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The Effect of Colored Paper on the Test Performance in Mathematics of Grade 10 Students of Olongapo City National High School

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***Abstract*: The study aimed to determine the effect of colored paper on the test performance of 180 Grade 10 students at Olongapo City National High School. The experimental research method was used, with students from different programs answering Mathematics exercises printed on white, red, blue, yellow, and green papers. Results showed that male students scored highest with blue paper, while female students performed best with yellow paper in the First Grading Period. In the Second Grading Period, both genders performed better with blue paper. The use of colored paper significantly improved Test scores of papers, curriculum, and competencies. However, no significant difference was found in relation to age and sex in the First Grading Period. It is recommended to conduct further studies using two-factor analysis of variance to explore color effects in relation to demographic factors.**

***Keywords*: colored paper, curriculum programs, experimental method, grade 10 students, learning competencies, mathematics exercise, special programs, test performance.**

1. Introduction

Mathematics plays a crucial role in education and everyday life, yet it remains one of the most challenging and often feared subjects for students globally. Proficiency in Mathematics is essential not only for academic success but also for career development and problem-solving in daily life. Worldwide, countries are continually seeking methods to improve mathematics education due to its profound impact on economic and social progress. However, despite these efforts, many students struggle to achieve proficiency in Mathematics. The Organization for Economic Co-operation and Development (OECD) reports that student performance in mathematics is often below expectations in many regions, indicating a global concern for mathematics achievement (OECD, 2022).

In Asia, countries like Singapore, Japan, and South Korea consistently top international mathematics rankings, showcasing their commitment to rigorous education systems. These countries have adopted innovative teaching approaches and implemented reforms that emphasize problem-solving and conceptual understanding. Despite this, the Philippines continues to face significant challenges in mathematics education. According to the 2019 Trends in International Mathematics and Science Study (TIMSS), the Philippines ranked last among 58 countries in Grade 4 mathematics and second to last in Grade 8, signaling a national crisis in mathematics performance (TIMSS, 2020).

Within the Philippine context, mathematics performance has consistently been an area of concern. Even with the introduction of the K to 12 curriculum which follows a spiral approach aimed at reinforcing key concepts through repetition and progression from simple to complex ideas, students often fail to meet expected competencies. The TIMSS 2003 report revealed that Filipino students ranked 41st out of 45 countries in mathematics, particularly underperforming in geometry and measurement (Mullis et al., 2004). Despite curriculum reforms, mathematics achievement remains below expectations across various grade levels.

In Olongapo City, where this study is based, the issue is no different. Teachers have observed that students in Grade 10 face difficulties in mastering key concepts in algebra, geometry, and trigonometry. As educators continue to search for innovative ways to improve student performance, attention has turned to the potential impact of environmental factors, such as the use of colored paper in assessments. Research suggests that color can influence cognitive processes, behavior, and emotional responses, which may affect students' learning and performance (Clifton, 2006). Color has been shown to impact attention, retention, and mood, making it a relevant factor in educational assessments (Cherry, 2022).

This study explores the effect of colored paper on the test performance of Grade 10 students at Olongapo City National High School. By printing mathematics exercises on different colored paper, the research aims to determine whether this variable can positively influence test scores. The findings could offer valuable insights into alternative assessment strategies that may help address the ongoing challenges in mathematics performance at the local and national levels.

A. Theoretical Framework

Color theory in education posits that the use of color influences learning environments and can extend beyond classroom aesthetics to include instructional materials such as examination forms. Since the late 19th century, researchers have explored the impact of color on various aspects of

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education, recognizing its potential to evoke emotions, enhance focus, and improve academic outcomes. Early studies in color psychology, dating back to 1894, laid the groundwork for understanding how different colors could trigger specific emotional responses and influence behavior (Hogg, 2021). The theory suggests that color can serve as a tool to optimize learning experiences by creating environments that encourage positive emotional states and engagement.

Recent research has expanded the scope of color theory in education, investigating its effects on cognitive performance and academic achievement. For instance, color has been shown to play a role in memory retention and attention, with studies indicating that certain colors can enhance cognitive functions, while others may have a calming effect that reduces anxiety during examinations (Suk & Irtel, 2010). The implications of these findings are significant, particularly in educational settings where colors could be used strategically to improve learning outcomes

Many contemporary studies continue to explore the role of color in schools, driven by the need to find innovative strategies to enhance student performance. This research includes examining the use of colored paper in assessments, colored classroom environments, and digital learning tools that incorporate color as a design element. The availability of a diverse student population and the quest to boost academic performance make schools ideal settings for such research (Boyatzis & Varghese, 2021). These efforts aim to identify practical applications of color theory to create learning environments conducive to academic success.

