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Can Professors' Encouragement Boost Exam Scores?: A Quasi-Experiment

by

Samantha R. Wood

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Under the Supervision of:

Chair: Dr. Danielle D. Gagne

Committee Members:

Dr. Grzegorz T. Pac

Dr. Beth C. Johnson

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Author Note

Samantha R. Wood, Department of Psychology Undergraduate Student, Alfred University.

Correspondence concerning this article should be addressed to Dr. Danielle D. Gagne, Department of Psychology, Alfred University; Dr. Beth C. Johnson, Department of Psychology, Alfred University; or Dr. Grzegorz T. Pac, Department of Economics at One Saxon Drive, Alfred University, Alfred, NY 14802

Abstract

Self-Determination Theory (STD) assumes people by nature are self-motivating and eager to succeed because it is personally satisfying and rewarding (Deci & Ryan, 2008). This suggests that academic success is highly determined by a student's motivational incentive to perform well. As a result, there has been extensive research investigating the differences between the types of motivation, extrinsic and intrinsic, and how they affect academic performance. Other research has studied the effects of incentives, both internal and external, on student performance. After exploring the research regarding academic success, the goal of this study was to understand how professors could increase students' motivation through incentives in a classroom setting. This quasi-experimental study with non-equivalent groups investigated the interaction between incentive (operationalized as positive encouragement) and performance in two Microeconomics course classes, comprising 58 college students (22 women, 36 men). Students either received encouragement from the professor or not, over the time period of two exams. T-tests revealed no effect of encouragement. However, a third exam score was included and a linear regression was used to isolate and analyze the effects of other variables, such as the students' background ability (e.g., GPA), habits (e.g., amount of time spent studying) and personality (e.g., type of motivation driving the student). The analyses indicated that encouragement increased exam scores by 2-4 points. The research limitations and suggestions for further research are later discussed.

Keywords: self-determination theory, academic success, motivation, professor encouragement, student performance, scores, incentives, quasi-experiment, linear regression

According to the National Center for Educational Statistics (2014), 21.8 million students were expected to attend colleges and universities in the fall of 2013 across America. Since more high school students are being directed towards college-oriented career paths to attain a higher education, college has become almost necessary for securing job opportunities after graduation. However, out of the 1.66 million students who graduated in 2013, only 43% met the SAT College and Career Readiness Benchmark (The College Board, 2013). The College Board deemed those who achieve a score greater than or equal to 1550 are academically prepared with the skills and knowledge needed for college-level work. These students are "more likely to enroll in a four-year college, more likely to earn a GPA of a B- or higher their freshman year, and more likely to complete their degree." Statistically, America's freshmen are beginning college with less of an opportunity to do well, and this has been the trend for the last five years (College Board, 2013).

Yet, Self-Determination Theory (SDT) assumes that people, by nature, take an active role in being self-motivated; they are curious and eager to succeed because success is rewarding and satisfying (Deci & Ryan, 2008). Educational success and future achievement goals have been found to be strong motivational factors for students, which are also highly correlated to their levels of performance in high school. Academic motivation has been seen as the "strongest predictor for academic achievement after accounting for socioeconomic differences." The research also supports higher correlations that link high school academic achievement to the student's future success in college and in their career (Siegle, Rubenstein, & Mitchell, 2014).

The increasing push to furthering one's education seems more of an assumed and accepted social norm than one's own personal desire to continue on with their schooling for future opportunities. One could imply that this shift in social expectation surrounding the

"college experience" has impacted how high school students view college. These changes from social influences suggest that academic motivation traits are changing and are a possible link to the increase in college attendance, but also related to the decrease in academic performance.

Are students losing their innate sense of personal success due to society's pressure to attend college? Why are we seeing so many students underprepared? Is academic motivation still the driving factor for students to be successful? What can college professors do to encourage these students, who are attending college with less of likelihood to perform well and possibly less academically motivated? This article is designed to examine the different types of motivation as well as their effect on student performance and the effects of incentives on motivation and performance. This is followed by our investigation of the research of what professors can do to encourage student motivation to improve students' performance in the classroom.

The most basic definition of *motivation* is any dynamic factor that directs behavior toward an objective. In educational psychology, motivation can be defined as "the process that directs and sustains student's behavior towards learning," (Moreno, 2009). Motivation determines whether or not, and to what extent, students are willing to engage in learning a skill or new material, and their persistence to practice and complete tasks. Once the student has successfully learned how to do something, educational motivation is the key factor for the student to continuing to learn (Lei, 2008). Those with high positive motivation are more likely to learn and achieve their academic goals because they find specific academic tasks meaningful. As a result, these students believe that they possess the skills and ability to perform well and complete tasks (Moreno, 2009; Siegle, Rubenstein, & Mitchell, 2014).

Questioning how students find academic tasks meaningful, we investigated the research on the different types of motivation and the incentives influencing a student's drive to perform well. Those who are *intrinsically motivated* are interested in learning for the sake of learning, enjoy learning and persistently performing the task, and they engage in that behavior because they find the activity itself to be challenging and rewarding (Cerasoli, Nicklin, & Ford, 2014; Moreno, 2009; Bruno, 2013). As a result, internal satisfaction is enhanced due to the increase in competence and desire. According to SDT, those who are autonomously motivated (i.e. by intrinsic means), behave with "a full sense of choice and a power of will" (Deci & Ryan, 2008).

When students choose to engage in a task or behavior to receive praise, awards, rewards, good reviews, or to avoid negative consequences, strive to learn the activity as a mean to an end, or use incentives to make decisions based on instrumental gains and losses, they are *extrinsically motivated* (Bruno, 2013; Moreno, 2009; Cerasoli, Nicklin, & Ford, 2014). Students who engage in controlled motivation require external sources of motivation (i.e. extrinsic means) and behave in regards to the pressures and demands surrounding a specific outcome (Deci & Ryan, 2008). Internal satisfaction is thus stimulated by external factors that don't necessarily persist after the task has been completed or after their goal has been reached.

Students who find a task meaningful must then have the belief that they have the capability to perform that task successfully. Albert Bandura defines this belief as *self-efficacy*. Experiencing personal success and failure as well as observing others' successes and failures are factors that influence self-efficacy (Bandura, 1977). Bandura's research suggests subliminal persuasion can influence a student's perception regarding their self-efficacy, which then can influence how they are motivated.

In attempt to boost perceived self-efficacy, researchers Tucker and Sexton (1991) investigated feedback persuasion. Students were first given a questionnaire to identify their perceived level competence and capability. They were assigned the task of creating test questions covering the content of the course. When returning the student's work, the professor handwrote positive feedback statements (e.g. "You did a good job" and "Your work is well-constructed") to half of the students and neutral feedback (i.e. "Your work was acceptable") for the other half. They found that those who receive positive feedback statement had an overall increase in their perceived level of self-efficacy while the other group was found to have no difference. These positive statements and feedback given by the professor, evaluated the quality of student performance Tucker and Sexton (1991) called *encouragement*.

