



# The Effect Color of Exams has on the Final Grade

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**Abstract:** Student success is an important topic at every level in any university setting, relating to attracting students, retaining students and students graduating timely. Understanding student performance is a complicated topic that has been the focus of many research studies with little distinct conclusion. Past literature demonstrates conflicting results leaving the expectations of this research study open to either direction. This study endeavors to aid in the understanding of factors that affect student success. In this study, a few key factors such as color of exam paper, gender, degree major, employment status, homework grade and position in the classroom are examined for association with the final grade earned by the student. The main focus of this study investigates is the effect of paper color on student exam scores and final grade results in an intermediate accounting class. The additional variables were used as controlling variables to isolate the effect of exam color on final grade. Future research is planned post COVID which has created too many variables to consider effectively and make comparison to the previously gathered data. We do find an effect between the color of exam paper with final grade. In addition, we also find an effect between gender and final grade.

**Keywords:** Exam, Color, Accounting, Gender, Final Grade

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## 1. Introduction

Colors often affect human emotions, mood, behavior, mental attitude, and judgment. Considerable research across numerous disciplines confirms this color influence. In addition, color variations may have positive or negative impacts on certain individuals. Contrary to these findings, educators frequently use different colored paper for exam distribution in order to deter cheating on tests. Varying paper color on assessments is a normal practice in university settings, where classrooms are commonly crowded, and monitoring for cheaters is a problematic task.

However, the possibility that diversity of paper color influences student performance has become a disturbing concern in recent years, as several studies have examined this issue. The prospect that a simple choice of the color of paper a test is copied on may put a student's grade at risk should be a point of consideration for any educator who uses this practice.

As we reviewed previous research, we found several paper color experiments involving psychology tests [1-3] along with marketing tests [4], science tests [5], business communication tests [6], GRE exams [7], and finally

accounting quizzes and exams [8, 9]. Due to the fact that we teach accounting classes, we were especially intrigued at the opposing results from the two studies involving accounting quizzes and tests. In addition, variations of pastel and primary colored paper were studied in these experiments with assorted contradictory outcomes.

### Literature Review

Numerous research studies have been conducted to determine the effect, if any, of colored paper on student exam performance. Among college professors, the general use of colored paper is employed to deter cheating on tests. This practice of printing exams in several colors conveys to the students that there are different versions of the same test, thus, incentives to cheat are reduced. However, several research findings have suggested that colored paper can significantly affect student performance on tests or quizzes [8, 1, 2, 7] while other reports indicate no effect from using colored paper on exams [9, 4, 3, 5].

In addition, contradictory results were reported when performance studies were separated between primary colors and pastel colors. Two of the earlier reports [2, 7] tested subjects with identical exams using red and blue primary

colors. In both of these samples, students scored significantly higher on tests printed on blue paper versus red paper. The latter study showed this to be true for low motivation but not high motivation tests, and for complex but not simple tasks. Skinner [1] and Soldat et al. [7] included white paper in their trials while the former added two more primary colors to this testing mix with yellow and green paper. Both studies resulted in white paper scoring higher than red. Furthermore, outcomes with four different primary colors, blue, green, red, yellow, along with white indicated the “scores on multiple-choice tests printed on colored paper were uniformly lower than scores for tests printed on white paper” [1] The negative consequences of using primary colored paper on student exams seem to indicate an adverse effect on student performance. However, when Tal et al. [3] performed the same experiment with the identical four primary colored test papers and white, they only found small contradictory effects with blue paper performance below other colors. Their conclusions negate previous findings and infer that primary colored paper does not affect student exam scores.

Due to the conflicting results using primary colored paper for exams, numerous experiments have been conducted using pastel colored paper [8, 9, 3, 6, 4, 5]. The majority of these studies compared student exam scores using four or more pastel colors and white. An exception is the Clary analysis which completely eliminated the white option. The overall outcomes from these various experiments revealed no significant effect on student grades printed on different pastel colored paper and white. The glaring discrepancy among these findings came from the 2009 Fordham and Hayes trial [8]. Their experiment contradicted prior studies and found that pastel colored paper did have a significant effect on student performance with white and yellow performing the best, and pink and blue achieving the lowest scores. Because the Fordham [8] outcomes were so controversial, Meyer and Bagwell [9] proceeded to repeat the research resulting in opposing conclusions. Both Fordham and Hayes [8] and Meyer and Bagwell [9] used Accounting course exams, although Fordham and Hayes [8] evaluated quiz scores, while Meyer and Bagwell [9] analyzed final exams. However, the Meyer and Bagwell [9] research used seven pastel colors versus Fordham’s [8] four colors. One explanation for the opposing results offered by Meyer and Bagwell [9] states “student motivation is likely to be higher on a final exam than on a quiz”. The obvious difference of seven colors versus four colors should also be considered.