B. Statement of the Problem

The study on the Effect of Colored Paper on the Test Performance in Mathematics of Grade 10 Students of Olongapo City National High School was undertaken to determine the effect on the test scores of printing the Mathematics Exercises on paper with different colors.

More specifically, it answered the following questions:

1. What is the profile of the respondents in terms of :
   1.1 Age;
   1.2 Sex; and
   1.3 Curriculum?
2. What is the score of the students in the Grade 10 Mathematics exercises during the First Grading Period that are printed on:
   2.1 Colored paper; and
   2.2 White paper?
3. What is the score of the students in the Grade 10 Mathematics exercises during the Second Grading Period that are printed on:
   3.1 Colored paper; and
   3.2 White paper?
4. Is there a significant difference in the student's test scores in the Grade 10 Mathematics exercises during the First Grading Period according to:
   4.1 Color of examination paper;
   4.2 Age of student;
   4.3 Sex of student;
   4.4 Curriculum; and
   4.5 Competencies?
5. Is there a significant difference in the student's test scores in the Grade 10 Mathematics exercises during the Second Grading Period according to:
   5.1 Color of examination paper;
   5.2 Age of student;
   5.3 Sex of student;
   5.4 Curriculum; and
   5.5 Competencies?

Null Hypothesis

1. There is no significant difference in the student's test scores in the Grade 10 Mathematics exercises during the First Grading Period according to:
   1.1 Color of examination paper;
   1.2 Age of student;
   1.3 Sex of student;
   1.4 Curriculum; and
   1.5 Competencies
2. There is no significant difference in the student's test scores in the Grade 10 Mathematics exercises during the Second Grading Period according to:
   2.1 Color of examination paper;
   2.2 Age of student;
   2.3 Sex of student;
   2.4 Curriculum; and
   2.5 Competencies

C. Significance of the Study

The result of the study on the Effect of Colored Paper on the Test Performance in Mathematics of Grade 10 Students of Olongapo City National High School will be significant to the following:

*Students***.** The students are the center of the educative process. The results of the study would (1) enable the students to develop awareness about test questions printed in paper of different colors;(2) provide information about innovations in the methods of assessment that will cause improvement in test scores and academic performance; and (3) provide information on the student's response towards printing the Mathematics examination on paper with different colors.

*Parents***.** Parents, in their special ways are teachers. They play a significant role in life and success on their children. The study would remind and enlighten the parents of their duties and responsibilities, not only in terms of financial necessities but also in the child's physical, emotional, mental and spiritual development.

Teachers. The teacher is considered to be one of the important constituents of the classroom. The results of the study would provide the teachers the information that colors convey in learning. The teachers would also be provided with the basis for the choice of the color of the mathematics test paper that would improve student's scores and academic performance.

School Administrators. The results of the study would generate awareness among administrators about innovative resources. Through this study the administrators would be

encouraged to provide materials that will enhance the capabilities and skills of the learners.

Curriculum Developers. The results of the study would provide basis for the curriculum developers to design and recommend assessment methods that will include the printing of test questions on colored paper.

D. Scope and Limitation of the Study

The study on the Effect of Colored Paper on the Test Performance in Mathematics of Grade 10 Students of Olongapo City National High School was undertaken to determine the effect on the test scores, of printing the mathematics exercises on paper with different colors.

There were180 respondents from the different curriculum programs: Science, Technology, and Engineering Program (STEP), Basic Education Curriculum (BEC), Special Program in the Arts (SPA), Special Program in Sports (SPS), Special Program in Journalism (SPJ), and Special Program in Foreign Language (SPFL). To increase the preciseness, accuracy and reliability of the research, only the students that belong to the top class section were included as respondents. The students in the lower sections tend to guess the answers in all kinds of examinations.

2. Methods

This portion presents the research methodology employed by the researcher in conducting the study. It includes the research design, respondents, sampling technique, research instrument, validation of the instrument, data gathering procedure and analysis, and the statistical treatment of data.

A. Research Design

The researcher used the experimental method. It is a widely used approach in educational research where participants are randomly assigned to either an experimental group, which receives an intervention, or a control group, which does not. This method allows researchers to isolate the effects of the intervention, ensuring that any differences in outcomes are attributed to the treatment rather than other factors (McLeod, 2020). By using random assignment, the experimental method helps in reducing bias and increasing the validity of the findings (Schneider et al., 2021). Moreover, the clearly defined intervention is essential for understanding its impact and ensuring the results are replicable in future studies (Johnson & Christensen, 2019). Its documentary analysis of the student's test score in the Grade 10 Mathematics exercises was conducted for the first and second grading periods.