Rodriguez-Keyes, Schneider, and Keenan (2013) investigated student perceptions of a professor and the influence on academic motivation. In their study, college students were asked to give feedback in regards to "being known by the professor." Students' responses indicated that they felt known when their professor was responsive and recognized them. Responsiveness included timely responses to emails, being helpful and available, gave feedback, and put effort into answering questions. Recognition included behaviors such as making eye contact with the students while lecturing, learning their names and different unique qualities about them, noticing them outside of class, and attempting to build a relationship with the class. These behaviors increased the level of comfort among the students, even in those who self-identified as shy, quiet, and students. Students were more likely to participate in answering question as well as motivated to ask more questions (Lei, 2008). It can be concluded that students who felt known were more motivated to work harder and learn more.

The research of Siegle, Rubenstein, and Mitchell (2014) also supports these findings. Their study examined college students who attributed their academic interest and motivation to their high school teachers. They responded that their teachers stimulated their beliefs of competency, allowing them the ability to complete tasks and promoting that academic tasks were worth the time and effort put into completing them.

The current empirical evidence shows conflicting results regarding the effect of incentives on motivation and more specifically intrinsic motivation. According to James (2005) once a student has been exposed to incentives, their intrinsic motivation slowly decreases or completely disappears or that specific task. This *crowding out effect* has been found to have a negative, positive, or no effect on intrinsic motivation. James attempts to create a model to show the exact shifts in motivation based on when incentives are applied. This is made challenging due to the findings of mixed results. He states that once intrinsically motivated people receive external incentives, they "behave as if they are no longer intrinsically motivated."

In contrast, researchers Cerasoli, Nicklin, and Ford (2014) have collected data results over the last 40-years from other researcher determining the impact of incentives on intrinsic motivation. They used a meta-analysis research design to compare and contrast the results from different studies in attempt to find patterns among them. They found consistent results regarding those who are intrinsically motivated; better performance was due to the enjoyment of task. They suggest that those who are strongly intrinsically motivated, even when given external incentives, will stay motivated to complete the task. "Intrinsic motivation remains a moderate to strong predictor of performance regardless of whether incentives are present… incentives coexist with intrinsic motivation"

As addressed earlier, some researchers think that competency, internal satisfaction, and learning are also incentive factors that motivate students to complete a task. Incentives in this case are not only represented as external rewards, awards, praise, etc. (Lei, 2008). This suggests that students can be both extrinsically and intrinsically motivated; if they strive to receive good grades, they can verify that they have mastered the material which increases their sense of competency. Accommodating this definition of incentives means that encouragement includes some external incentive qualities. The professor is the one doing the influencing on the student and it is done by recognizing and praising student behavior (e.g. "I am pleased to hear you are going to recitation/doing your homework").

The main purpose of this research study was to investigate if students could be motivated to perform better by the use of encouragement. This study defines encouragement as a positive incentive designed to acknowledge the student's academic performance (e.g. coming to class, doing homework), to give students the feeling of being know by their professor (e.g. I know you will do well), and includes influence from external incentives as just defined. We used this definition of encouragement in attempt to influence self-efficacy and stimulate intrinsic motivation among the students. We hypothesized that students who received encouragement from their professor prior to an exam would do better than those who did not receive encouragement.

Method

Participants

Participants were 58 undergraduate students (22 women, 36 men) enrolled in a microeconomics course at a small, rural university in western New York (see Table 1 for demographics). Participants were not compensated for their participation.

Apparatus

Several measures were collected to assess knowledge, motivation, and perception of the exam. The participants' performances were measured over the course of three exams created by the professor for his microeconomics course. Knowledge was assessed by participants SAT and GPA scores as well as obtained from a pop quiz measuring the students' existing economic and mathematics knowledge (see Table 1). Figures 1, 2, and 3 show the mean pop quiz scores with a standard deviation curve.

The Supplemental Feedback Questionnaire (SFQ) was created to measure participant's opinions about the exam (see Appendix A). The following are the main questions of interest that were analyzed: "Do you feel like this exam was a fair assessment of your knowledge?," "Rate this exam's difficulty," "How many hours did you spend studying for this exam?," and "Did you attend tutoring hours?" Motivational personality was also measured from the SFQ by assessing the following question: "What do you want to get out of this class?"

Procedure

Participants were divided into two separate classes based on their registration into a microeconomic course. The first class we labeled as Group A and the second class we labeled as Group B. Any participant knowledge regarding the process of our research study and the observations performed would have change the outcome of our results. Thus, informed consent was not obtained from our participants. To ensure confidentiality, participant names were removed from tests before data entry and recorded by their student identification number. Before the trials, participants were given a pop quiz. The pop quiz was graded by the professor who informed both groups with the neutral statement: their performance "Was okay" (see Appendix B).

After the pop quiz, we randomly assigned Group A to the encouragement before the first exam while Group B was assigned to the control condition. Encouragement was giving to the class in the form of the following positive feedback statements, "You have been doing well coming to class" and "The Teaching Assistant tells me that you are going to recitation and doing your homework. Keep it up;" and before the exam, "Good luck. I know you will do well on this exam" (see Appendix B). Exposure to the encouragement in the experimental condition ceased after the professor handed out the first exam.

Following the completion of the exam, the participants were asked to detach the SFQ from their exam (to promote anonymity) and complete it. All participants received a letter and number grade on their exam. After this, the treatment and control conditions switched before the second exam. Treatment was applied to the class meeting following the exam to Group B; they received the positive feedback statements while Group A was given no encouraging feedback (see Appendix B). The neutral statement was given to both classes so that the professor's perception regarding the class performance on the exam would not reflect a similar form of praise. The treatment procedure was continued until Group B received their second exam. Participants were again asked to detach and complete the SFQ and given a letter and number grade on their second exam.

Results

Our design for this study was a between-subjects quasi-experiment with non-equivalent groups. A baseline quiz was given to the students to determine their previous economic and mathematic knowledge. Mean scores with a standard deviation curve can be seen in Figure 1 and Figure 2; Figure 3 shows the total mean scores for the pop quiz. An independent samples *t*-test was conducted to test our hypothesis and compare the mean effect of treatment on scores.

Analyses focused on this interaction of encouragement on performance within a class; two classes were observed at two different time intervals. The means scores from the exams can be seen in Figure 4, Figure 5, and Figure 6.

To determine significance, we evaluated our data at the .05 level, 2-tailed value. There were no significant differences at time one between the experimental group (M = 78.68, SD = 11.74) and the control group (M = 78.14, SD = 12.17), $t(55) = .171$, $p = .87$. Non-significance was also found at time two between the experimental group (M = 77.41, SD = 12.14) and the control group (M = 73.86, SD = 15.90), $t(56) = .96$, $p = .34$ (see Table 2 & Table 3). Our results indicated that there was no interaction or effect on exam scores that was influenced by the encouraging feedback from the professor. Therefore, we have no support for our hypothesis and accept the null hypothesis.

Further Exploration

Economic Contributions

Similar to psychology, economic motivation focuses on the "initiation, direction, intensity, and persistence of human behavior," but in regards for outweighing costs and benefits, decision making, and maximizing utility (Bruno, 2013). However, the field of behavioral economics attempts to integrate the disciplines of psychology and economics by incorporating their different perspectives to better understand human behavior. Research psychologists Daniel Kahneman and Amos Tversky (1974, 1979) have utilized economic models and compared them to their psychological models. They have found that their models contradict economic principles, specifically related to consumer utility. Other researchers, psychologists and economists, have expanded their research to investigate individual rationality and consumer decisions.

