A SIMULATED ASSESSMENT OF THE RELATIONSHIP BETWEEN SUCCESS, CONFIDENCE, AND STUDY HABITS

By

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ABSTRACT

The relationship between confidence, pre-exam preparation, and exam success is an extremely important relationship to explore and understand in modern educational psychology. This simulation study will explore the relationship between hours studied, studying methodology, pre-exam confidence, post-exam confidence, and exam scores using simulated data from a large instructor lead course. The simulated participants are 100 students chosen 10 at a time from 10 different sections of a course taught by the same professor, no specific stratification was simulated beyond this clustering. The potential procedure would entail two different surveys to collect the full set of data to be analyzed. The pre-exam survey would ask about study time, study intensity and pre-exam confidence while the post-quiz survey would inquire about exam score and post-exam confidence. Multiple correlations will be run between all variables since the survey questions are designed to create quantitative variables and identify the correlation between them, then multiple linear regression would be the logical next step for analysis. The simulated data were produced based on prior hypotheses about the relationship between these variables. The correlations between Hours Studied, Studying Intensity, Post-Test Confidence, and Test Scores are all strong. Pre-Test Confidence is weakly correlated with the other four variables. This study creates a structural blueprint for future explorations on all subject areas and assignment types ranging from exams to essays.

ACKNOWLEDGEMENTS

This project would not have been completed or even left the ground floor without the invaluable support and guidance imparted by Dr. Stephanie Dingwall, Associate Professor of Teaching in Biochemistry and UCR Honors Faculty Fellow, and Dr. Annie S. Ditta, Assistant Professor of Teaching in Psychology.

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INTRODUCTION

A vast majority of a student's time in primary and secondary education is spent preparing for and completing a series of competency checks. More specifically, students are constantly being given new information to absorb and then are tested on said information to gauge their ability to recall and utilize it in the future. Are they being the most effective they could be in this endeavor? College students have been trying to maximize their learning and class success with the least amount of effort possible to make room for activities that make them more well rounded applicants for the job market or postgraduate education. A central component of increasing this efficiency has to do with the relationship between studying habits, confidence, and academic success. Beyond just students, professors wish to create an environment that can foster as much success and learning as possible, but they won't know which avenues to encourage without using research methods that can lead to a better understanding of the relationships between these factors. Eventually experimental methods can be developed to solidify causal relationships.

This simulation study will explore how hours studied, studying intensity, confidence, and test scores could relate to each other. One previous study analyzed how confidence related to a person's academic success (Stankov, 2008). Hypothesizing that there was a strong positive correlation between confidence and markers of academic success, the methodology used to collect the data was a combination of self-reported statistics (GPA, SAT score), surveys, and administered language proficiency tests. The authors found there was a significant positive relationship between high confidence and intellectual success, but causation was not established.

A study unrelated to academic success explored how success or failure behavior in a practical test related to post-test confidence (Feather, 1969). The researcher gave participants an anagram test after a survey asking for a score prediction from the participants. The authors found

that overachieving (getting scores higher than those predicted) led to higher satisfaction while underachieving led to the opposite. Higher pre-test confidence was positively associated with higher test scores. While the study's main goal was not to gauge academic success based on confidence, this finding provides a great template on how this experiment could be conducted based on pre-test confidence and post-test scores. This suggests that a two survey data gathering method for pre-assignment and post-assignment variables would be effective in finding important relationships. These relationships can then be explored in further research to determine if causation can be established.

Studies have been done that explored the relationships between academic success and variables unrelated to studying habits and/or work ethic. One study explored what other factors besides study time influenced the GPA of college level students (Ashby Plant, 2005). The methodology used was a thorough analysis of high-school records and through packets of surveys given to students before their college freshman year. The researchers found that GPA was only related to studying habits when all other variables in consideration were equal including socio-economic status and past success.

Another study done in a similar vein to the previous one analyzed how new college students' high school academic performance, expectations, motivations, and self-confidence relate to each other (Tavani, 2003). Data was collected through surveys taken during the summer orientation before the student's first year in university and it was found that all the above stated variables were positively correlated. This study included many variables and provides a good background for the interrelationship of confidence and success.

Another relevant study discussed how academic confidence, studying approach, and academic success are related to each other (de la Fuente, 2013). The methodology was to collect

data using the ABC (academic behavioral confidence) survey, a survey that aimed at exploring studying habits, and the student's GPA and it was found that higher confidence meant a deeper approach to studying while no direct correlation could be established with GPA. This study is relevant as it explores the relationship between confidence and studying alone, which is not a topic that has been explored before and will be expanded upon on a smaller scale in a following study. It also provides a contradictory study to compare potential results to refine the current theory of academic success, confidence, and study time.