B. Respondents

The respondents were the 180 students of the Olongapo City National High School, Olongapo City. The students were selected from the population belonging to the top section in the six curriculum programs: Basic Education Curriculum (BEC), Science and Technology Engineering Program (STEP), Special Program in Foreign Language (SPFL), Special Program in Journalism (SPJ), Special Program in Sports (SPS), and Special Program in the Arts (SPA). The distribution of the respondents in each curriculum is presented in Table 1.

C. Sampling Technique

The quota sampling method was used in randomly selecting the respondents. The researcher selected 30 respondents from each curriculum of the school as the fixed quota. Only students from higher section were selected for more reliable results.

D. Research Instrument

The data gathering tool was the 15-point researcher-made Math Exercises consisting of different lessons in the first and second grading periods. The questions were printed on white and colored papers (blue, red, yellow and green). Casual observation and informal interviews were also undertaken to check the veracity of the experiment. During the first grading period, the Grade 10 students were given tests to determine their competencies on: (1) Finding the missing number to complete the sequence; (2) Giving the first three terms of the sequence; (3) Determining arithmetic sequence; (4) Arithmetic means; (5) Problem Solving on arithmetic sequence; (6) Finding the common ratio and the next two terms of the geometric sequence; (7) Identifying the kind of sequence; (8) Geometric means; (9) Geometric series; (10) Problem solving on geometric and harmonic sequences. During the second grading period, the Grade 10 students were given tests to determine their competencies on: (1) Definition of Polynomials; (2) Writing division in the form Dividend = (Quotient) (Divisor) + Remainder; (3) Long Division; (4). Synthetic Division; (5) Solving Problems on Polynomials; (6) Evaluation of Polynomials; (7) Remainder Theorem; (8) Factor Theorem; (9) Finding the value of k given the polynomial; and (10) Writing polynomial function in standard form.

E. Validation of Instrument

The first draft of the instrument was shown to researcher's adviser for comments and suggestions. The improved examination questions were administered to seventy Grade 10 students who were not respondents of the study at the Olongapo City National High School, Olongapo City. Items that were found to be vague were either modified or changed. Suggestions and comments from the teachers and friends were also considered.

Table 1
Frequency and percentage distribution of the respondents by curriculum program

Curriculum	Frequency	Percentage
Basic Education Curriculum (BEC)	30	16.67%
Science Technology Engineering Program (STEP)	30	16.67%
Special Program in Foreign Language (SPFL)	30	16.67%
Special Program in Journalism (SPJ)	30	16.67%
Special Program in Sports (SPS)	30	16.67%
Special Program in Arts (SPA)	30	16.67%
Total	180	100.00

F. Data Collection

The researcher wrote letters to the Schools Division Superintendent, Division of Olongapo City, the School Principal, and the Mathematics Department Head to request permission to conduct the study. After getting the approval of the request, the randomly selected respondents were divided into 5 groups. Each group corresponded to a particular color of the examination paper. The respondents in the control group answered the examination questions printed in white paper. The respondents in the experimental group answered the questions printed in blue, red, green, and yellow colored papers respectively. There were an equal number of respondents in each group.

Copies of the examination papers were distributed after assigning the randomly selected respondents to each group. To ensure a high percentage of return, the assistance of the teachers-in-charge were requested. Retrieval of the examination papers was done personally by the researcher to ensure one hundred percent (100%) retrieval rate.

G. Data Analysis

The following statistical tools were employed for the analysis and interpretation of the data:

The Raw Score. The raw scores were determined by counting the number of correctly answered questions.

The Frequency and Percentage. The frequency and percentage distribution were determined by counting the number of respondents classified according to age, sex, and curriculum. These were computed using the Statistical Package for Social Sciences (SPSS) version 11.5.

The Weighted Mean. The weighted mean is a single value that was used to quantitatively describe the respondent's test scores in the Grade 10 Mathematics using the SPSS version 11.5 software.

The Rank. The rank was used to qualitatively describe the order of the respondent's test scores in the Grade 10 Mathematics based on the computed weighted mean value.

The Analysis of Variance (ANOVA). The analysis of variance using the F-test was used to test (1) the null hypothesis of no significant difference in the respondent's test scores in the Grade 10 Mathematics exercises according to color of examination paper, age, sex; competencies, and curriculum during the first grading period; and (2) the null hypothesis of no significant difference in the respondent's test scores in the Grade 10 Mathematics exercise according to color of examination paper, age, sex; competencies, and curriculum during the second grading period.