The developing psychological research integrating economic assumptions and vice versa, suggests a more realistic variation in consumer decision making; this has set it apart from the traditionally stable and restricting ideology of economics (Rabin, 1998). As a result, newly developing economic theories rely heavily on evidence produced from psychological experiments to better explain human behavior. These new perspective challenges the long standing assumptions and theories of neoclassical economics, but allows for more exploration and different interpretations of the research (Katona, 1978; Hattwick, 1989). By investigating behavioral economics, we applied an economic perspective to our research to further our understanding of student (i.e. the consumer) motivation and other individual factors that influence academic performance.

Method

We continued our previously described research procedure for a third trial and randomly selected which class would receive treatment; Group B received encouragement from the professor while Group A was the control condition and received no encouragement.

Results & Conclusions

The final data was collected and organized to fit a time series data model, also referred to as panel data (see Table 4). This allows us to look at the individual student and their scores across time. Table 5 shows the combination of mean scores with the standard deviation curve from the two classes at each of the three exams (see Figures 4, 5 & 6) Table 6 shows the total combination of exam scores and standard deviations from the two classes; we control for time by creating dummy variables that remove time as a factor.

A linear regression analysis was used to estimate the relationship between the effects of professor encouragement (T) on student exam scores (y) while controlling for other observable variables (x). These variables included demographic information regarding GPA and SAT scores (math, verbal, and writing; scale: 2400 points), a quiz measuring the students' already existing economic and mathematics knowledge (Quiz; scale: 4 points mathematics, 12 points economics), the individual motivation of the student (Motivation; see table 7 for scale), the amount of time spent studying for the exam (Study Hours; scale: 0- 4+ hours), whether or not the student sought help from a tutor (Attended Tutoring, scale: 1= yes, 0= no), a student assessment of the lecture speed of the professor (Pace of Class; scale: 5 point likert scale from 1= too slow to 5= slow down), and the level of difficulty rating the exam (Exam Difficulty; 5 point likert scale from 1= too hard to 5= too easy).

We used a Fixed-Effects (FE) regression model to analyze our data because this type of model assumes that our participants' individual unobservable characteristics remain constant because it these individual variables do not change over the course of time (e.g. GPA and SAT scores). This assumption allows the model to specifically assess individual variation to estimate the effect of the treatment. These factors related to individual variance drop out of the equation and thus allow us to control for their observable characteristics (x; e.g. amount of time studying, personal motivation, and attended tutoring sessions). We also used a Random-Effects (RE) linear regression model to investigate the effects of the unobservable variables (Z) that do account for any individual time-variant variables (e.g. GPA and SAT scores) that were not previously controlled for in the FE model and possibly changed during the time of our study.

We represent this economic relationship as the linear regression equation:

$$Y_{\text{Scores}} = T_{\text{Encouragement}} + X_{\text{SFQ, Demographics}} + Z_{\text{Unobservables}} + e_{\text{error term}}$$

From this linear regression equation, we estimated the relationship between treatment and the unchanged demographic information (3, RE) as well as the effects of treatment and all of our measured variables on exam scores (4, RE) (see Table 7).

When we estimated the relationship between treatment and exam scores using FE and RE models, professor encouragement significantly increased students' exam scores from 2.4 to 4.1 points at the .10 and .05 significance levels respectfully (see Table 7, Treatment). When controlling for specific demographic information, we found significance among our variables at the 0.10, 0.05, and 0.01 levels (see Table 7, Note).

Investigation of the effect of student motivation on exam scores, found the relationship to be positive and significant. Those who were motivated by learning and wanting to learn had an exam score increase by 8.9 to 13.1 points. Similarly, those motivated by learning and wanted to achieve a grade in the class showed an increase by 8.7 to 14.8 points. Those motivated to apply classroom material to the real world had an increase in the exam scores by 11.4 to 16.4 points while the motivation for the class to not be a waste of time (i.e. get something out of the class) showed an increase in exam scores by 13.3 to 16.3 points. The students who were not motivated and did not want to achieve anything from the class were found to have no significance among their scores; we used this type of motivation as a dummy variable to compare our other motivational variables to. We also found significance among the variables attended tutoring, perceived exam difficulty, and SAT and GPA scores (see Table 7).

Discussion

Conclusion & Limitations

Using a quasi-experimental design allowed us to examine a real college classroom environment in which the participants are current students. Unlike laboratory experiments which

allow for almost complete control, real life situations cannot account for all the observable and unobservable differences among our participant groups. By using analyses that controls for these factors, we are able to look at just the effect of professor encouragement on exam scores. And we find an overall positive and significant difference among those who received encouragement and those who did not. We especially see these results when we account for the student' type of motivation which relates back to the research. Those who are more intrinsically motivated are more likely to learn and achieve academic goals, resulting in better exam scores (Moreno, 2009; Siegle, Rubenstein, & Mitchell, 2014).

This quasi-experimental design limited our use of random assignment. Our participant sample was already separated into pre-existing groups, allowing us to randomly assign these groups to our treatment conditions. Comparisons between the mean scores from the treatment conditions could be analyzed, but we could not assume that these differences between the groups where specific to the treatment and not a result from other extraneous factors. Our results obtained through Independent samples *t*-tests did not reveal significant results.

We can assume from these results, like Wlodkowski (1978), the possibility that professors cannot directly motivate their students to do better. Wlodkowski argues that if they could, students would "have no responsibility for their learning" which stimulates their self-affirmation. Instead, he says professors, especially elementary teachers; should help foster the development of a student's competence and attempt to match their interest with learning activities. In conclusion, to stimulate academic performance, professors should encourage students by increasing their self-efficacy (i.e. develop competence) and to make them feel known (i.e. noticing their interests). Instead of completely accepting our null hypothesis regarding no effect, it is possible that our manipulation was not strong enough to effect exam scores.

This could be due to our small sample size influenced by our environment. The students who were studied were from a small university in represents a narrow range of students. A larger sample size would accompany more diversity as well as provide the opportunity to include more courses. Although small, this quasi-experiment allowed us to examine a real college classroom environment in which the participants are current students. Their exams were based on the material they learned over the course of a semester and changed to reflect the new information learned in class. This occurs in all academic courses and demonstrates one of the many real life extraneous factors that could have negatively influenced our results.

Again, we used an economic approach to investigate further because economics allows us to make different assumptions to analyze human behavior and to control for extraneous factors (Z- unobservables). We were able to test and control for specific demographic variables that posse to have the greatest influence on performance. This included gather demographic and previous knowledge assessments from the students to help control for academic ability and background.

Additionally, student perception regarding the course material and exams were analyzed because they controlled for feelings of competency related to self-efficacy. We also collected students' responses on what they wanted to get out of the course; this was used as a prompt to discover the individual factors motivating the students. These allowed us to better understand if a student was intrinsically and/or extrinsically motivated, and see if their motivation changed over the semester. Our results obtained through linear regressions revealed significance from professor encouragement, leading to varying point increases on exam scores.

