographics and study habits is shown in Table 2. First, we compare demographics, such as age, gender, standing, and residence during the semester/quarter, between both groups. The table shows that the average age was very similar in the regrading and the non-regrading groups, with 22 years in the regrading group and 23 years in the non-regrading group. The breakdown by age shows that both the regrading group and non-regrading group consisted of mostly older students with the majority of students in both groups being 21 years and older. Gender distribution was skewed towards the male population, with 76% of the non-regrading group and 68% of the regrading group being male. The majority

**Table 2. Demographics and Study Habits of the Non-Regrading and Regrading Groups**

Variable	Categories	Non-Regrading Group (n=128)	Regrading Group (n=190)
<i>Demographics</i>			
Age	18	1%	3%
	19	6%	7%
	20	12%	17%
	21	27%	24%
	22	22%	21%
	23+	23%	28%
	Average	23	22
Gender	Male	76%	68%
	Female	24%	32%
Standing	Freshmen	2%	9%
	Sophomore	17%	9%
	Junior	37%	37%
	Senior	41%	42%
	Graduate	3%	1%
Average distance to School		19 Miles	15 Miles
<i>Study habits</i>			
Number of credit hours during the semester/ quarter		14	15
Average number of hours worked per week		26.5	21.6
Number of hours studied per week		2.6	2.9
Typically do assigned readings		39%	42%
Class required for major		89%	90%

of students in both groups were upper classmen with the number of freshman students being below 10% for both groups. This distribution of academic standing is similar to the sample in Nickels and Uddin (2003), which focused their data collection on sophomore and junior/senior level classes.

Regarding the student's residence during the semester/quarter, most students indicated that they do not live on campus, as the average commuting distance to campus was 19 miles in the non-regrading group and 15 miles in the regrading group.

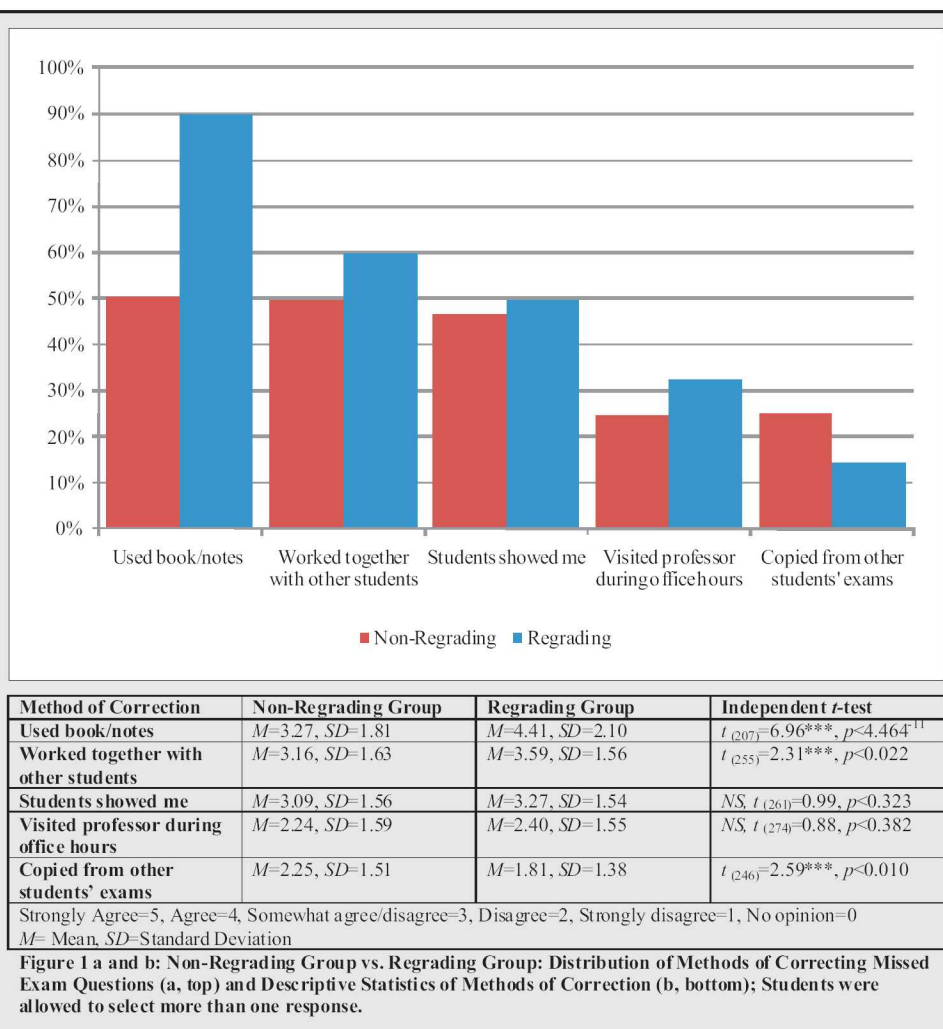
In order to assess the general study habits of the students, questions about the number of credit hours during the semester/ quarter, number of hours worked, and number of hours studied were included. In addition, the survey asked whether the student typically reads the assigned class material and whether the class is required for their major. Table 2 shows that respectively, the average number of credit hours per semester/ quarter was similar in both groups, with 14 and 15 credit hours per semester/ quarter. The number of hours worked was comparable between both groups, with a mean of 26 hours worked per week in the non-regrading group and a mean of 22 hours worked per week in the regrading group. Results showed that the minority of students did the required readings in the class, with 39% of the students in the non-regrading group and 42% of the students in the regrading sample reportedly doing the required reading. The majority of students in both samples stated that the class they were enrolled in was required for their major, with 89% in the non-regrading sample and 90% in the regrading sample. This is similar to the sample by Nickels and Uddin (2003), where 83% of the students stated that the class was required for their major.