Currently there is academic consensus on the relationship between several variables that are relevant to this study. Factors outside of studying are influential to in-class performance (Ashby Plant, 2005). Higher confidence is correlated positively with usage of deeper methods of studying (de la Fuente, 2013). High expectations, motivations, and confidence are positively correlated with future academic success as well as current academic success markers like GPA (Stankov, 2008; Tavani, 2003).

Specifically, this study's focus is to provide a proof-of-concept of the ability to use surveys and linear correlation to provide an analytical avenue for an evaluation of student success on an exam/assignment. In the best-case scenario, this capstone is a stepping stone for other researchers to use in their own forays into pedagogy. It will set up a general framework for quantitative variable-based analysis of different assignment types in a variety of subjects. There is a possibility for a consensus on how students can most efficiently use their time in preparation for academic endeavors. This study specifically will provide a method on how courses can use the overarching concepts provided by previous studies to analyze their own assignments or exams in order to find trends in student learning. These newly analyzed correlations can then be

taken further in different studies and experimental designs, ideally to help establish causal relationships between the variables of interest.

METHODS

The simulated sample population consists of students from a single university course in the process of preparing and having taken an exam. The population of real data would be students that have enrolled in a specific course with a single instructor at a specific institution. Samples would be taken from different sections of a course with ideally little to no changes in the construction of the target examination. In order to have a large enough participant pool and sample size, potential courses would have to be taught in multiple quarters over a single year and/or have an extremely large per quarter enrollment. Stratified random sampling can be achieved via sampling a number of students at a time from TA-led discussion sections.

Outside of a simulated dataset, surveys would need to be constructed keeping in mind that all variables, even qualitative, can be given a numerical/measurable value. The pre-test survey would need questions regarding studying time and intensity as well as confidence while the post-test survey for the student's post-test confidence and score. Questions related to Confidence and Studying Habits would be worded as to be answerable on rating scale. For example, a potential question could read as, "For the following statements, rate yourself on a scale from 0-6 on how representative they are for you. 0 being not representative at all and 6 being extremely representative". These questions would then delve into different aspects of confidence and studying habits. Pre-Test and Post-Test confidence questions could be completely identical to allow for a more effective comparison between the variables and could delve into the confidence to teach others, to learn novel material related to the examination, to score above average on the examination, and to be satisfied with the studying done. "I feel like I could teach the concepts covered in this exam to those who have not taken this class.", would constitute as an acceptable Likert Scale style phrase to evaluate a student's confidence in the target material.

Studying intensity questions can be constructed by delving into specific studying techniques utilized via Likert Scale questions. Potentially, students could respond to the phrase, “I used practice problems or homework assignments in order to prepare for this exam”. Particular study styles could then be weighted according to their known efficacy (e.g., re-reading lecture notes would have a low weight, while testing oneself would have a high weight).

No real data was used in this simulation, so privacy is not an applicable concern for this exploration. If this study were to take place, IRB approval would be required but would not fall under any of the special provisions clauses in relation to ethical concerns if conducted at a university-level Institution. Acceptable identifiers that fall within ethical/privacy guidelines (like NetIDs) would have to be used to connect the two surveys. Surveys would be conducted over an online service like Qualtrics or other encrypted academic survey hosting website. The survey would be linked directly to Canvas/Blackboard based course materials tabs as a voluntary activity with extra credit being offered as an incentive if approved by the instructor and the relevant ethical review board.

This simulation study was conducted using a set of generated data that follows a survey-based research method to analyze multiple correlations simultaneously. Data were randomly generated based upon hypothesized relationships between the variables. Variables were designated correlations based on known literature. Correlations between variables outside of Pre-Test Confidence (Post-Test Confidence, Hours Studied, Studying Intensity, and Test Scores) were designated to be strong while Pre-Test Confidence is meant to have a weak correlation with the other four variables. All of the above variables share positive correlations with each other. The distribution of test scores followed a ruleset of ranges and correlation types. Test scores were generated in a range between 61-89 and then rounded to whole numbers, signifying a typical

range of exam scores. Hours Studied ranged between 1-11 hours. Pre-Test and Post-Test Confidence, exist as a numerical value between 0-30 based on survey questions.

The following two sections of results and conclusions will be written as if the simulated data is being reviewed in a manner that would be expected using real data. The hypothesis of this simulated study is that Pre-Test confidence has a significant influence on test scores, but not to the extent that studying time and studying intensity does. The correlation between Pre-Test Confidence and test scores is positive, significant, and weak, while the correlations between studying intensity/hours studied and test scores will be positive, significant, and strong. This set of analyses will then be followed by a section of discussion on the possible validity of this technique, its use-cases, and further explorations that can be done.