The Supplement Feedback Questionnaire could have possibly had a reverse effect on encouragement given by the professor. Encouragement was given to acknowledge positive

student behavior and to help students feel known in order to promote self-efficacy. On the SFQ, students were given the opportunity to make suggestions to the professor to make the class "a more positive learning experience." Many students gave feedback about wanting the professor to write more notes on the board, to explain the material better and give clearer examples, have study sheets available before the exam, and to stay on topic. If the professor were to have adjusted the class in regards to their responses, we would have created the potential to expose our results to confounds.

This is supported by the research of Rodriguez-Keyes, Schneider, and Keenan (2013) who found that feeling unknown by the professor, has a negative impact on student motivation. As a result, we could have unintentionally created a negative atmosphere where students did not understand the material making the exams more difficult, thus resulting in lower levels of self-efficacy. This lack of responsiveness from the professor could have possibly caused students to not want participate, ask questions, and disengage themselves from learning.

Although, before furthering our fundamental research study, our results did not support our hypothesis but, we can conclude that it is important to continue researching the effects of encouragement and motivation to stimulate students' desire to do well academically and influence intrinsic motivation.

Future Research

Changing the design of our study would be the most beneficial to obtain clear results regarding the effects of professor encouragement on student motivation and exam scores. We would want to ensure that our participant sample is randomly selected to insure we have similar groups to compare. As addressed earlier, a larger sample size would allow us to have a more representative sample of the whole population. By changing our experiment to a with-in subjects

design, we would expose all of our participants to the different levels of treatment (i.e. encouragement, monetary reward, nothing) before taking an exam. From here, we can determine which treatment had the greatest effect on their performance. Since all participants would experience all levels of the treatment, the results are less likely to be influenced by individual differences. We would make sure to remove the question, "What can I do to make this class more of a positive learning experience for you?" to avoid possibly creating feelings of being unknown.

We would also like to investigate further by varying the amounts of encouraging statements. This would able us to asses which amount of encouragement has the most effect on performance and at what amount does encouragement stops effecting performance. Furthering research on motivation and professor encouragement is especially important if we want to help a seemingly unprepared generation of college students be more successful.

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Table 1

Participant Demographics

Variable	Descriptive	N	%	Mean	S.D
Gender	Female	22	37.9		
	Male	36	62.1		
SAT		54		2095.1	251
College		58		2	0.9
	Liberal Arts & Sciences	14	23.7		
	Professional Studies	35	59.3		
	Engineering	5	8.5		
	Art Department	2	3.4		
	Graduate Program	2	3.4		
Standing		58		1.6	1
	Freshman	6	10.3		
	Sophomore	26	44.8		
	Junior	12	20.7		
	Senior	12	20.7		
	Graduate	2	3.4		
Major		58		6.2	4.5
	Psychology	2	3.4		
	Accounting	5	8.6		
	Business	17	29.3		
	Academic Exploration	4	6.9		
	Marketing	10	17.2		
	Education	1	1.7		
	Art Design	2	3.4		
	Environmental	1	1.7		
	Finance	3	5.2		
	Ceramic Engineering	1	1.7		
	Spanish	1	1.7		
	Political Science	2	3.4		
	Communication	3	5.2		
	Materials Engineering	2	3.4		
	Biology	1	1.7		
	Athletic Training	1	1.7		
	Biomedical Engineering	1	1.7		
	Glass Engineering	1	1.7		
GPA		58		3	0.7
Pop Quiz		50		9.9	3.4
	Economics	50		7.3	2.9
	Mathematics	50		2.5	1.8

Table 2

Independent Samples Group Performance Statistics

	Tx	N	Mean	SD	Error
Exam 1	1	28	78.68	11.74	2.22
	0	29	78.14	12.17	2.26
Exam 2	1	29	77.41	12.14	2.25
	0	29	73.86	15.9	2.95

Note. Tx= treatment; 1= received encouragement; 0= no encouragement (control).

Table 3

Independent Samples T-Test Analysis

	Levene's Test		t-test for Equality of Means						
								95% CI	
	F	Sig.	t	df	Sig. (2-tailed)	MD	Error	LL	UL
Exam 1	0.395	0.532	0.171	55	0.865	0.541	3.17	-5.811	6.893
Exam 2	2.106	0.152	0.957	56	0.343	3.555	3.714	-3.885	11.007

Note. CI= confidence interval; LL= lower limit; UL= upper limit. For exam 1, $n = 57$; exam 2, $n = 58$ (see Table 2). Significance level= * $p < .05$. Levene's Test determined non significance; equal variances assumed.

Table 4

Time Series Data Example

Participant	Time	Treatment	Score
266781	1	1	68
266781	2	0	79.1
266781	3	1	68
324090	1	1	76
324090	2	0	65.7
324090	3	1	68
292674	1	1	92
292674	2	0	89.2
292674	3	1	89
295375	1	1	80.5
295375	2	0	83.2
295375	3	1	83
295671	1	1	94
295671	2	0	96.3
295671	3	1	93
284378	1	0	83
284378	2	1	86.5
284378	3	0	79
370828	1	0	63
370828	2	1	69
370828	3	0	58
350422	1	0	59
350422	2	1	75.1
350422	3	0	72
369804	1	0	85
369804	2	1	91.9
369804	3	0	79

Table 5

Combined Class Scores

	N	Mean	SD
Exam 1	57	78.4	11.86
Exam 2	58	75.64	14.13
Exam 3	58	70.66	13.19

Note. Over the semester, course material and exam difficulty was rated more difficult than previous exams. This difficulty factor is common among the progression of college courses. This is one uncontrollable factor that could explain the differences between the overall decline between the exam scores.

Table 6

Overall Combined Exam Scores

	N	Mean	SD
Combined	173	74.88	13.42

Table 7

Linear Regression Analyses Results

	(1, FE) Score	(2, FE) Score	(3, RE) Score	(4, RE) Score
Treatment	2.422*	4.107**	2.646**	2.953*
	-1.213	-1.58	-1.336	-1.631
Motivation				
Learning		8.853**		13.083***
		-4.007		-4.47
Grade		7.649		8.913
		-4.602		-5.542
Real World		11.392**		16.376***
		-4.45		-4.361
Grade & Learning		8.68*		14.839***
		-4.654		-5.374
Not Waste Time		13.308**		16.299***
		-5.454		-4.84
Unsure		4.367		3.64
		-4.841		-5.678
Study Hours		-0.136		-0.201
		-1.237		-1.118
Attended Tutoring		9.157**		0.865
		-4.09		-3.58
Pace of Class		-0.237		-0.216
		-2.267		-2.006
Exam Difficulty		5.153		3.158**
		-1.273		-1.296
GPA			7.311***	4.687***
			-1.413	-1.458
SAT			0.022***	0.018**
			-0.008	-0.009
Quiz			0.753**	0.614
			-0.375	-0.46
Observations	173	110	143	96
Time Fixed Effects	Yes	Yes	Yes	Yes
Overall R-Squared	0.065	0.069	0.488	0.532
Robust standard errors in parentheses				