The analysis of variance was computed using the SPSS version 11.5 software and was guided by the following decision rules.

1) Decision Rule 1

If the computed significance (Sig.) value is less than or equal to the 0.01 alpha level of significance (Sig. $\leq$ 0.01), reject the null hypothesis. There is a highly significant difference.

2) Decision Rule 2

If the computed significance (Sig.) value is greater than the 0.01 but less than or equal to the 0.05 alpha level of significance (0.01 $\leq$ Sig. $\leq$ 0.05), reject the null hypothesis. There is a significant difference.

3) Decision Rule 3

If the computed significance (Sig.) value is greater than the 0.05 alpha level of significance (Sig. > 0.05), accept the null hypothesis. There is a no significant difference.

3. Results and Discussion

This portion presents the results and interpretation of the findings based on collected data, related literature and studies, and the researcher's observations and actual experience.

A. Profile of the Students

Table 2
Personal profile of the grade 10 students

Age (years)	**Frequency**	**Percent**
18	3	1.70
17	4	2.20
16	36	20.00
15	129	71.70
14	8	4.40
Total	180	100.00
Mean= 15.25		
Sex	**Frequency**	**Percent**
Female	98	54.40
Male	82	45.60
Total	180	100.00

Out of 180 students, 129 (or 71.70%) were 15 years old, with a mean age of 15.25 years. Additionally, 98 (or 54.50%) of the students identified as female. A total of 30 students were randomly selected from each of the following curricular programs: Special Program in Sports (SPS), Special Program in the Arts (SPA), Special Program in Journalism (SPJ), Special Program in Foreign Language (SPFL), Science, Technology, and Engineering Program (STEP), and the Basic Education Curriculum (BEC).

In the Philippine educational system, children typically begin basic education in elementary school at age six, which means they would be around 15 years old upon reaching Grade 10 in junior high school. Some Grade 10 students reported being 18 years old, indicating that delays in enrollment were often due to financial constraints. Many of these students felt compelled to seek employment to support their families, which impacted their educational progression (Philippine Institute for Development Studies, 2022).

This finding aligns with previous studies that highlight the impact of socioeconomic status on educational participation in the Philippines. According to Bacolod and Ranjan (2021), financial instability and the need for income-generating activities contribute significantly to delayed enrollment, particularly among males in rural areas. The data also underscore the importance of addressing economic barriers to education, as these can perpetuate cycles of poverty and limited educational attainment.

Gender disparities persist at the secondary and higher education levels, with more female students enrolled compared to males. In rural areas, traditional gender roles often dictate that males engage in work, while females are afforded the opportunity to pursue education. However, research indicates

that males experience higher rates of failure, dropout, and grade repetition at both the elementary and secondary levels (Cruz et al., 2021).

Furthermore, Santiago (2008) found that males in rural areas are more likely to leave school earlier, as they are expected to prioritize work over education. Additionally, males have been shown to have higher rates of failure, dropout, and repetition in both elementary and secondary education levels (UNESCO, 2019). This pattern is evident in the current study, where the higher proportion of females suggests that girls are more likely to persist in their education, while boys may face greater external pressures to contribute economically to their families.

Test Scores in the Grade 10 Mathematics Exercises: First Grading Period

Table 3
Test scores in the grade 10 mathematics exercises: first grading period

Grading Period	Sex	Color of Paper	SPS	SPA	SPJ	SPFL	STEP	BEC	Mean
First	Male	White	6.71	10.05	9.42[1]	10.53	9.71	8.13	9.09[2]
		Red	8.21	10.00	8.84	10.13	9.71	8.96[1]	9.31[1]
		Blue	8.68[1]	10.50[1]	7.13[5]	10.74[1]	9.79	6.88	8.95[3]
		Yellow	7.32	9.65[5]	8.29	10.35	8.84[5]	6.14[5]	8.43[5]
		Green	6.09[5]	9.85	8.09	10.03[5]	9.84[1]	8.25	8.69[4]
	Mean		**7.40**	**10.01**	**8.35**	**10.36**	**9.58**	**7.67**	**8.90**
	Female	White	8.16[1]	7.93[5]	8.70	9.18	10.34[5]	8.60[1]	8.82[2]
		Red	5.42	9.10	8.56	10.10[1]	10.70	7.39[4.5]	8.55[4]
		Blue	5.20[5]	9.18	9.17	9.09[5]	11.08	7.39[4.5]	8.52[5]
		Yellow	8.00	10.03[1]	9.64[1]	9.46	12.70[1]	7.97	9.63[1]
		Green	7.08	8.20	7.25[5]	10.00	11.56	8.25	8.72[3]
	Mean		**6.77**	**8.89**	**8.66**	**9.57**	**11.28**	**7.92**	**8.85**

The data on the test scores in the Grade 10 Mathematics Exercises during the First Grading Period are presented in Table 3.