### Method of Correcting Missed Exam Questions

The survey included questions about how students corrected their missed exam questions, such as working with other students, visiting the professor during office hours, or using the book/ notes. A combination of these techniques was

possible as well and the students were able to indicate all the methods that they used. Both the regrading group and the non-regrading group assessed their methods of correcting missed exam questions. Figure 1 shows the various methods employed by the non-regrading and the regrading groups and the percentage of students who used each of these methods. For the 'another student showed me' and 'I visited the professor for assistance' options, there was no significant difference between the two groups in the percentage of students who used these methods for correcting missed exam questions. For the other methods, the t-tests showed a significant difference between the non-regrading and the regrading group.

In the non-regrading group, 50% used the book/notes, whereas in the regrading group, 90% of students utilized this method to correct their missed exam questions ( $t_{(207)} = 6.96^{***}$ ,  $p < 4.464 \times 10^{-11}$ ). In the non-regrading group, 49% of the students stated that they worked together with other students to figure out what they solved incorrectly on the exam, while



this percentage was 59% in the regrading group ( $t_{(255)} = 2.31^{***}$ ,  $p < 0.022$ ). In addition, in the non-regrading group, 47% asked other students to show them how to correct what they solved incorrectly on



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the exam, while there were 49% who employed this method in the regrading group (NS,  $t_{(261)} = 0.99$ ,  $p < 0.323$ ).

Of all students in the non-regrading sample, 25% visited the professor during office hours, while 32% took advantage of this opportunity in the regrading group (NS,  $t_{(274)} = 0.88$ ,  $p < 0.382$ ). While overall the traffic during office hours significantly increased during a “regrading” semester/quarter, it was not required to meet with the instructor. This differs from Haskett (2001) who required his students to meet with the instructor to review their mistakes between resubmissions of their work. Given the diversity in learning styles, students in our study were free to choose which method of correction best suited themselves.

Interestingly, a greater percentage of students in the non-regrading group than in the regrading group stated that they copied the correct solutions from other students, with about 25% vs. 14%, respectively ( $t_{(246)} = 2.59^{***}$ ,  $p < 0.010$ ).

Thus, our survey suggests that the regrading activity supports active and collaborative learning, since the majority of the students used book/notes and worked together to solve the questions they missed on the exams. Bacon and Beyrouty (1988) put a twist on this concept by having students retake exams in groups of two or three, thus allowing the students to learn from each other. According to Light (2001), it is vital to organize interactive relationships around the academic work in order to be a successful college student. Teamwork is something that is valuable in a working environment and employers look for employees who are willing to work together and use resources such as books or notes to solve problems.

### Motivation for Correcting Missed Exam Questions

Figures 2a and 2b show the students' motivation for correcting missed exam questions in the non-regrading and regrading groups, respectively. Students tended to be idealistic in what would motivate them to make test corrections, yet realistically, they appear to be more concerned about their grades than they are about learning.