Note: *significant at .10; ** significant at .05; ***significant at .001

Motivation scale: 1= better understanding, 2= achieve good grade, 3= application to real world, 4= nothing, 5= good grade and better understanding, 6= not waste time, 7= not sure

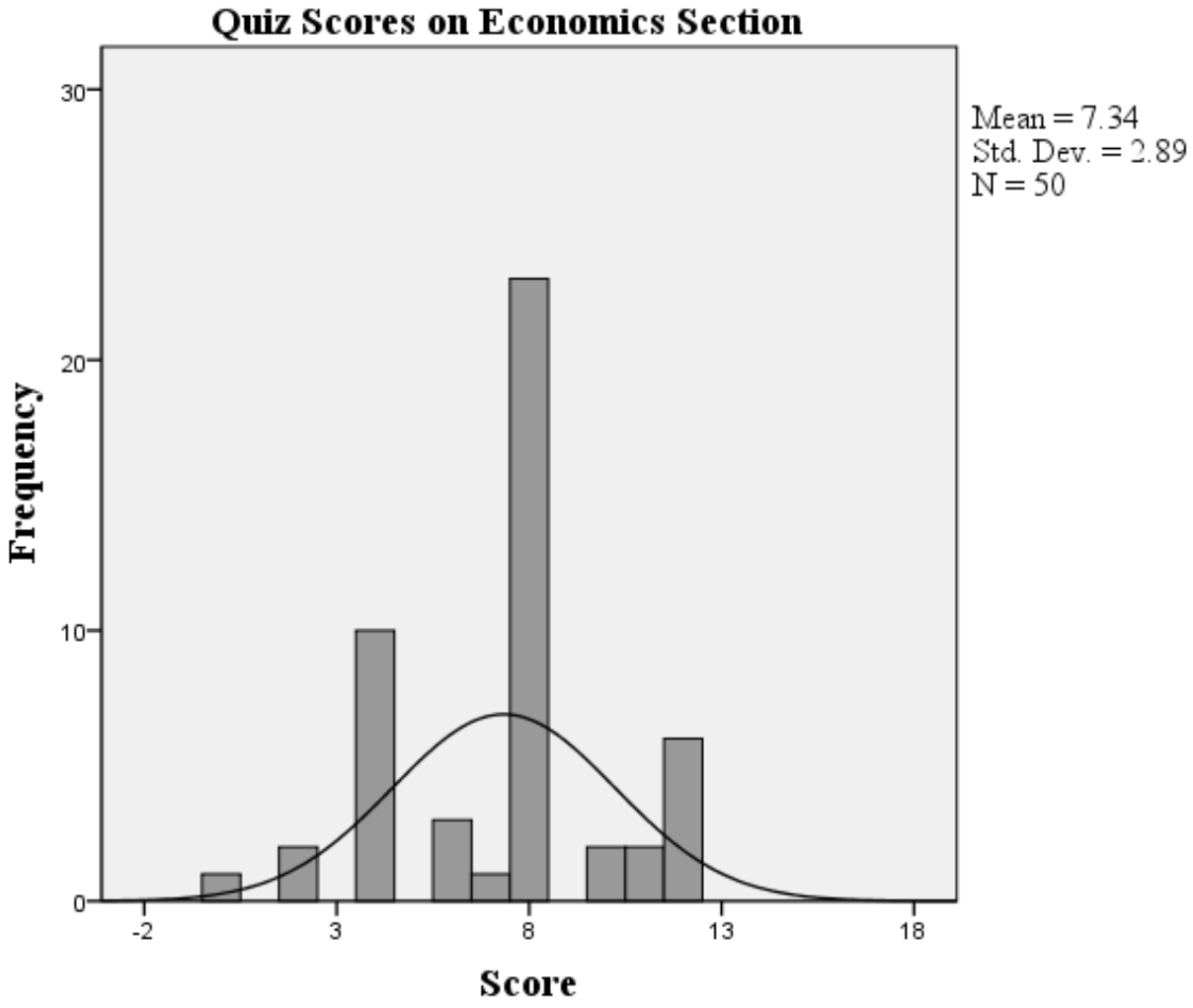
Quiz Scores on Economics Section
Mean = 7.34
Std. Dev. = 2.89
N = 50
Frequency
30
20
10
0
-2
3
8
13
18
Score

Figure 1.

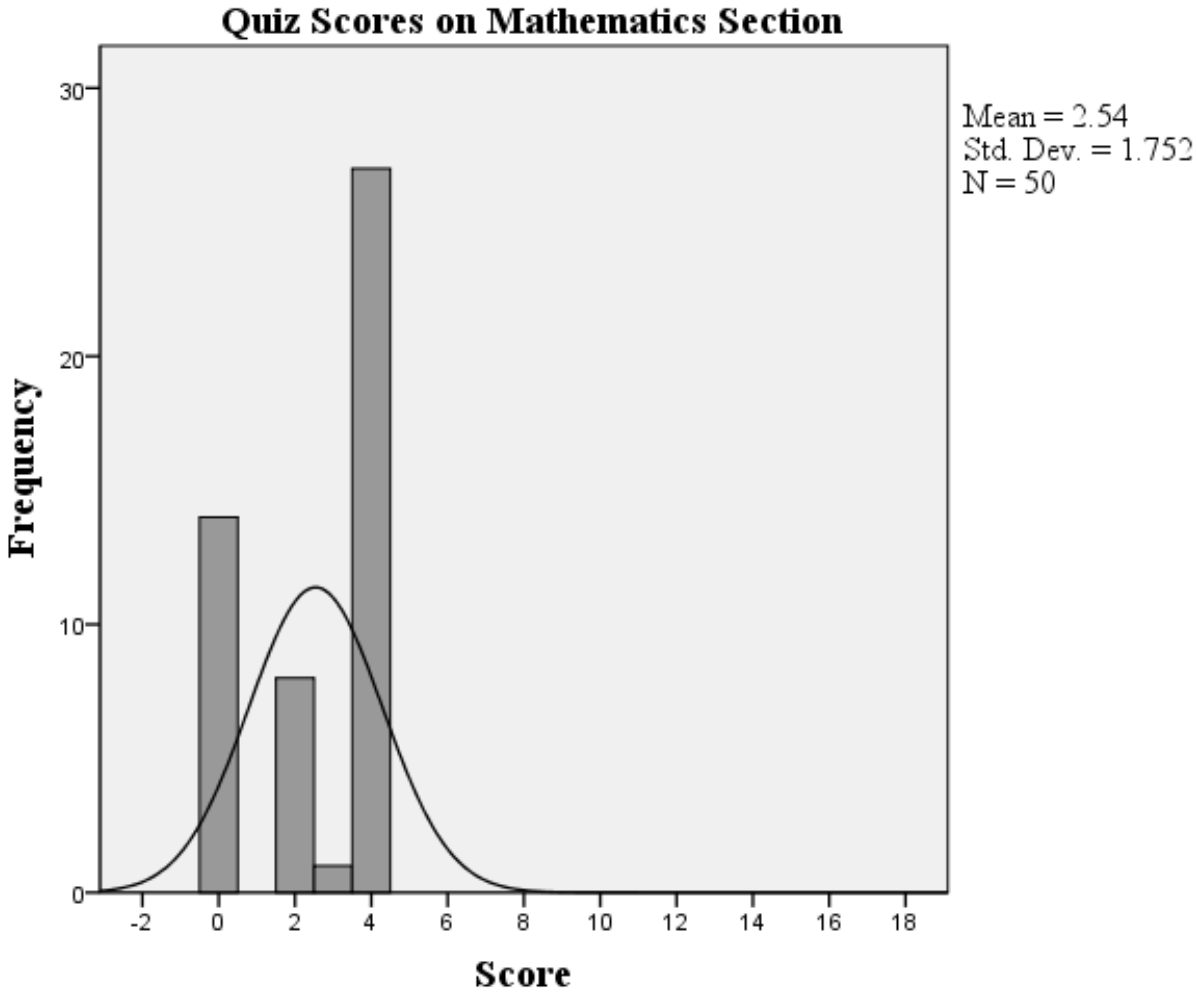
Quiz Scores on Mathematics Section
Mean = 2.54
Std. Dev. = 1.752
N = 50
Frequency
Score
0
10
20
30
-2
0
2
4
6
8
10
12
14
16
18