For the male students in the SPS Curriculum, the highest test score was 8.68 (blue paper); 6.09 was the lowest (green paper); in the SPA Curriculum, 10.50 was the highest (blue paper); 9.65 was the lowest (yellow paper); in the SPJ Curriculum, 9.42 was the highest (white paper), 7.13 was the lowest (blue paper); in the SPFL Curriculum, 10.74 was the highest (blue paper), 10.03 was the lowest (green paper); in the STEP Curriculum, 9.84 was the highest (green paper); 8.84 was the lowest (yellow paper); in the BEC Curriculum, 8.96 was the highest (red paper); 6.14 was the lowest (yellow paper). There were more high scores using the blue paper. There were more low scores using the yellow paper. Averaged across the color of the papers, the mean score of the male students was the highest in the SPFL (10.36); lowest in the SPS (7.40) curriculum. Averaged across the curricular programs, the mean score was the highest using the red paper (9.31); lowest using the yellow paper (8.43). The overall mean score was 8.90.

For the female students in the SPS curriculum, the highest test score was 8.16 (white paper), 5.20 was the lowest (blue paper); in the SPA Curriculum, 10.03 was the highest (yellow), 7.93 was the lowest (white paper); in the SPJ Curriculum, 9.64 was the highest (yellow paper), 7.25 was the lowest (green paper); in the SPFL Curriculum, 10.10 was the highest (red paper), 9.09 was the lowest (blue paper); in the STEP Curriculum, 12.70 was the highest (yellow paper), 10.34 was the lowest (white paper); in the BEC Curriculum, 8.60 was the highest (white paper), 7.39 was the lowest (red and blue papers). There were more high scores using the yellow paper. There were more low scores using the blue paper. Averaged across the colors of the papers, the mean score of the female students was the highest in the STEP (11.28); lowest in the SPS (6.77) curriculum. Averaged across the curricular programs, the mean score was the highest using the yellow paper (9.63); lowest using the blue paper (8.52). The overall mean score was 8.85.

The data indicate that the color of the test paper plays a significant role in student performance. For male students, blue paper appears to have a positive impact on test scores, while yellow paper is associated with lower scores. In contrast, female students perform better on yellow paper, while their performance on blue paper is relatively lower. These findings align with existing research that suggests color can influence cognitive processing and test performance (Dreiskaemper et al., 2013).

Test Scores in Grade 10 Mathematics Exercises: Second Grading Period

Table 4
Test scores in the grade 10 mathematics exercises: second grading period

Grading Period	Sex	Color of Paper	SPS	SPA	SPJ	SPFL	STEP	BEC	Mean
Second	Male	White	4.80	3.50[1]	4.69	7.61	11.50	1.92	5.67[2]
		Red	3.86[5]	2.15[5]	4.96[1]	7.08[5]	10.17[5]	3.25	5.25[5]
		Blue	4.24	3.20	2.45[5]	7.92[1]	11.38	3.92[1]	5.52[3]
		Yellow	5.77[1]	2.35	3.59	7.53	12.92[1]	2.71	5.81[1]
		Green	5.21	3.20	3.83	7.82	10.67	1.67[5]	5.40[4]
	Mean		**4.78**	**2.88**	**3.90**	**7.59**	**11.33**	**2.69**	**5.53**
	Female	White	3.35	8.90	4.70	6.91	11.14	4.31	6.55[5]
		Red	2.77[5]	9.13	4.11[5]	9.05[1]	10.81[5]	4.19	6.68[3]
		Blue	4.58[1]	8.58[5]	5.92[1]	6.00[5]	10.95	3.59[5]	6.60[4]
		Yellow	4.39	9.70[1]	5.36	8.09	12.00[1]	4.00	7.26[1]
		Green	3.58	9.68	5.56	7.37	11.36	4.47[1]	7.00[2]
	Mean		**3.73**	**9.20**	**5.13**	**7.48**	**11.25**	**4.11**	**6.82**

Table 4 presents the test scores in the Grade 10 Mathematics Exercises during the Second Grading Period.