SIMULATION RESULTS

Multiple correlations analysis is the best course of analysis for this experiment since this study intends to find correlations between a plethora of variables. Linear correlations were run on ten distinct relationships between five variables. The correlation constants and the *p*-values of the relationships between these variables are observable in *Figure 1* as a quick referential summary of the more in-depth analysis that is necessitated by the situation. A $p<0.05$ will be considered as significant.

There is a very weak positive nonsignificant correlation between hours studied and pre-test confidence, $r(98) = 0.01$, $p = 0.43$. This means that the relationship between these two variables is basically negligible. The R-squared value of 0.01 indicates that less than 1% of the variance in Pre-Test confidence is related to variance in hours studied. The slope of the regression equation illustrates that a unit increase in hours studied for an examination relates to a 0.13 unit increase of pre-test confidence. This relationship is illustrated in *Figure 2.*

There is a positive nonsignificant correlation between studying intensity and pre-test confidence, $r(98) = 0.14$, $p = 0.19$. This means that the relationship between these two variables is negligible. The R-squared value of 0.02 indicates that around than 2% of the variance in Pre-Test confidence is related to variance in studying intensity. The slope of the regression equation illustrates that a unit increase of studying intensity relates to a 0.12 unit increase of pre-test confidence. This relationship is illustrated in *Figure 3.*

There is a positive significant correlation between post-test confidence and pre-test confidence, $r(98) = 0.27$, $p = 0.01$. This means that the relationship between these two variables is weak. The R-squared value of 0.07 indicates that around 7% of the variance in Post-Test confidence is related to variance in Pre-Test confidence. The slope of the regression equation

illustrates that a unit increase of pre-test confidence relates to a 0.32 unit increase of post-test confidence. This relationship is illustrated in *Figure 4*.

There is a positive significant correlation between test scores and pre-test confidence, $r(98) = 0.25$, $p = 0.01$. This means that the relationship between these two variables is weak. The R-squared value of 0.06 indicates that around 6% of the variance in Test-Scores is related to variance in Pre-Test confidence. The slope of the regression equation illustrates that a unit increase of pre-test confidence relates to a 0.46 unit increase of test scores. This relationship is illustrated in *Figure 5*.

There is a positive significant correlation between hours studied and studying intensity, $r(98) = 0.88$, $p < 0.01$. This means that the relationship between these two variables is very strong. The R-squared value of 0.78 indicates that around 78% of the variance in studying intensity is related to variance in studying hours. The slope of the regression equation illustrates that a unit increase of studying hours relates to a 1.36 unit increase of studying intensity. This relationship is illustrated in *Figure 6*.

There is a positive significant correlation between hours studied and post-test confidence, $r(98) = 0.6$, $p < 0.01$. This means that the relationship between these two variables is moderately strong. The R-squared value of 0.36 indicates that around 36% of the variance in post-test confidence is related to variance in studying hours. The slope of the regression equation illustrates that a unit increase of studying hours relates to a 0.93 unit increase of post-test confidence. This relationship is illustrated in *Figure 7*.

There is a positive significant correlation between hours studied and test scores, $r(98) = 0.76$, $p < 0.01$. This means that the relationship between these two variables is strong. The R-squared value of 0.57 indicates that around 57% of the variance in test scores is related to

variance in studying hours. The slope of the regression equation illustrates that a unit increase of studying hours relates to a 1.87 unit increase of test scores. This relationship is illustrated in *Figure 8.*

There is a positive significant correlation between studying intensity and post-test confidence, $r(98) = 0.84$, $p < 0.01$. This means that the relationship between these two variables is very strong. The R-squared value of 0.70 indicates that around 70% of the variance in post-test confidence is related to variance in studying intensity. The slope of the regression equation illustrates that a unit increase of studying hours relates to a 0.85 unit increase of post-test confidence. This relationship is illustrated in *Figure 9.*

There is a positive significant correlation between studying intensity and test-scores, $r(98) = 0.71$, $p < 0.01$. This means that the relationship between these two variables is strong. The R-squared value of 0.50 indicates that around 50% of the variance in test scores is related to variance in studying intensity. The slope of the regression equation illustrates that a unit increase of studying intensity relates to a 1.36 unit increase of test scores. This relationship is illustrated in *Figure 10.*

There is a positive significant correlation between post-test confidence and test scores, $r(98) = 0.61$, $p < 0.01$. This means that the relationship between these two variables is strong. The R-squared value of 0.37 indicates that around 37% of the variance in test scores is related to variance in post-test confidence. The slope of the regression equation illustrates that a unit increase of post-test confidence relates to a 0.97 unit increase of test scores. This relationship is illustrated in *Figure 11.*

SIMULATION ANALYSIS

Before delving into the analysis of relationships between the five target variables for this simulated study's "examination," it is important to establish why finding relationships and understanding their nature is important. Before future studies exploring causal relationships can be established or developed, there first needs to be a pilot study that can be used to point out important correlations to potentially explore.