Figure 2.

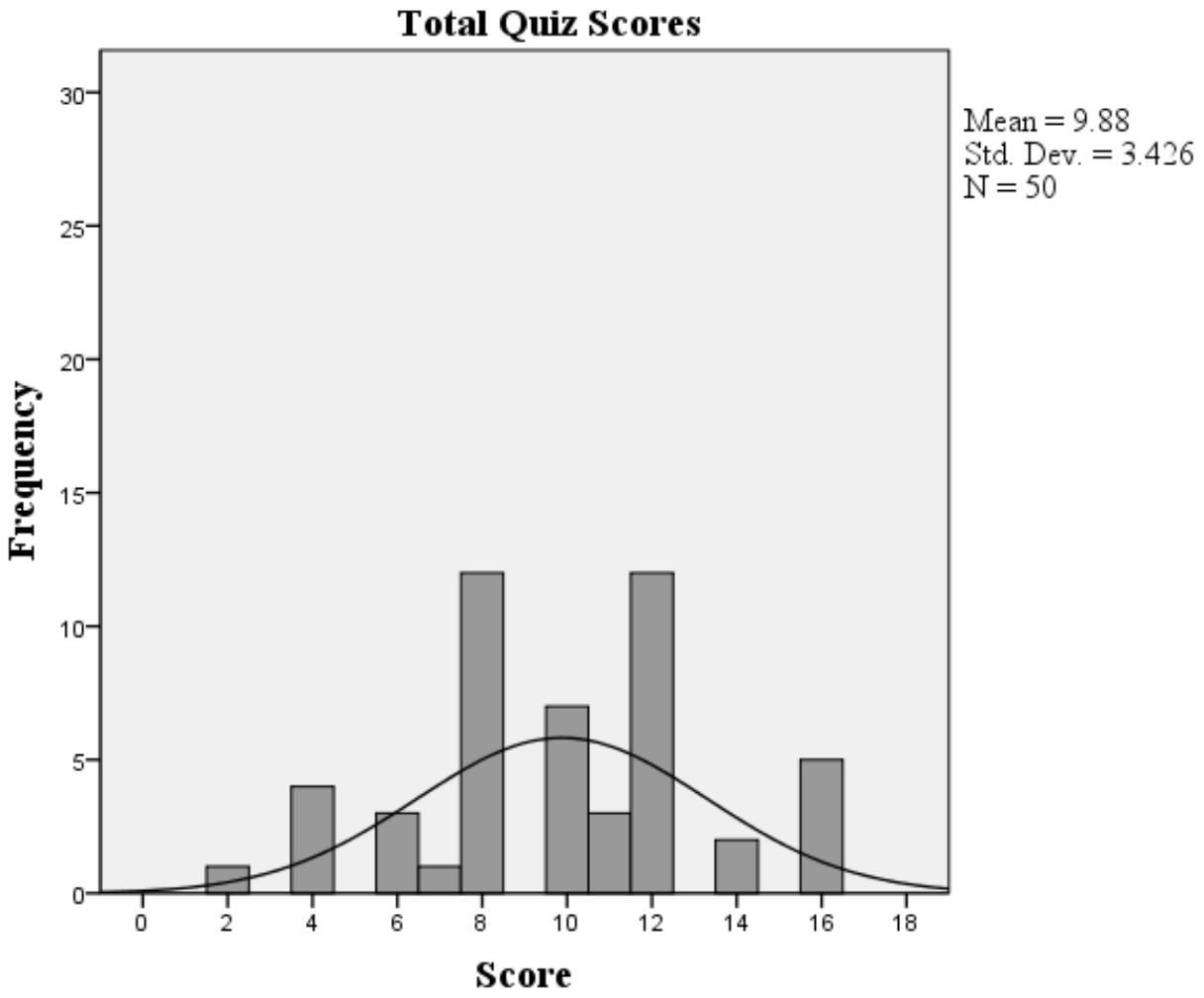
Total Quiz Scores
Mean = 9.88
Std. Dev. = 3.426
N = 50
Frequency
Score
0
5
10
15
20
25
30
0
2
4
6
8
10
12
14
16
18

Figure 3.

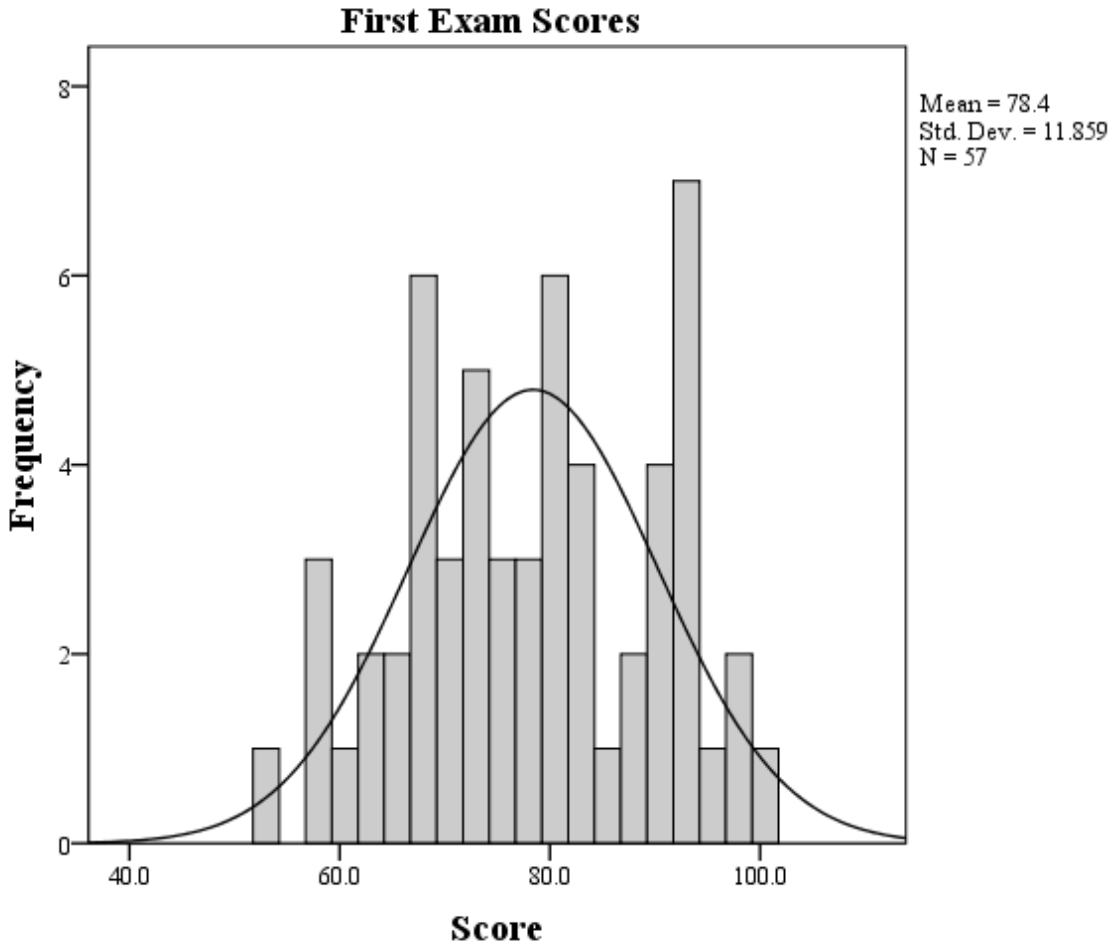
First Exam Scores
Mean = 78.4
Std. Dev. = 11.859
N = 57
Frequency
Score
0
2
4
6
8
40.0
60.0
80.0
100.0