For the male students in the SPS Curriculum, the highest test score was 5.77 (yellow paper); 3.86 was the lowest (red paper); in the SPA Curriculum, 3.50 was the highest (white paper); 2.15 was the lowest (red paper); in the SPJ Curriculum, 4.96 was the highest (red paper), 2.45 was the lowest (blue paper); in the SPFL Curriculum, 7.92 was the highest (blue paper), 7.08 was the lowest (red paper); in the STEP Curriculum, 12.92 was the highest (yellow paper); 10.17 was the lowest (red paper); in the BEC Curriculum, 3.92 was the highest (blue paper); 1.67 was the lowest (green paper). There were more high scores using the blue paper. There were more low scores using the red paper. Averaged across the colors of the paper, the mean score of the male students was the highest in the STEP (11.33); lowest in the BEC (2.69) curriculum. Averaged across the curricular programs, the mean score was the highest using the yellow paper (5.81); lowest using the red paper (5.25). The overall mean score was 5.53.

For the female students in the SPS curriculum, the highest test score was 4.58 (blue paper), 2.77 was the lowest (red paper); in the SPA Curriculum, 9.70 was the highest (yellow), 8.58 was the lowest (blue paper); in the SPJ Curriculum, 5.92 was the highest (blue paper), 4.11 was the lowest (red paper); in the SPFL Curriculum, 9.05 was the highest (red paper), 6.00 was the lowest (blue paper); in the STEP Curriculum, 12.00 was the highest (yellow paper), 10.81 was the lowest (red paper); in

the BEC Curriculum, 4.47 was the highest (green paper), 3.59 was the lowest (blue paper). There were more high scores using the blue and yellow papers. There were more low scores using the red and blue papers. Averaged across the colors of the paper, the mean score of the female students was the highest in the STEP (11.25); lowest in the SPS (3.73) curriculum. Averaged across the curricular programs, the mean score was the highest using the yellow paper (7.26); lowest using the white paper (6.55). The overall mean score was 6.82.

There are several factors relating to color that affect cognitive processing. Color influences a person's behavior, thought processes, and moods (Clifton, 2020). Positive moods can lead to nonsystematic, less detail-oriented, and more heuristic processing, while negative moods may result in more systematic, detail-oriented, and less heuristic processing. Colors can serve as affective cues, and students whose examination forms are in colors that convey positive emotions may process information less systematically, resulting in differential performance on examinations (Sinclair et al., 2019).

Pett and Wilson (2019) determined that color significantly affects moods. Cool and calming colors, such as those from the blue end of the spectrum, evoke tranquility, while warm and exciting colors derive from the red end of the spectrum. Goldstein (1942) established that psychological experiences can be triggered by physiological reactions to color. Performance can also be influenced by associations with color; colors from the red spectrum draw a person's attention outward, while those from the blue spectrum encourage inward focus. A study by Elliot et al. (2013) found that color can influence motivation without conscious awareness. Participants associated the color red with failure, leading to anxiety and significantly poorer performance compared to other colors, even to the extent of subliminally evoking avoidance motivation towards red.

Color adds another dimension when considering the ability to perceive print on a page. Irlen (2013) suggested that the best paper colors for classroom use are beige, yellow, goldenrod, pink, blue, and green to reduce distortions and enhance readability. Johnston (1984) investigated the readability of blue versus white paper in testing secondary vocational agriculture teachers and concluded that neither color significantly impacted the readability of materials.

In a study by Sinclair et al. (2019), psychology college students took the same midterm exam on either Astrobright lunar blue or Astrobright rocket red paper. The results indicated a significant main effect of color, with participants using blue paper (M = 66.63, SD = 15.35) outperforming those using red paper (M = 56.45, SD = 12.73). Blue paper was particularly beneficial for answering more challenging questions.

The findings in Table 3 and Table 4 show that the highest test score was obtained by the male students in the SPFL curriculum during the first grading period; in the STEP curriculum during the second grading period. The female students in the STEP curriculum got the highest scores during the first and second grading periods. The male students in the BEC curriculum got the lowest test scores during the first and second grading periods. The female students in the SPS curriculum got the lowest test scores during the first and second grading periods.

The difference in the test scores during the first and second grading periods could be attributed to the intended outcomes of the curriculum. The Basic Education Curriculum (BEC) provides special features for in preparation for the students' higher learning and gainful employment (DepEd Order No. 43, s. 2002). Technical-Vocational Education is the core of this program. The Special Program in Sports (SPS) builds awareness through affinity in sports (DepEd Order No. 25, s. 2015). The Special Program in Foreign Language (SPFL) focuses on the study on different languages and speech development (DepEd Memorandum Order No. 560, s. 2008). The Science, Technology, and Engineering Program (STEP)promotes quality knowledge in Mathematics, Science and Statistics (DepEd Order 38, s. 2013).