The relationship between pre-test confidence and hours spent studying shows a very interesting trend. Pre-test confidence seems to be unrelated to how long a student spent studying. This can be extrapolated to mean that students who are facing an examination in the relatively near future don't measure their confidence on the amount of time they have been exposed to material. This could relate to previous studies showing that previous academic success leads to a belief of higher academic success in the future (Ashby Plant, 2005). The simulated data match the trends observed in literature because our hypothesis reflected large scale trends between the variables simulated. This could mean that university level courses reflect the trends witnessed in previous studies that had a more broad range of participants.

Studying intensity and pre-test confidence have a weak insignificant positive correlation similar to the relationship between studying time and pre-test confidence. While slightly more related, these variables can still be considered as relatively unrelated. Some increase in related changes in variance could be due to students who study with more intensive methods are able to increase their confidence in material. It is evident in the lack of correlation that there is no strong relationship between how intensely students study for this course to how confident they felt before taking the examination. This could be a course that can be approached with much more confidence given prior exposure to material is common among the enrolled students.

Both post-test confidence and test scores have a significant but weak positive correlation with pre-test confidence. Post-test confidence is basically a measure of how a student feels about their level of success after having been tested on the materials. It is highly probable that students who carry high pre-test confidence into an exam are influenced to have high post-test confidence despite higher pre-test confidence not being related to better studying habits. Test scores also experience an observable relationship with pre-test confidence. The covariate relationship between posttest and pretest confidence is slightly higher than the relationship between test scores and pre-test confidence. Overall, pre-test confidence seems to have a noticeable beneficial relationship on student performance and self-confidence post examination.

A further interesting correlation found within this study is the relationship between time spent studying and the intensity of studying techniques used. There was a strong positive relationship between these two variables; while causality cannot be established as there is no temporal gap between the two variables and the variables were not being manipulated to rule out reasonable alternatives, exploration of potential causes for this interaction can be conducted via a specific experimental design. Students who study for longer periods of time may have incentive to elevate the techniques that they use to stay engaged over a longer period as well as an inability to repeatedly approach the same material in a similar manner without feeling that the work was becoming redundant. A counterpoint is that more intense techniques of studying require more time to be effectively practiced and executed.

Relationships between time spent studying and post-test confidence as well as test scores present a clear strong positive correlation This course's examinations clearly reward those who study for this course for longer periods of time. Post-test confidence having a strong positive correlation to hours studied could be due to a higher awareness of what the student is able to

confirm as correct based on self-evaluations that are made during and directly after examinations.

Studying intensity had a strong positive correlation to both post-test confidence and test scores similar to studying time. This too is within expected results and shows that time spent preparing with active methods is related to increasing time spent.

The relationship between post-test confidence and test scores provides a very interesting insight into the ability of students to self-evaluate. The moderately strong correlation between the variables illustrates that students are often very good predictors of their effectiveness post-examination from the low end to the top end of academic achievement for this course.

Hypotheses about the most important factor for test score improvement can be made using the strength of correlation of test scores to study intensity, study hours, or pre-test confidence. Hours studied had the highest correlation with exam scores compared to pre-test confidence and studying intensity. This does not contradict previous assumptions made. Overall, the hypothesis postulated at the beginning of this study was supported by the simulated data. The design outlined here can be used in future studies in a real classroom to investigate the relationship between students' study habits, confidence, and test scores, which may inform the course's instructor how students approach learning inside and outside of the classroom and their confidence levels in their learning leading up to and after examinations. This could then lead to future research and study design that can find more concrete causal relationships.

ANALYSIS OF METHODS AND CONCLUSIONS

A potentially major issue with utilizing this method when analyzing real data is that there is an extremely large tradeoff in increasing internal validity by decreasing the external validity due to a more specific population. This is due to test creating philosophies varying wildly between instructors even for the same course. In this sense, instructors from participant courses would have the most to gain by allowing for analysis of how students approach studying and what matters most in student success for their course.