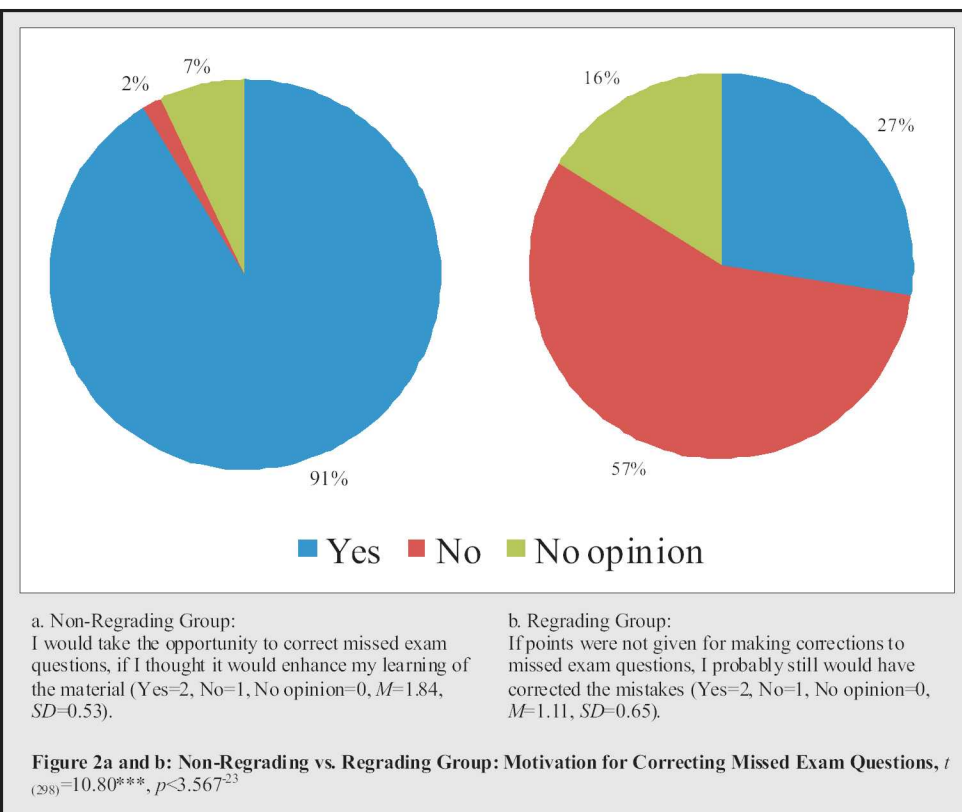
The independent t-test revealed a significance difference ( $t_{(298)} = 10.80^{***}$ ,  $p < 3.567 \times 10^{-23}$ ) in the average motivation between the

non-regrading and the regrading group, with the regrading group being significantly opposed to correcting missed exam questions if points were not given for making these corrections. Thus, the incentive to obtain more points through regrading was an important motivator. More students in the regrading sample took the time to correct missed exam questions when they were rewarded with additional points for doing so, as opposed to the students in the non-regrading sample who were not rewarded directly with points. Of the students in the regrading group, only 27% said that they would have corrected their exams if no points were awarded. When asked the similar question, 91% of the non-regrading group said that they would correct a missed exam question if they felt it would enhance their learning of the material. There was no mention of extra points with this question given to the non-regrading group.

Our findings show that it is important to provide additional points as a reward for correcting missed exam questions, especially given the short turnaround time, in order to increase participation and reap the learning benefits. Nickel and Uddin (2003) awarded up to 80% of the points lost. In their study, some students still felt that there was not enough incentive when their original scores were high or, similarly, when reworking was too time-consuming.

### Test Anxiety

Both student samples had positive perceptions about having the opportunity to correct missed exam questions and felt it would put them more at ease during the exam. Figures 3a and 3b show that 71% of



students in the non-regrading group either fully agreed or agreed that the opportunity to correct their exam would have alleviated anxiety regarding test taking, while 77% of the regrading group stated they felt less test anxiety with the opportunity to correct their exams ( $t_{(304)} = 2.34^{**}, p < 0.020$ ). These findings build on the study of Brye et al. (2005) who reported decreased anxiety among his students. In the regrade study by Nickels and Uddin (2003), students stated that even though they did not use the regrade possibility, they felt it was nice to know that they had the option, and it allowed them to be a little more relaxed.