Difference in the Test Scores in the Grade 10 Mathematics Exercises During the First Grading Period

The data on the difference in the test scores in the Grade 10 Mathematics exercises during the First Grading Period as influenced by color of paper, age, sex, curriculum, and competencies are presented in Table 5.

There was no significant difference in the test scores when grouped according to the students' age (Sig. = 0.69) and sex

Table 5
Difference in the test scores in the grade 10 mathematics exercises during the first grading period as influenced by the color of paper, age, sex, curriculum, and competencies

Independent Variables	Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Color	Between Groups	4592.36	9	510.26	15.29**	0.00
	Within Groups	59696.43	1789	33.37		
	Total	64288.79	1798			
Age	Between Groups	80.18	4	20.04	0.56ns	0.69
	Within Groups	64208.61	1794	35.79		
	Total	64288.79	1798			
Sex	Between Groups	0.001	1	0.001	0.00ns	1.00
	Within Groups	64288.79	1797	35.78		
	Total	64288.79	1798			
Curriculum	Between Groups	2637.18	5	527.44	15.34**	0.00
	Within Groups	61651.61	1793	34.38		
	Total	64288.79	1798			
Competencies	Between Groups	4543.25	1	4543.25	136.65**	0.00
	Within Groups	59745.54	1797	33.25		
	Total	64288.79	1798			

** - highly significant at 0.001 alpha level of significance, Ho is rejected
ns – not significant at 0.05 alpha level of significance; Ho is accepted

Table 6
Difference in the test scores in the grade 10 mathematics exercises during the second grading period as influenced by the color of paper, age, sex, curriculum, and competencies

Independent Variables	Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Color	Between Groups	452.68	9	50.30	1.46^{ns}	0.16
	Within Groups	61601.90	1784	34.53		
	Total	62054.59	1793			
Age	Between Groups	2558.26	4	639.57	19.23**	0.00
	Within Groups	59496.32	1789	33.26		
	Total	62054.58	1793			
Sex	Between Groups	689.39	1	689.39	20.13**	0.00
	Within Groups	61365.19	1792	34.24		
	Total	62054.59	1793			
Curriculum	Between Groups	12326.74	5	2465.35	88.64**	0.00
	Within Groups	49727.84	1788	27.81		
	Total	62054.58	1793			
Competencies	Between Groups	329.94	1	329.94	9.58**	0.00
	Within Groups	61724.65	1792	34.45		
	Total	62054.59	1793			

** - highly significant at 0.01 alpha level of significance; Ho is rejected
ns – not significant at 0.05 alpha level of significance; Ho is accepted

(Sig. = 1.00). The computed significance values are greater than the 0.05 alpha level of significance. There was a highly significant difference in the test scores when grouped according to the color of paper (Sig. = 0.00), curriculum (Sig. = 0.00), and competencies (Sig. = 0.00). The computed significance values (Sig.) are less than the 0.01 alpha level of significance

During the first grading period, the Grade 10 students were given tests to determine their competencies on: (1) Finding the missing number to complete the sequence; (1) Finding the missing number to complete the sequence; (2) Giving the first three terms of the sequence; (3) Determining arithmetic sequence; (4) Arithmetic means; (5) Problem solving on arithmetic sequence; (6) Finding the common ratio and the next two terms of the geometric sequence; (7) Identifying the kind of sequence; (8) Geometric means; (9) Geometric series; (10) Problem solving on geometric and harmonic sequences.

These results are similar to the findings in the study of Sinclair et al., (1998) indicating that students taking an exam on blue paper outperformed students taking the exam on red paper. The blue paper influences affective processing and is implicitly perceived as being more serious and requiring a systematic processing protocol, compared to red. Skinner (2006) found that students taking an exam on white, blue, or green paper outperformed students taking the exam on red or yellow paper.

The findings of this study, where no significant differences in test scores were observed based on age and sex, align with previous research suggesting that demographic factors may not strongly influence academic performance in mathematics (Suleiman & Abdulraheem, 2020). However, as demonstrated by Steele & Lynch (2021), external factors such as paper color can significantly affect cognitive processes during test-taking. Furthermore, research indicates that curriculum and competency-based education, as observed in studies by Wang & Lee (2019) and Nguyen & Huynh (2020), play critical roles in shaping student performance in mathematics, particularly in topics like sequences and series.

Furthermore, recent research by Jones et al. (2022) supports these findings, showing that paper color significantly impacts student performance on assessments. In their study, students who took tests on blue or green paper demonstrated better performance than those using red or yellow, reinforcing the idea that color affects cognitive processing and emotional responses during testing situations.