Introductory courses do have their own issue when being considered as a subject for this method of analysis. The multi-faceted makeup of variables like pre-test confidence leaves previous exposure to examination related materials in other courses as extremely influential. In other words it is imperative to control for prior knowledge; that is, ensuring that the material being covered in a course is novel to students or the students being studied do not have previous exposure to the topic. If this is not taken into consideration, pre-test confidence may appear as less related to studying habits yet preserve its relatedness to exam success and post-exam confidence. The best course of action would be to conduct this study on a course that does not share much of its curriculum with other courses students may have taken or to somehow ensure all participant students had equal exposure to the material in the past.

Creative works such as research papers and stories can also be analyzed in this manner during the writing process. While these sets of assignments are clearly extremely subjective, experienced instructors do provide quantitative grade data that must have some level of consistency. Time spent studying/studying intensity can be replaced by other quantitative variables such as number of revisions, time spent drafting, and number of editors. The methods

described in this study are not limited to the variables that lie within the simulated study, the possibilities of new variables being explored and established is endless.

The more variables a researcher adds will lead to an exponential increase in the number of correlations needed to fully analyze the potential correlations. This increase in the number of correlations will lead to more lengthy sets of conclusions and may lead to an increase in the reevaluation of old data in comparison to new correlations. In these potential future datasets, certain known correlations could be used as a benchmark for potential mistakes made during the data analysis/variable quantification aspects of the study. If these marker correlations follow patterns seen in earlier iterations of analysis on a similar assignment type, this could be a possible source of validation for the new dataset as a whole. Essentially, as this method is used repeatedly, certain correlations will be seen often and can thus be used as a comparison point for new datasets being gathered and analyzed. Predictable correlations involving study time or intensity can be analyzed to ensure that no mistakes were made during the computational process.

As with any basis for study design, there will always be limitations and advantages that need to be considered. The best researchers are those who can analyze the needs of the study, from monetary to ethical, and are able to balance those needs with their desire to answer their underlying questions. The method discussed here is a hopeful addition to the arsenal of science and will allow for greater achievements by students, instructors, and researchers.

TABLES AND FIGURES

	Pre-Test Conf	Study Hours	Study Intensity	Post-Test Conf
Pre-Test Conf				
Study Hours	r=0.096, p=0.4321			
Study Intensity	r=0.14, p=0.1945	r=0.883. p<0.0001		
Post-Test Conf	r=0.27, p=0.0062	r=0.601, p<0.0001	r=0.838, p<0.0001	
Score	r=0.245, p=0.014	r=0.756, p<0.0001	r=0.707, p<0.0001	r=0.611, p<0.0001

Figure 1. Correlation coefficients and regression p-values between hours studied, pre-quiz confidence, post-quiz confidence, and quiz score. There are strong positive correlations between the four variables outside of Pre-Test Confidence. Correlations between Pre-Test Confidence and the other four variables are weak.

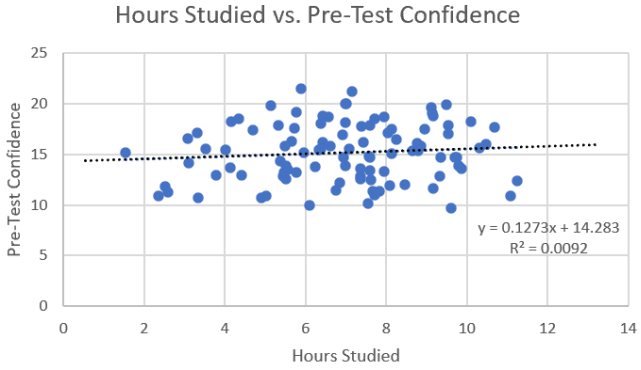

Figure 2. Correlation between hours studied and pre-test confidence. There is a very weak correlation between variables with the regression line having a slope of 0.1273.

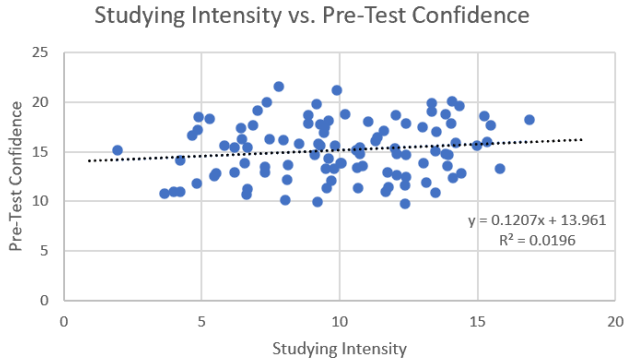

Figure 3. Correlation between studying intensity and pre-test confidence. There is a weak correlation between variables with the regression line having a slope of 0.1207.