Figure 4.

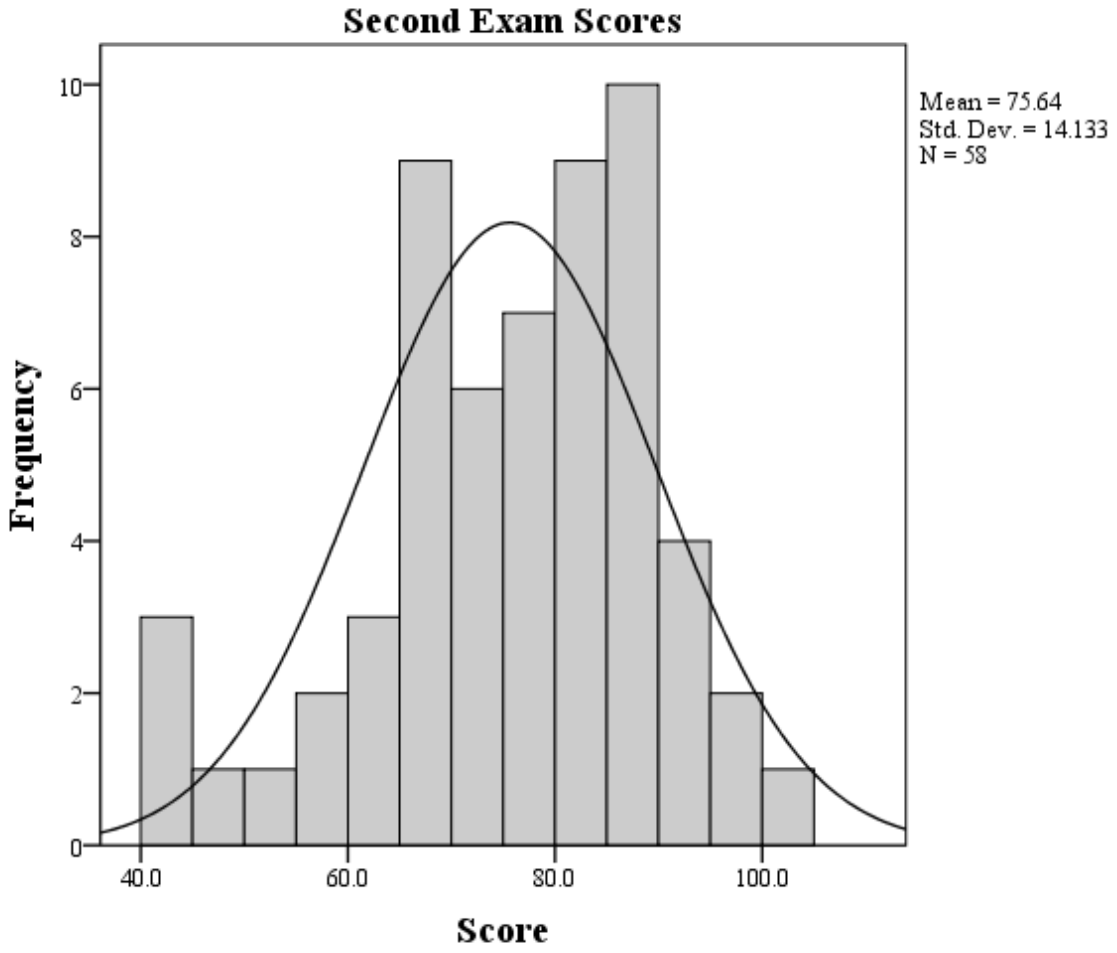
Second Exam Scores
Mean = 75.64
Std. Dev. = 14.133
N = 58
Frequency
Score
0
2
4
6
8
10
40.0
60.0
80.0
100.0

Figure 5.