### Post-Exam Learning

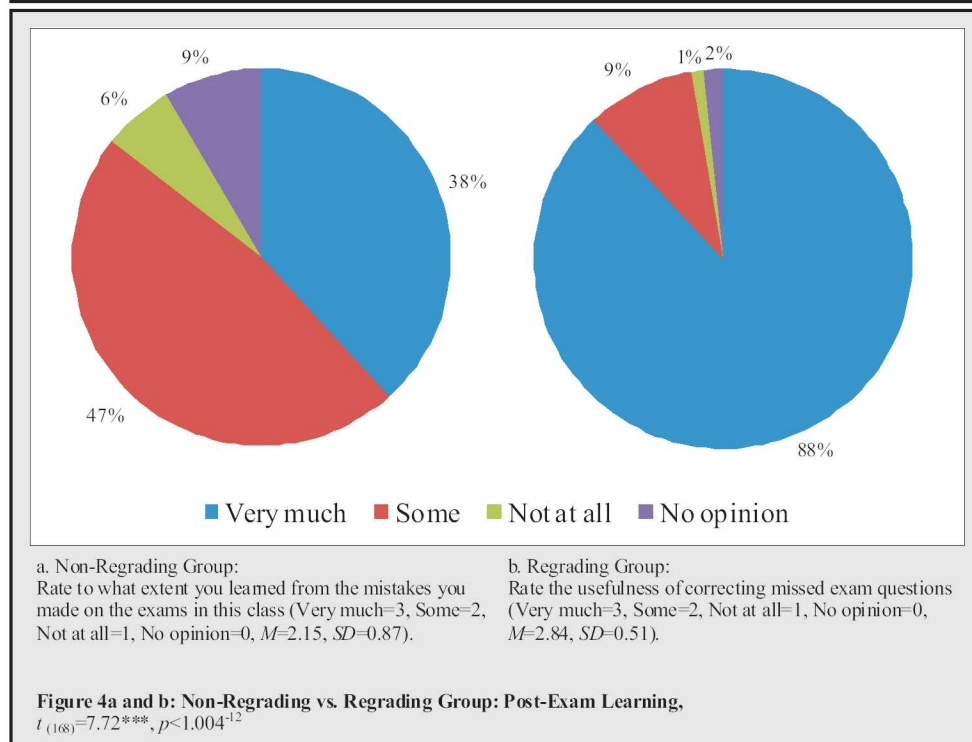
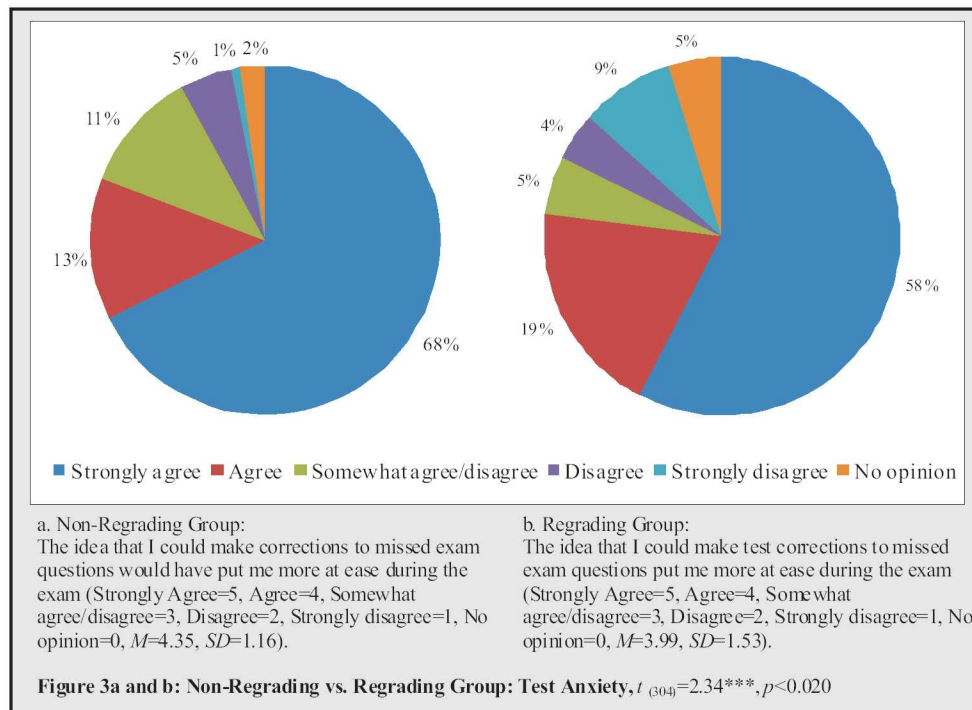
The additional time students spend on correcting their exam and working on class material may be beneficial, as this repeated exposure to the material may add to their learning. As figures 4a and 4b indicate, in the non-regrading sample, 38% felt they learned “very much” from the mistakes they made on the course exams, while 47% learned “some” from these mistakes. In the regrading group, 88% of the students felt that correcting their tests was very useful and caused them to learn from their mistakes, and an additional 9% stated they experienced some learning benefit from it ( $t_{(168)} = 7.72^{***}, p < 1.004 \cdot 12$ ).

Thus, this question clearly suggests that students feel there is learning benefit to correcting missed exam questions.