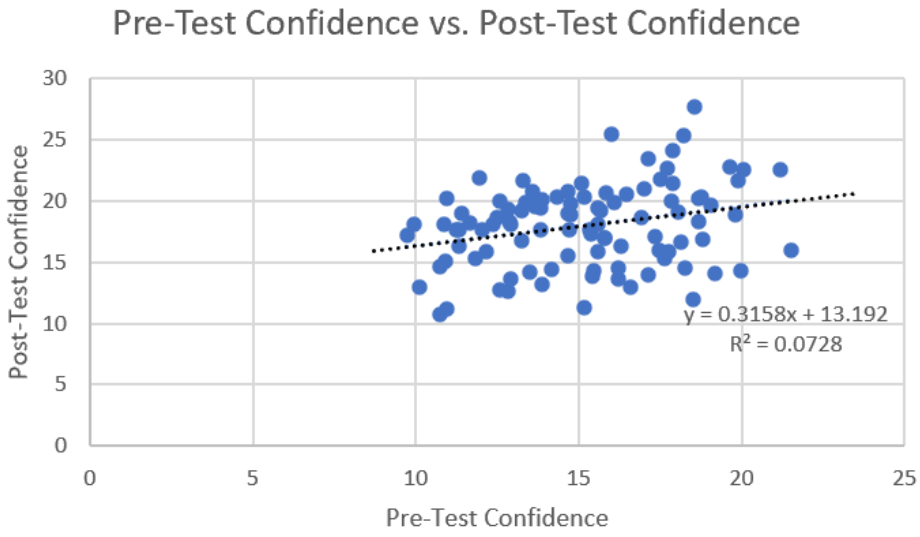

Figure 4. Correlation between pre-test confidence and post-test confidence. There is a weak correlation between variables with the regression line having a slope of 0.3158.

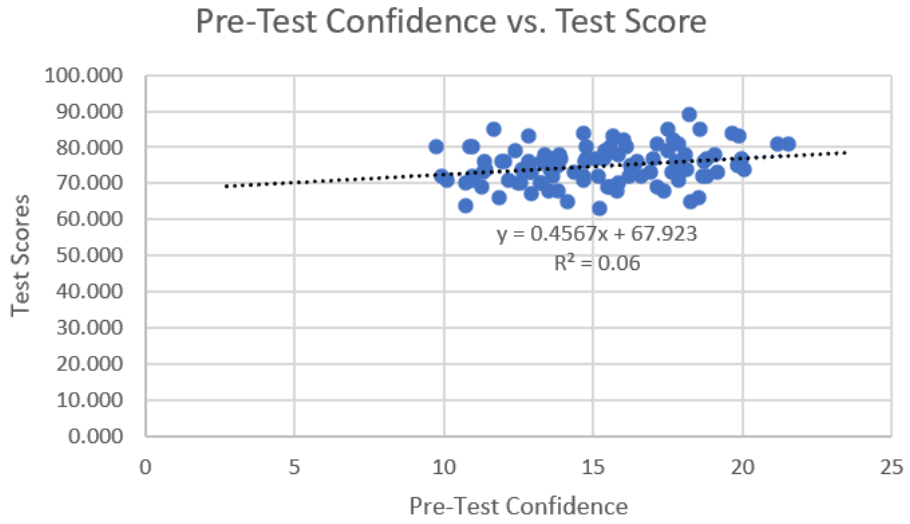

Figure 5. Correlation between pre-test confidence and test scores. There is a weak correlation between variables with the regression line having a slope of 0.4567.

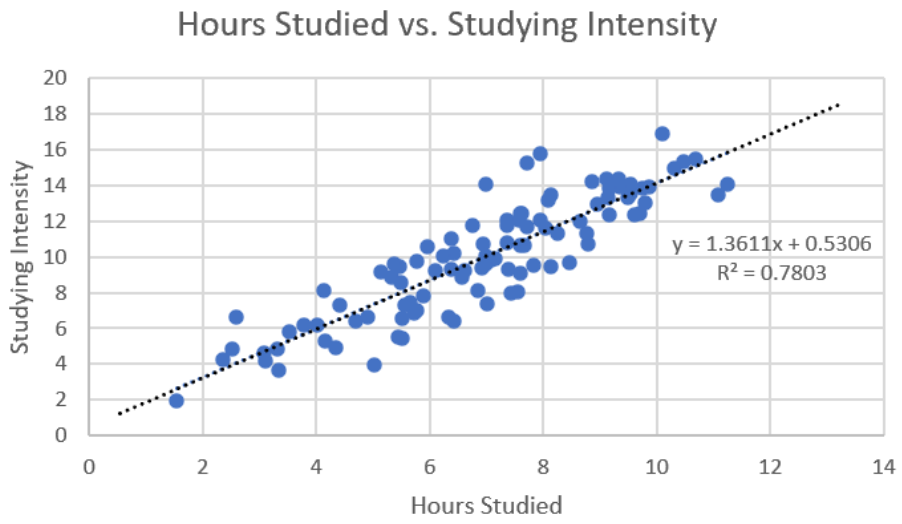

Figure 6. Correlation between hours studied and studying intensity. There is a strong correlation between variables with the regression line having a slope of 1.3611.