After careful evaluation of the contradictory outcomes in

the numerous studies conducted using colored paper for test differentiation, the only conclusion that can be made is that more research should be done. The possibility that colored exams could be detrimental to student success must be evaluated further.

Seating location in the classroom is another factor that has conflicting findings in prior research. Prior studies have found that students that sit close to the front of the classroom miss fewer classes and perform better. These two factors have been shown to be correlated with higher student motivation. [10] In addition, students that were randomly assigned to the front of the class were also found to learn better when in closer proximity to the teacher. [11] Bergtold et al. find that endogenous spatial peer effects were present only on the first exam and further that gender, being an economics major, sitting in the back of the classroom and what year the class was taken affected exam and class performance [12].

Gender as it relates to academic performance is another area in which research conflicts. One study finds that American high school female students put greater effort into school and therefore out-perform male students [13]. Another study finds a relationship between gender and active learning [14]. Male students are more likely to participate voluntarily in an active learning environment than female students. Female students perform better in a less interactive learning environment. Gender has been used as a control variable in prior studies [12-15]

## 2. Data

This exploratory study is based on data gathered in 2 intermediate I accounting courses in the spring of 2019. One class was a traditional face-to-face class and the other was a hybrid. The hybrid watched lectures outside of class and came to class one time a week as opposed to the twice a week the traditional class met. At the beginning of the semester, the traditional class had 28 students and the hybrid had 33. There were 57 usable observations after removing students who did not consent to participate in the study. Four exams were administered including the final exam, which was not comprehensive. The first three exams were administered on yellow or white paper, while the final exam was administered on pink or green paper. In addition to color of exam, we also collected information about student gender, what row the student sits on in class, grade for each exam, average homework grade, whether the student is an accounting major or not, and whether or not the student is employed.

**Table 1.** Descriptive Statistics.

*Descriptive Statistics for Model Variables*

Variable	N	Mean	Standard Deviation	Minimum	Maximum
NMRC	57	75.09	14.65	50	90
EXAM1	57	60.95	17.48	19	93
EXAM2	57	76.14	20.21	0	104
EXAM3	57	74.41	15.92	32.5	100
EXAM4	57	85.03	10.33	45	101
HW	57	84.91	16.16	37	100

Categorical Frequency Statistics

Variable		Variable		
CLRE1Y	50.1% Yellow	49.9% White	AROW	10.5%
CLRE2Y	49.1% Yellow	50.9% White	BROW	21.1%
CLRE3Y	47.3% Yellow	42.7% White	CROW	21.1%
CLRE4P	52.6% Pink	47.4% Green	DROW	26.3%
GENDER	49.1% Male	50.9% Female	FROW	21.0%
ACCT	75.4% Accounting Major	24.6% Non Accounting		
WORK	47.4% Work	52.6% Do not work		

NMRC-Numeric representation of final letter grade (need real) is the dependent variable

Variable and Definition	Expectation
CLRE1Y -color of exam 1 coded 1 if yellow and 0 if white	+/-
CLRE2Y-color of exam 2 coded 1 if yellow and 0 if white	+/-
CLRE3Y-clor of exam 3 coded 1 if yellow and 0 if white	+/-
CLRE4P-color of exam 4 coded 1 if pink? and 0 if green	+/-
GENDER-male or female coded 1 if male and 0 if female	+/-
AROW-sits on 1 <sup>st</sup> of 4 rows	+/-
BROW-sits on 2 <sup>nd</sup> of 4 rows	+/-
CROW-sits on 3 <sup>rd</sup> of 4 rows	+/-
DROW-sits on 4 <sup>th</sup> of 4 rows	+/-
EXAM1-grade on exam 1	+
EXAM2-grade on exam 2	+
EXAM3-grade on exam 3	+
EXAM4-grade on exam 4	+
HW-homework average	+
ACCT-accounting major or not coded 1 if student is an accounting major and 0 if not	+
WORK-student works or no coded 1 if student works and 0 if not	+/-

Model Development

We exam the final class average to determine the effect the color of the exam has on the final average. Factors expected to be related to the investigation are as follows:

Final average grade (NMRC) for each student. This study uses NMRC as the dependent variable. This data was hand collected by the class instructor.