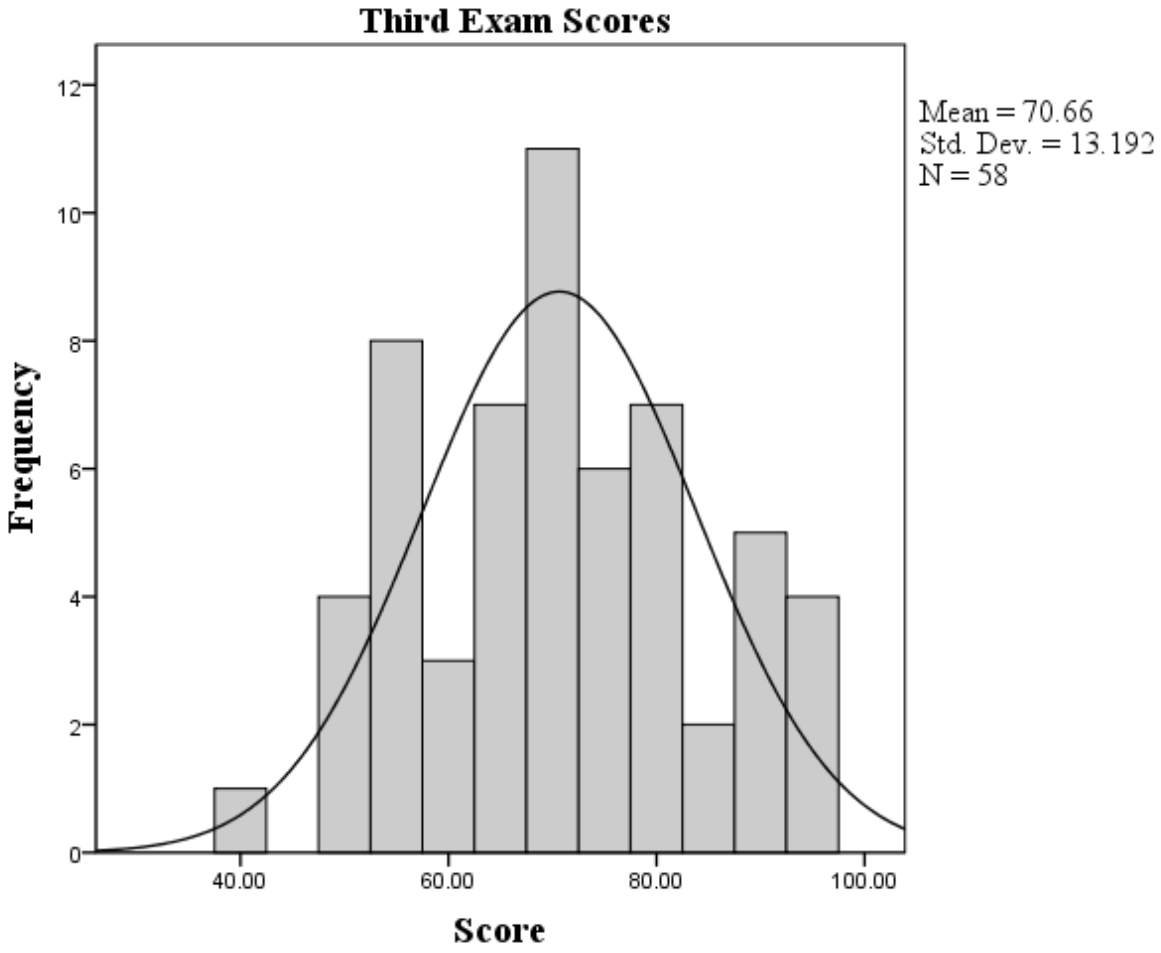
Third Exam Scores
Mean = 70.66
Std. Dev. = 13.192
N = 58
Frequency
Score
0
2
4
6
8
10
12
40.00
60.00
80.00
100.00

Figure 6.

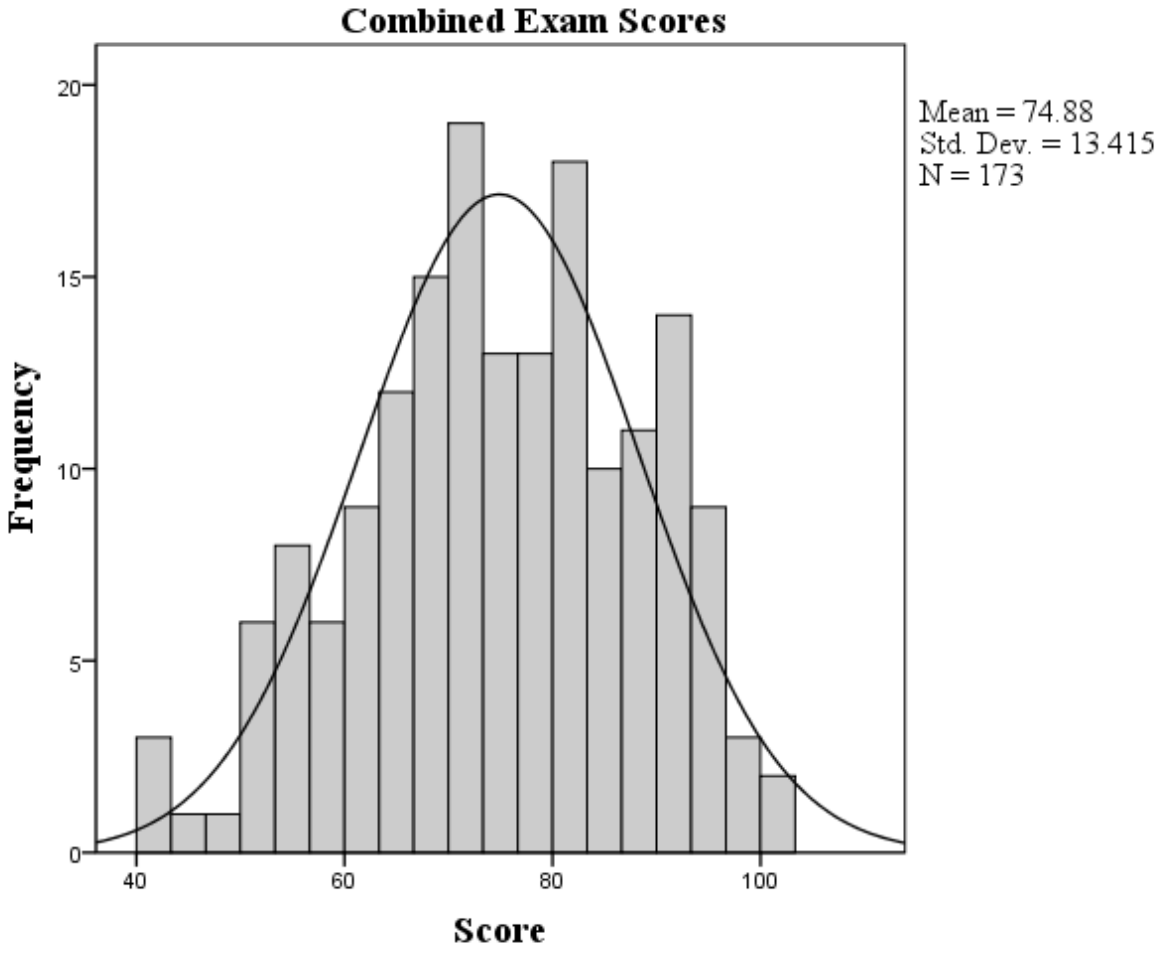
Combined Exam Scores
Mean = 74.88
Std. Dev. = 13.415
N = 173
Frequency
Score
0
5
10
15
20
40
60
80
100

Figure 7.

Appendix A

Supplemental Feedback Questionnaire (SFQ)

SUPPLEMENTAL FEEDBACK

Please help me to make this a better learning experience for you.

Your feedback is completely anonymous.

How is the pace of the class?

1	2	3	4	5
Too Slow	Slower than I'd Like	Just Right	Faster than I'd like	Slow down

Do you feel like this exam was a fair assessment of your knowledge? Y N

If No, why not? _____

Please rate this exam's difficulty

1	2	3	4	5
Too hard	Harder than most	Just right – challenging, but not too easy	Easier than most	Too easy

How many hours did you spend studying for this exam?

0 -1	1-2	2- 3	3- 4	4+

Have you attended tutoring hours? Y N

What can I do to make this class a more positive learning experience for you?

What do you want to get out of this class?

Appendix B

Positive Feedback: Encouraging Statements made by Professor

(In class):

"If you need help, please come see me or the teaching assistant."

"The TA tells me that you are going to recitation and doing your homework. Keep it up."

"I am pleased to hear you are going to recitation/doing your homework."

"You have been doing well coming to class and/or participating in class."

(Right before exam):

"I know you are prepared."

"Good luck; I know you will do well on this exam."

"Good luck; I know you can do it."

(Neutral Feedback after Exam):

"You did [performance on exam] okay."