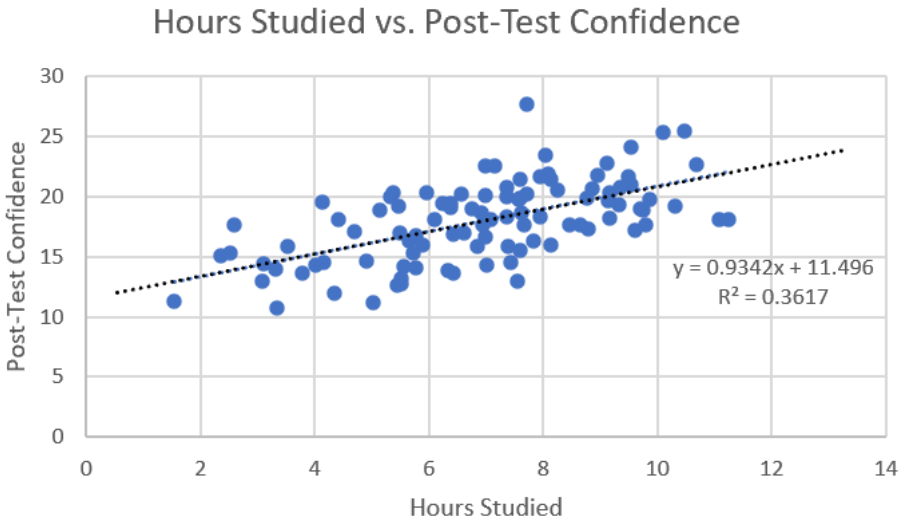

Figure 7. Correlation between hours studied and post-test confidence. There is a strong correlation between variables with the regression line having a slope of 0.9342.

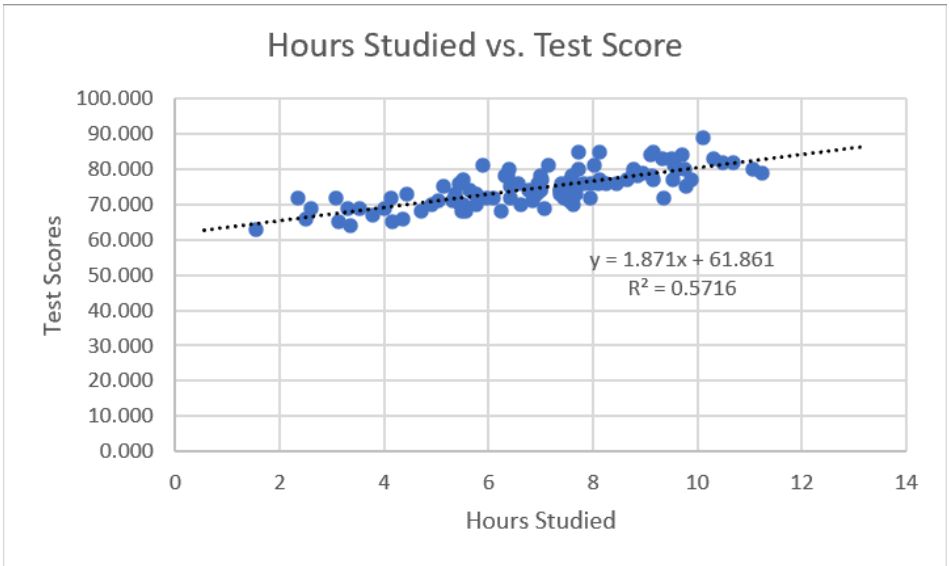

Figure 8. Correlation between hours studied and test scores. There is a strong correlation between variables with the regression line having a slope of 1.871.