Four exams were administered in the class. Exams 1, 2 and 3 (variables CLRE1Y, CLRE2Y and CLRE3Y respectively were administered on either yellow or white paper. Based on prior research, we are not able to predict how these variables will be associated with the final grade in the class. Exam 4 (CLRE4P) was administered on pink or green paper.

Gender. GENDER male or female coded 1 if male and 0 if female.

AROW indicates that the student sits on the first row in the classroom.

BROW indicates that the student sits on the second row in the classroom.

CROW indicates that the student sits on the third row in the classroom.

DROW indicates that the student sits on the fourth row in the classroom.

FROW indicates that the student sits on the fifth row in the classroom.

EXAM1 indicates the student’s grade on exam 1. EXAM1 is expected to be positively associated with the final average in the class.

EXAM2 indicates the student’s grade on exam 2. EXAM2 is expected to be positively associated with the final average in the class.

EXAM3 indicates the student’s grade on exam 3. EXAM3is expected to be positively associated with final average in the class.

EXAM4 indicates the student’s grade on exam 4. EXAM4 is expected to be positively associated with final average in the class.

Homework. Homework (HW) indicates the student’s homework average. HW is expected to be positively associated with final average in the class.

Accounting Major. Accounting major (ACCT) or not coded 1 if student is an accounting major and 0 if not.

Work. Work (WORK) captures whether the student works or not, coded 1 if student works and 0 if not.

HYPOTHESIS:

H<sub>1</sub>: Color of exam measured with by CLRE1Y, CLRE2Y, CLRE3Y and CLRE4P will be associated with NMRC.

The following linear regression model, Model 1, is used to test the hypothesis:

$$NMRC = \beta_1 CLRE1Y + \beta_2 CLRE2Y + \beta_3 CLRE3Y + \beta_4 CLRE4P + \beta_5 GENDER + \beta_6 AROW + \beta_7 BROW + \beta_8 CROW + \beta_9 DROW + \beta_{10} EXAM1 + \beta_{11} EXAM2 + \beta_{12} EXAM3 + \beta_{13} EXAM4 + \beta_{14} HW + \beta_{15} ACCT + \beta_{16} WORK + \epsilon$$

### 3. Results

Our results indicate that the color of EXAM1 has a positive association with the final grade in the class. GENDER indicates that being male has a negative association with the final grade in the class. As expected the grades for EXAM2, EXAM3 and EXAM4 and HW have a positive association with the final grade in the class. Unexpectedly, EXAM1 does not have an association with the final grade in the class, nor does the location of the student in the class. Also, there is no association between the student being an accounting major or working with his or her final grade in the class.

*Table 2. Regression Results.*

Variable	Expectation	Coeff
Intercept		-12.878
CLRE1Y	+/-	4.343***
CLRE2Y	+/-	-1.850
CLRE3Y	+/-	.476
CLRE4P	+/-	2.157
GENDER	+/-	-3.68**
AROW	+/-	-3.172
BROW	+/-	-1.509
CROW	+/-	-.891
DROW	+/-	-1.314
EXAM1	+	.193
EXAM2	+	.255***
EXAM3	+	.181**
EXAM4	+	.278***
HW	+	.225***
ACCT	+	1.534
WORK	+/-	-.596

Note \*,\*\*,\*\*\* indicate significance at the 10%, 5%, and 1% level respectively.

#### 3.1. Limitations

Students that chose not to participate in the study cannot be evaluated. There is not enough data on the students who dropped the course to determine any statistics on them. This study is limited to two sections of one class taught by one professor at one university.

#### 3.2. Extension

The plan is to extend this study to other professors and other accounting courses over longer periods of time. This expanded data collection was occurring with three faculty members, six class sections, and three different courses when the 2020 pandemic hit. Data collection stopped due to the format of classes suddenly changing.

### 4. Conclusion

Exam color was the main variable of the study. The additional variables were used as controlling variables to isolate the association of exam color with final grade.

The results of this study indicate that the color of the exam does have an effect on the final grade in the class.

Interestingly, there is also a positive association between being female and the final grade in the class. Student success is important for the survival of the university. The color of exams is an aspect that the instructor can control. The gender association is not within the control of the instructor. Further research should be done to determine if actions could be taken to ensure student success.

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