Table 6 presents the data on the difference in the test scores in the Grade 10 Mathematics exercises during the Second Grading Period as influenced by the color of paper, age, sex, curriculum, and competencies.

There was no significant difference when grouped according to the color of the test paper (Sig. = 0.16). The computed significance value is greater than the 0.05 alpha level of significance. There was a highly significant difference in the test scores when grouped according to the age (Sig. = 0.00), sex (Sig. = 0.00), curriculum (Sig. = 0.00), and competencies (Sig. = 0.00). The computed significance values (Sig.) are less than the 0.01 alpha level of significance.

During the second grading period, the Grade 10 students were given tests to determine their competencies on: (1) Definition of Polynomials; (2) Writing division in the form Dividend = (Quotient)(Divisor) + Remainder; (3) Long Division;(4).Synthetic Division; (5) Solving Problems on Polynomials; (6) Evaluation of Polynomials; (7) Remainder Theorem; (8) Factor Theorem; (9) Finding the value of k given the polynomial; and (10) Writing polynomial function in standard form.

The findings are consistent with recent research condected by Wichmann, Porter, and Mihalcea (2019). They concluded that the color of paper does not have a significant effect on academic performance, highlighting that cognitive tasks, such as exams, are not substantially influenced by the color of the medium used.

On the other hand, the significant differences in test scores when grouped by age, sex, curriculum, and competencies are well-supported by contemporary research. Anders et al. (2020) found that age can play a significant role in academic achievement, particularly in secondary education, where older students tend to perform differently than younger students. In terms of gender, Lindberg, Hyde, and Linn (2020) revealed that gender differences in math achievement still exist, with males often outperforming females in problem-solving, while females excel in computation-based tasks. Regarding curriculum and

competencies, Heckman and Karakoç (2019) emphasized the strong link between competency-based curriculum designs and improved student performance, particularly in subjects like mathematics.

Possessing mathematical competency consists of being prepared and being able to act mathematically on the basis of knowledge and insight. The ability to understand, judge, do, and use Mathematics in a variety of mathematical contexts and situations plays or could play a role (Niss, 2002) in attaining competency. The significant difference in the test scores in the Mathematics exercises during the first and second grading periods suggests that the Grade 10 students differ in their level of understanding, judging, doing, and using Mathematics.

4. Conclusions and Recommendations

A. Conclusions

1. The Grade 10 student in Mathematics is a young, female who belongs to a class in either the Special Program in Sports (SPS), Special Program in the Arts (SPA), Special Program in Journalism (SPJ), Special Program in Foreign Language SPFL), Science and Technology Engineering Program (STEP), or the Basic Education Curriculum (BEC).
2. For the male students during the First Grading Period, there were more high scores using the blue paper. There were more low scores using the yellow paper. The mean score of the male students was the highest in the SPFL; lowest in the SPS curriculum. The overall mean score was 8.90

   For the female students during the First Grading Period, there were more high scores using the yellow paper. There were more low scores using the blue paper. The mean score of the female students was the highest in the STEP; lowest in the SPS curriculum. The overall mean score was 8.85.
3. For the male students during the Second Grading Period, there were more high scores using the blue paper. There were more low scores using the red paper. The mean score of the male students was the highest in the STEP; lowest in the BEC curriculum. The overall mean score was 5.53.
4. For the female students during the Second Grading Period, there were more high scores using the blue and yellow papers. There were more low scores using the red and blue papers. The mean score of the female students was the highest in the STEP; lowest in the SPS curriculum. The overall mean score was 6.82.
5. During the First Grading Period, there was no significant difference in the test scores when grouped according to the students' age and sex. There was a highly significant difference in the test scores when grouped according to the color of paper, curriculum, and competencies.
6. During the Second Grading Period, there was no significant difference in the test scores when grouped according to the color of the test paper. There was a highly significant difference in the test scores when grouped according to the age, sex, curriculum, .and competencies.

B. Recommendations

1. The Grade 10 Mathematics teacher should use a variety of teaching strategies appropriate for the students in the different curricular programs to improve the test scores.
2. The blue colored test paper should be used.
3. Conduct a similar study to determine the effect of using colored test papers on the affective domains of learning.
4. Conduct a similar study using the two-factor analysis of variance as a statistical tool with color as the main factor and the profile variables such as the age, sex, curriculum, and competencies as the sub-factors respectively.
5. Conduct a similar study in other secondary schools in the province of Zambales to validate the findings.

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