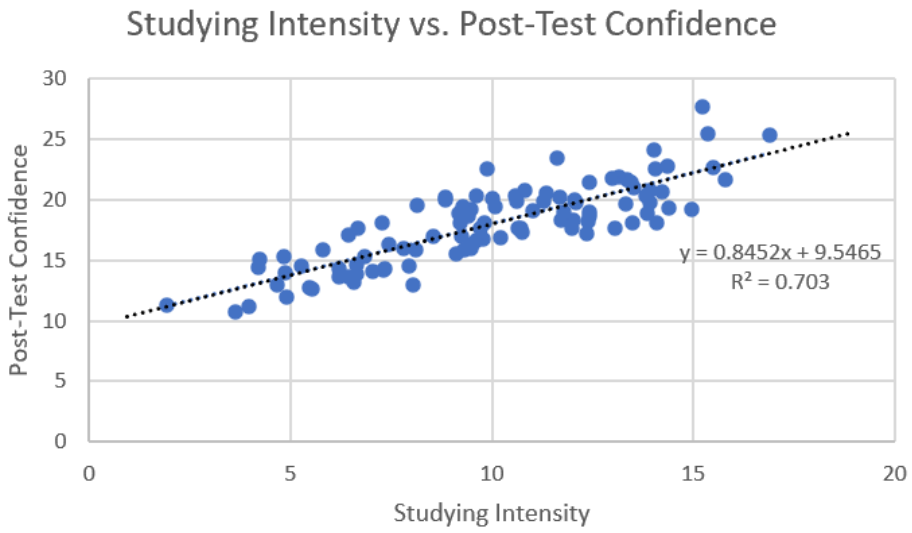

Figure 9. Correlation between studying intensity and post-test confidence. There is a strong correlation between variables with the regression line having a slope of 0.8452.

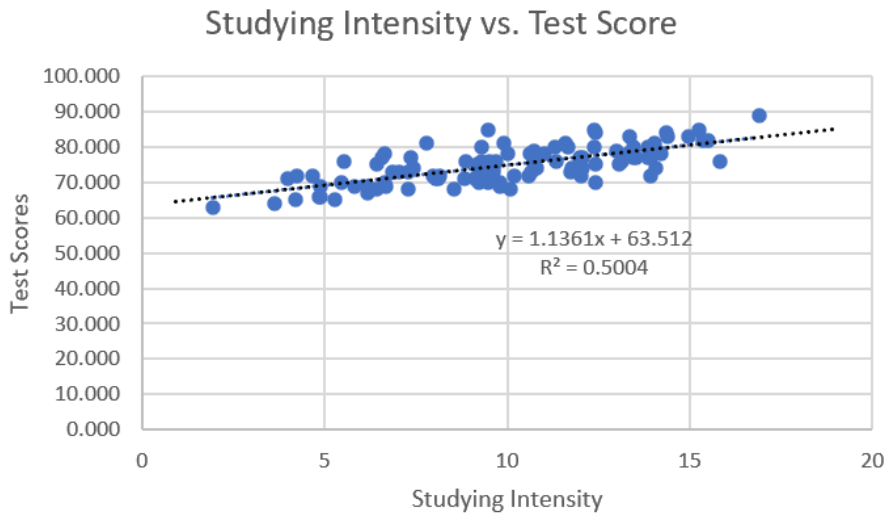

Figure 10. Correlation between studying intensity and test scores. There is a strong correlation between variables with the regression line having a slope of 1.1361.

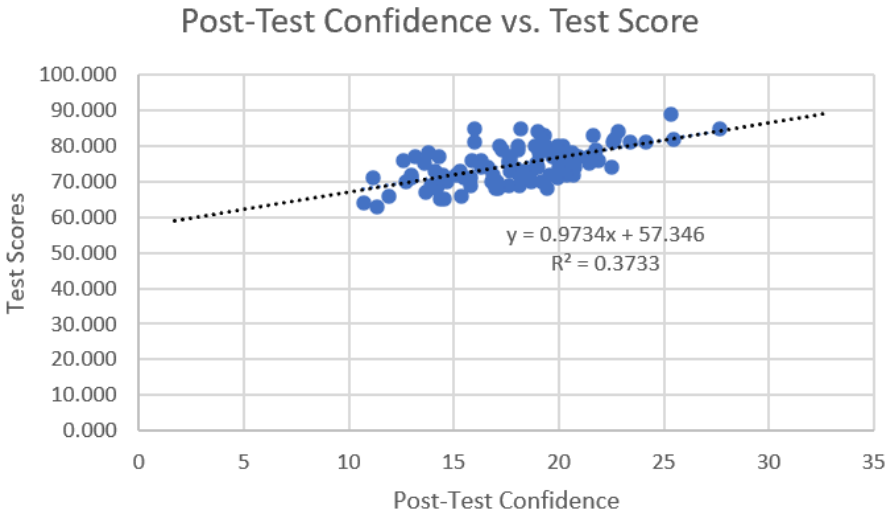

Figure 11. Correlation between post-test confidence and test scores. There is a strong correlation between variables with the regression line having a slope of 0.9734.

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