This is consistent with previous studies in which students indicated that the regrade policy did result in increased learning (Bacon and Beyrouy, 1988; Nickels and Uddin, 2003). It also confirms the findings by Haskett (2001), who allowed students who were unhappy with their grades to resubmit their term papers and abstracts as many times as they wished until they had obtained the grade they wanted. Haskett describes this regrading method as a powerful teaching tool, since several students showed significant improvement in their writing ability after obtaining feedback and resubmitting their work. For example, one student who struggled with his writing style on the early assignments turned in later papers that were of very high quality on the first attempt (Haskett, 2001).

### Benefits and Costs to Instructor

Regrading does require a heavy time commitment for both the professor and the students. Given that this study has only been carried out in classes with less than 50 students, the instructor's added time





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commitment due to regrading could prevent this alternative measure from working in a large class setting. However, given that this study only employed exams in short answer formats, which are quite time-consuming to grade, larger classes could be accommodated with the regrading option in a multiple choice exam format. Thus, the method could work in a large classroom setting depending on the type of exam chosen. Even if the students would solve a few exam questions together in the classroom on the day the exam would be returned, there would likely be an added learning benefit.

In addition, correcting missed exam questions is not only beneficial to the students, professors may learn from repeated exposure to students' work as well. When a professor takes the time to review a student's exam for a second time, it allows for an insight to which exam questions students struggle with and which ones they succeed at. Thus, reviewing what students miss on their exams provides reliable feedback which allows professors to adjust their teaching styles accordingly. Another benefit to the professor is the opportunity to incorporate more peer-learning activities since the students will already be familiar with one another.

Previous studies observed an improved student-instructor relationship (Longer et al., 1987; Risley, 2007; Nickels and Uddin, 2003). Risley (2007) found that the students felt better about the class, as they felt more fairly treated by the instructor. This was observed in our study as well: Allowing students to correct their exams resulted in less apprehension regarding exam taking and resulted in a more relaxed classroom environment.

Lastly, allowing students to gain more points by regrading exams lessened the need and want for extra credit activities which can cause stress and a large time commitment to the professor.

## Summary

This study constitutes a unique contribution to the existing literature because it evaluates whether altering a traditional assessment tool can enhance student learning. Our study shows that the opportunity to correct their semester/quarter exams significantly eased students' test anxiety, which would create a more positive learning environment. Correcting missed exam questions as an alternative teaching method allowed for increased student interaction, more positive attitudes regarding exam taking and a better learning environment. This alternative exam lifecycle also revealed students' affinity for using their books and notes to correct answers and working together in groups in addition to visiting the professor for assistance.

Furthermore, the survey suggests that the additional opportunity for students to review missed exam questions may help to retain the information long term. This study shows that if professors and students are willing to put in the time and effort to

correct missed exam questions and regrade exams, the benefits may outweigh the time commitment. Students who were given the opportunity to re-submit their exam for regrading expressed that they were more likely to learn from their mistakes than the non-regrading group. Repeated exposure to material and the opportunity to re-submit exams that have already been graded may help students retain information and learn from their mistakes, as opposed to the traditional exam, which is routinely discarded after completion.

Additionally, correcting missed exam questions allows instructors to see where most students struggle with the material that is being taught. Thus, teaching styles could be adjusted accordingly. Ultimately, this may lead to higher exam grades during the next quarter, if the educator was successful in conveying the material in an improved way. It could be argued though, that through regrading a mere inflation of the students' grades may occur. However, this was not confirmed by previous literature, as Risley (2007) found that only about 18% of his students who participated in a similar regrading activity received a higher semester/quarter course grade. Even if allowing students to resubmit their work for more points does not affect their final course grade, the students' morale is increased and a better learning environment and student/teacher relationship is established (Nickels and Uddin, 2003). In our study, students overwhelmingly indicated a positive attitude about the opportunity to make corrections to missed exam questions for regrading.

This study leaves some questions open for future research. As a preliminary study in this area, it is limited to college students at two universities in California and Arkansas. Expanding the geographic focus of the study to include college students on more U.S. states, or even other countries, would enrich the findings. Further data collection may continue, where more detailed data on the students' time spent and method of regrading the exams will be collected. Additional information about student learning will be collected by repeating questions from the semester/quarter exams on the final exam. Although students indicated that they learned from their mistakes, an objective comparison of final exam grades will need to be conducted to quantify whether their learning was realized and retained sufficiently long term to score well on the final exam. Given that the regrading option is not offered on the final exams of either treatment groups, a comparison by final exam grades could show additional insight into student learning.

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